APPRAISAL OF MANAGEMENT PRACTICES OF SNAIL FARMING IN BENIN METROPOLIS, EDO STATE, NIGERIA

BY

Ebiyon Jones EKENGBUDA
PG/AGR0806118
BACHELOR OF AGRICULTURE IN ANIMAL SCIENCE, UNIBEN (2016)

DEPARTMENT OF ANIMAL SCIENCE,
FACULTY OF AGRICULTURE,
UNIVERSITY OF BENIN,
BENIN CITY,
EDO STATE, NIGERIA

MAY, 2025

APPRAISAL OF MANAGEMENT PRACTICES OF SNAIL FARMING IN BENIN METROPOLIS, EDO STATE, NIGERIA

Ebiyon Jones EKENGBUDA
PG/AGR0806118
BACHELOR OF AGRICULTURE IN ANIMAL SCIENCE, UNIBEN (2016)

A THESIS SUBMITTED TO THE DEPARTMENT OF ANIMAL SCIENCE, FACULTY OF AGRICULTURE, UNIVERSITY OF BENIN, BENIN CITY, IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF MASTER'S OF SCIENCE DEGREE IN ANIMAL PHYSIOLOGY

MAY, 2025

CERTIFICATION

This is to certify that this research work was carried out by Ebiyon Jones EKENGBUDA in the Department of Animal Science, Faculty of Agriculture, University of Benin, and that the research thesis was approved as adequate in scope and quality for the partial fulfillment of the award of the Master's of Science (MSc.) degree in Animal Physiology.

_____ _____

Prof. J.M. Omoyakhi. (Project supervisor)

Dr.N.C. Akaeze (Head of Department)

Date:_____ Date:_____

_____

Prof. J. Ahmadu
(Co-Project Supervisor)

Date:_____

CERTIFICATION OF THESIS/DISSERTATION ON PLAGIARISM

We the undersigned attest and declare that the thesis of Ebiyon Jones EKENGBUDA titled "**Appraisal Of Management Practices Of Snail Farming In Benin Metropolis, Edo State, Nigeria**" has successfully passed the anti-plagiarism test and does not violate any copyright regulations.

_____ _____

Prof. J.M. Omoyakhi. Dr.N.C. Akaeze
(Project supervisor) (Head of Department)

Date:_____ Date:_____

_____
Prof. J. Ahmadu
(Co-Project Supervisor)

Date:_____

UNIVERSITY OF BENIN, BENIN CITY, NIGERIA

RELEASE FORM

NAME OF AUTHOR: Ebiyon Jones EKENGBUDA

TITLE OF THESIS: APPRAISAL OF MANAGEMENT PRACTICES OF SNAIL FARMING IN BENIN METROPOLIS, EDO STATE, NIGERIA

DEGREE FOR WHICH THESIS WAS PRESENTED: MASTER OF SCIENCE (M.Sc.)

YEAR THIS DEGREE WAS GRANTED: 2025

PERMISSION IS HEREBY GRANTED TO THE UNIVERSITY OF BENIN LIBRARY TO REPRODUCE SINGLE COPY OF THIS THESIS AND TO LEND SUCH COPY FOR SCHOLARLY OR SCIENTIFIC RESEARCH PUPRPOSES ONLY.

THE AUTHOR RESERVES OTHER PUBLICATION RIGHTS, AND NEITHER THE THESIS NOT EXTENSIVE EXTRACTS FROM IT MAY BE PRINTED OR OTHERWISE REPRODUCED WITHOUT THE AUTHOR'S WRITTEN PERMISSION.

Signed: _____

Department Of Animal Science,
Faculty of Agriculture,
University of Benin,
Benin City

DEDICATION

This thesis work is dedicated to GOD ALMIGHTY whose blessings makes rich and adds no sorrow to it, and without whom I could not have done this project work successfully.

The thesis work is also dedicated to my lovely wife Mrs.Gift Ekengbuda, who has been ever supportive. I appreciate you.

ACKNOWLEDGEMENTS

I want to give God all the glory for His favour, immense love and grace to do this research work successfully and also through out the course of my study.

My indebtedness goes to my thesis supervisor, Prof. J.M. Omoyakhi for his scholastic guidance and kind cooperation with me from the choice of topic to the completion of my project work. He made sure that the work was thorough and successful. May God continue to reward him. My special gratitude also goes to my co-supervisor. Prof. J. Ahmadu for his understanding and kind guidance in my thesis work. May God bless him.

My special thanks also goes to the Head of Department, Dr. N.C. Akaeze, my course lecturer, Prof. .A. Imasuen, and Dr. G.I. Odafe who also made valuable corrections of my project work. Also my appreciation goes to other lecturers and staff of the Department of Animal Science as well as the Faculty of Agriculture for their support and assistance throughout the course of my study. May God reward you all.

Finally, my profound and invaluable gratitude goes to my lovely wife, Mrs. Gift O. Ekengbuda for her love and continuous spiritual and moral support. Also, to my Dad and Mum, Mr. and Mrs. J.A. Ekengbuda for their advice, love and moral support, I am grateful. May God bless you all. Amen.

TABLE OF CONTENTS

LIST OF TABLES

ABSTRACT

An appraisal of the management practices of snail farming in Benin Metropolis of Edo State, Nigeria was done. The socio-economic characteristics of the respondents, the snail management practices according to management systems and culture practices, the level of snails output, cost, returns and profitability from the management practices, and the constraints to snail production in the study area were the specific objectives of the study. Snow balling sampling technique was adopted to identify a total of 30 snail farmers in the study area and this formed the sample size for the study. Data collection was done through the use of structured questionnaire, direct observation, and personal interview. The work was analysed using descriptive statistics, budgetary analysis and likert scale. The results showed that majority of the respondents were males (83.4%) between the age bracket of 41 and 50 (40%), married (33.4%), had farming experience of 0-4 years (53.3%) and had tertiary education (56.7%). The results also showed that majority of the snail farmers adopted management practices that are in line with best standard practices and had average stock size and average output of 4317.8 snails each. The cost and return analysis revealed that for snail farms that are 2 to 3 years old, TC incurred during the production period was ₦1,157,631.00(100%), while TR of ₦2,225,861.20 was realized with a NFI of ₦1,068,230.00(92.2%) and NROI was N0.92. For snail farms that are 4 years and above, average TC incurred was ₦6,404,840.70 (100%) while TR was ₦16,138,530.00 and NFI was ₦9,733,689.30 (152.70%). NROI was ₦1.52. Results about constraints facing the snail farmers in the study area showed that only 3 of the 12 constraints presented were rated as serious, which are low capital (2.68), epileptic power supply (2.75) and inaccessibility to land (3.0). It was concluded that the management practices adopted by majority of the snail farmers were in accordance to best standard practices and that snail farming is a very profitable venture as justified by a NROI of N1.52. It was recommended that low income earners and women be sensitized to venture into snail farming, snail farmers be encouraged to restock foundation stock every 2 months to guarantee regular income, the need by government to establish snail research and breeding institutes, make funds readily available to farmers, encourage programs that provides farms inputs free of charge to farmers and mop up the produce, and finally, policy formulation drive of government be channeled towards achieving large scale snail production in Nigeria.

Key: TC= Total cost, TR= Total Revenue, NFI= Net Farm Income, NROI= Net Return on Investment.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of Study

In the contemporary Nigerian Society, there has been growing concern on healthy living, especially as it bothers on the level of protein and vitamin intake from crops and animal produce in the nation. According to Cobbinah, 2001, the daily per capital animal protein intake remains less than 10 grams which is a far cry from the recommended minimum requirement of 35grams (Food and Agriculture Organization (FAO), 2011). For this to be addressed, there is the need to invest and explore other sources of animal protein in addition to the conventional sources such as poultry and ruminants. Among other sources of animal protein farming and production that is creating jobs and increasing productivity is snail farming.

Snail meat has been consumed by humans throughout the world since pre historic times (Cobbinah, 2001). It is socially well accepted in many parts of Edo State and Nigeria at large. Many species of edible land snails are recognized, but the popular species of economic interest are the *Achatina achatina* and *Archachatina marginata.* Heliculture (snail farming), is an excellent alternative to obtain snail instead of wild snail hunting and it is a relatively new lucrative field of agricultural production.

The interest in snail farming stems from the snails' high quality protein and medicinal value. For example, protein from snail meat is said to be very rich in all essential amino acids such as lysine, leucine, arginine and tryptophan (Imevbore and Ademosun, 1988). Snail meat has been found to be higher in protein content (37-51%) compared to that of guinea pig (20.3%), poultry (18.3%), fish (18%), cattle (7.5%), sheep (16.4%) and swine (14.5%). Iron content of snail is 45.59mg/kg, it is low in fat (0.50 – 0.08%), sodium and cholesterol level (Bayode, 2009).

The bluish liquid obtained from snail has high iron content and is used for treatment of anaemia, hypertension and poor sight (Imevbore and Ademosun, 1988). The formulations from this liquid can be used to treat burns, abscesses and other wounds, measles, small pox and some skin diseases (Bayode, 2009). In Ghana, the bluish liquid is believed to be good for infant's development (Ashaye, *et al.,* 2001), According to Amao, Adesiyan and Salako (2007), snail meat was recommended in the past for treatment of ulcer, asthma, etc. In Rome, it was thought to contain aphrodisiac properties and was often served to visiting dignitaries in the late evenings. Snail meat is also rich in calcium, potassium, magnesium and iron, and it is recommended for pregnant women. It also brings additional income to farmers.

Inspite of these advantages and opportunities in snail production, there is still low production rates and poor involvement of youths in snail production in Edo State, particularly Benin Metropolis. In Benin Metropolis, snails are still sourced from the forest, and as such, the number of snail farmers are still small. Snail farmers' population is small compared to the increasing demand for the snail meat. Odunaiya (2011) pointed that the farmers and the extension agents have a critical role to play in improving the production of snail meat. To achieve this, the farmers need to be taught the innovative measures and improved snail varieties which they should adopt to improve the farm productivity. At the same time, wild snail production is declining rapidly due to indiscriminate hunting of snail before they reach maturity, bush burning, use of agro-chemicals, deforestation and change in weather conditions (Efarmspro, 2016).

1.2 Statement of Problem

Naturally, snails are collected from the forest, which is their natural habitat. However, with the gradual rise in human population in Benin Metropolis, the pressure on the forest for development of infrastructures and for the use of wood for fuel and construction, the habitat of the snails have been lost. This has made them very scarce and expensive (Aminu, Edun and Abiodun, 2020).

Furthermore, the demand for snail meat has increased over the years in both local and international markets probably due to rising population and the need to meet up the daily per capital animal protein intake. According to FAO, 2011, the recommended daily minimum requirement of animal protein intake is put at 35grams. Also, the farmer's production is not commensurate with the quantity and quality demanded by the local and international markets (Aminu, Edun and Abiodun, 2020).

These have led to the widening of the demand-supply gap of snail meat. Therefore, it becomes very necessary to introduce commercial snail domestication into our farming systems. This study however, seeks to answer the following questions;

1. What are the socio-economic characteristics of snail farmers in Benin Metropolis?
2. What are the snail production variables in the area?
3. What are the production challenges/constraints variables in the area?

1.3 Objectives of the study

The main objective of the study was to appraise the management practices of snail farming in Benin Metropolis, Edo State, while the specific objectives were to:

1. describe the socio-economic characteristics of snail farmers in Benin Metropolis.

2. examine the management practices according to management systems of snail farming in Benin Metropolis.
3. examine the management practices according to culture practices of snail farming in Benin Metropolis.
4. ascertain the level of output from the management practices of snail farming in Benin Metropolis.
5. determine the cost, returns and profitability of snail farming in Benin Metropolis.
6. ascertain the constraints to snail production in Benin Metropolis.

1.4 Justification of the Study

Researches on snail have focused more on its marketing, profitability (Ekunwe and Enato, 2016), (Idayat, et al., 2021), nutritional and medical values (Blessing, 2023), (Bayode 2009) and less on the management practices by snail farmers (Ekunwe and Enato, 2016). The second in the value chain of snail farming is management practices after snail sourcing. Available information from scholarly researches on economics of snail production such as that of Ahmadu and Ojogho (2012), Okeke (2015), Anochili and Aneke (2022) and many more have shown that information on management practices of snails is limited.

This work will be of benefit to policy makers in government in the agricultural sector, the intending investors, practicing investors and teaming unemployed youths in the area and beyond. To government policy makers, they would find the work useful in the sense that the peculiar problems of the local people involved in the rearing of snails will be discussed with recommendations on how to solve them. This will guide the government on how to assist the farmers. The result of the management practices will be of benefits to intending investors in the

sense that they would be better informed about the many prospects in improved management practices of snails in the area. It will serve as an eye opener to the practicing investors in the area and will help to boost their output. Finally, to the fleeing unemployed youth in the area, who may not have known about the job opportunities and/or economic reward in snail farming, this work would serve as a moral booster to them.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Snail Production

According to Nigerian Forum for Agricultural Advisory services (NIFAAS) (2016), to start a snail farm, it is advisable to get snails directly from the forest instead of buying from the market after they have been exposed to sunlight and have dehydrated. This is because snails drink a lot of water, so are easily dehydrated and this stresses them out and reduces their fertility capacity. The intending snail farmer could pick the snails from the bush with a very simple technique; clear a little portion of land during rainy season and sprinkle spicy fruits like pineapple, pawpaw, plantain, banana, etc at about 5 o'clock in the evening, when you go back there about 7pm or 8pm, you will pick up snails suitable for rearing. Repeat the procedure until you get enough quantity.

The production of snail is an important source of livelihood to the producers. The demand for snail meat has increased over the years in both local and international markets, probably due to rising population or the need to make up for animal protein deficiency, thereby widening demand-supply gap as only few farms exist for commercial breeding and production of snails in Ogun State (Aminu, Edun and Abiodun, 2020). Snail according to Ejidike (2002) can be reared in urban environment without infringing on the peace of neighbors. The practice also has the need for small space requirement. Besides, snail has been shown to adapt to various environmental conditions hence can be raised in small towns, cities, farms, at backyard, commercial level and villages.

Snail farming (heliculture) is an evolving industry that is laying a solid foundation for long-term economic freedom for the people involved. The business yields good returns.

The land snail of West Africa which is an edible snail cultured in Nigeria belongs to two closely related genera; Achatina achatina and Archachatina marginata. The major difference between A. achatina and A. marginata is in their shell pattern, shape of shell, apex, colour and numbers of eggs laid per clutch. These land snails are marginal but very successfully terrestrial. When actively moving, they continuously use water. During period when water is unavailable, they retreat into their shell and remain inactive until conditions improve.

Naturally, the snails are collected from the forest (their natural habitat). However, with the upsurge in human population of region, the pressure on the forest for other developmental projects and for fuel wood has increased, resulting in the loss of the habitat of these snails thereby making them very scarce and expensive. Therefore, it becomes very necessary to introduce commercial snail domestication into our farming systems.

These snails are vegetarians and will accept many types of food items. Investigation has shown that *A. achatina* and *A. marginata* are capable of utilizing a remarkable wide range of food items. However, it also prefers wet rather than dry leaves and thrives on the food plants provided in the pen. This makes for very low cost of domesticating snail. Domesticating the snail would provide conducive atmosphere for its growth and productivity all through the year. This would ensure an uninterrupted supply of the product to satisfy the demands of the consumers and as well provide regular income for the farmers.

2.2 Socio-Economic Characteristics of Snail Producers

Snail farmers are composed mainly of males, implying the dominance of males in the snail production industry. This is reported by Ogunniyi (2009), Aiyelola and Ogunjinmi (2010) and Ahmadu and Ojogho (2021). Snail producers are found to be relatively young, which means they

might be vibrant in the snail production business and portends better future for it. This is confirmed by Ngenwi, Mafeni, Etchu and Oben (2010), and also Ahmadu and Ojogho, (2012) who reported that the age bracket of 30 – 39 years is considered the economical active age. Majority of snail farmers are married while a few are single. This indicates that married people are more involved in snail farming probably to increase household income. This is in line with findings by Yahaya, (2012) and also Ahmadu and Ojogho (2012). Furthermore, it has been shown that snail production is a business for the educated farmer. Ogunniyi (2009) reported that most snail farmers were educated and Aiyelola and Ogunjinmi (2010) estimated that all persons involved in snail production had tertiary education. Education is vital to snail rearing especially in the area of record keeping and modern management practices. Also, commercial snail rearing being new in agroforestry production activity is seen to be embraced by educated people (Hamzat, 2014). However, snail farmers had low years of experience in snail farming (Ahmadu, 2012) and this might affect their managerial ability. Majority of snail farmers belonged to social organizations such as Cooperative Societies, Farmers Development Union, Community Development Associations, etc (Hamzat, 2014). This implies that inspite of their rearing activities, they still have time for other activities since snail rearing is not time consuming. Assessing the occupational status of snail farmers, Raheem (2001) stated that majority of snail farmers practice snail farming on part-time basis while a few on full time basis implying that it does not deprive farmers the time for other productive activities. Majority of the part-time farmers were civil servants implying that they were involved in snail farming as a source of increasing household income and for household consumption. Lastly, Raheem (2001) stated that majority of snail farmers used personal savings as a source of initial capital.

2.3 Management Practice Characteristics

a. Snail rearing Techniques/system

Bayode (2009) stated that majority of snail farms were involved in intensive system of snail rearing, a few were involved in semi-intensive system of rearing, while the least number of snail farmers were involved in extensive system of snail rearing. This implies that farmers were more involved in intensive system because snail grow well under this system.

Munonye and Moses (2010) stated that intensive system is a commercial system and the most productive system, because adequate attention is paid to the welfare of the snails in a controlled system. *Archachatina marginata,* when there is regular supply of water, food and time, they can grow and reproduce throughout the year (Ebenebe, 2016).

Bayode (2009) stated that in semi-intensive system, the snails are commonly reared on pasture but at times in cages where minimal attention is given to the snails. They are commonly served supplementary feeds to provide some nutrients and improve the productivity of the farm. Also, egg laying and hatching occur in a controlled environment. The young snails are sorted after 6 – 8 weeks to grow-out pens for fattening according to their sizes.

Munonye and Moses (2019) stated that extensive system is also called outdoor, free-range snail pen in which snails are reared on pasture field majority. There is no precise feeding requirement and little attention is given to the snails. They are allowed to move freely in the pasture, sourcing for food and water. This is a traditional method of rearing snail and commercially, it is not productive, as it slows the growth rate of the snails. In terms of rearing structure, Raheem (2001) stated that snail farmers reared their snails in trench pen,

followed by drums and pots and then tyre, implying that trench pen is the most preferred. He also stated that intensive system is majorly adopted by snail farmers.

Sourcing of Snails for Stocking

According to Ebenebe (2013), majority of snail farmers got their laying stock from snail farmers or research institutes that produce snails for farmers, while the remaining farmers got their laying stock from the wild, especially during the rainy season. Although this is not reliable as purchasing from snail farmers, it remains quite popular probably because it is less expensive.

b. Feeds and Feeding of Snails

Giants African snails have voracious appetite. They are known to eat at least 500 different types of plants including peanuts, beans, peas and melon. If fruits and vegetables are not available for snails to eat, they will take a wild variety of ornamental plants and tree barks, (Akinnusi, 1998). The food also includes grains, waste products such as maize, plantain and succulent vegetables, including nuts, cherry, water leaves, cassava, cocoyam and lettuce (Okafor, 2001). Concentrate feed is also given to snails, lime is also given for shell formation. Majority of farmers fed their snails once a day (Ebenebe, 2013). This implies that snails do not require much feed since it is able to convert low quality of feed to high quality animal protein and meat.

c. Pests and disease of Snails

Ogunniyi (2009) stated that the major pests faced by snail farmers are predators such as lizards, snakes, frogs, toads, army ants, termites, cockroaches. Okorie (2012) also noted that enemies of the snail are members of the invertebrate group such as ground beetles, crickets, centipedes and vertebrate group like crow, birds, rats, mice, snakes and lizards. These are

capable of reducing productivity and cause mortality. Cannibalism among snails could also be a problem. Parasites, nematodes, fungi and bacteria may likewise attack snails reducing productivity and causing mortality (Ogunniyi, 2009).

2.4 Level of Output from Management Practices

Munonye and Moses (2019) stated that intensive system of snail production is the most productive system of rearing because adequate attention is channeled towards the welfare of the snails. This is followed by the semi-intensive system and lastly the extensive system of rearing. Under the intensive system, trench pen and tents are commonly used because of their high productivity (Raheem, 2015).

According to Ebenebe (2013), output from snail farm is high when the foundation stock is sourced from other snail farmers or research institutes that produce snails for farmers. Also, snail farms that have breeding and hatchery departments record remarkable output. This is in contrast to stock sourced from the wild.

Also, Raheem (2001) stated that the *Archachatina marginanta* species is preferred majorly over the *Achatina achatina* species because of its excellent source of animal protein and its large body size, as well as its ease of management. Therefore output using the *A. marginata* species is higher than the *A. achatina* species.

Lastly, Ebenebe (2013) stated that the use of concentrate feeds, lime and clean water gives a higher output compared to vegetables and fruits although costly.

2.5 Constraints to Snail Production

According to Aguaguiyi, Fortune, Emegha, Umebali and Emmanuel (2022), major constraints facing snail farmers are; high cost of feeds, lack of financial capacity for business expansion, poor storage facilities, scarcity of quality breeding stock and high cost of transportation. The combined effects, of these factors is capable of affecting the economics of snail production by farmers. These findings agree with that of Baba and Adeleke (2006) who reported that high cost of feed, lack of financial capital and scarcity of quality breeding stock were responsible for the low rate of snail production by snail farmers in Nigeria. While lack of stable market for snail producers, poor access to information relating to snail farming, absence of strong cooperative societies, scarcity of land for pen construction, problem of diseases and pests infestation from contamination, insufficient labour and source of water do not constitute a serious constraint to snail farming (Aguaguiyi, Fortune, Emegha, Umebali and Emmanuel., 2022).

Inspite of these constraints, snail farming in Nigeria is still a very profitable venture, as justified by the net farm income generated by the farmers and high return of ₦1.73 on every N 1 spent. (Ahmadu and Ojogho, 2012) and so, it is still worth venturing into. It is even more worthy if these constraints are addressed properly before they present themselves.

2.6 Costs and Returns Analysis

The costs that are being considered are variable and fixed costs, incurred during the snail rearing. The fixed cost include costs such as constructions/buildings, equipment, e.t.c, while the cost of management/staff salaries, feeds, water, transportation, parent stocks etc, constitute the major variable costs. Baba and Adeleke (2006) stated that fixed cost constitutes about 65.49% of the total cost of snail production while variable costs constituted 34.51%. This is also in line with Uche (2015) who stated that fixed cost took majority of the total cost. He also stated that under variable cost, labour took the largest component. Ajibefun and Yusuf (2000) stated that the

return per naira investment was ₦3.04. This also agrees with the findings of Ahmadu and Ojogho (2012) who reported that return per naira invested in snail was N1.73. This shows that snail production is profitable. Labour cost which is the largest component of variable cost in snail rearing is at variance with other types of livestock such as poultry where feed is the most expensive input (Ajibefun and Yusuf, 2000). The cost of vegetative materials might be low but the labour involved in obtaining them might contribute to high labour cost. (Cobbinah, Vink and Onwuka, 2014).

Factors affecting Snail Profits

The result of the economic analysis of edible land snails by Ojo *et al.,* (2017) revealed that the level of education, years of experience in snail farming and farm size were significant factors influencing the profits made by snail farmers. This is in line with Ahmadu and Ojogho (2012) who stated that stock size, cost of feed, labour cost, depreciated cost, educational level and farming experience are the major factors that affects snail profits. In particular, increasing farm sizes could substantially increase profits. An increase in stock size by one snail, other factors remaining constant, can increase profit by about 40 snails (Baba and Adeleke, 2006).

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Study Area

The study area was Benin metropolis located in Edo State, Nigeria. It is made up of five (5) Local Government Areas (LGAs) out of the eighteen (18) LGAs that make up Edo State. The 5 LGAs are; Oredo, Egor, Ikpoba-Okha, Ovia North East and Uhunmwonde. The first 3 LGAs make up Benin City which is the capital of Edo State, and it is the fourth largest city in Nigeria according to the National population commission, 2006, after Lagos, Kano and Ibadan. The population estimate of Benin Metropolis is about 1,851,506 as of 2016 which constitutes 57.53% of the total state population. It lies between latitudes 6°16'N to 6°33'N and longitude 5°31'E to 5°45'E. Total land mass is 1,204km^2 (465sq miles) and population density is 870/km^2.

Benin Metropolis has two (2) district climatic seasons, the wet season which starts by April and ends by October, and the dry season which is from November to March. Relative humidity and rainfall are high, giving rise to thick vegetation cover. The major occupation of the inhabitants of the study area is Agriculture, hospitality, transportation, trading as well as civil service.

3.2 Sampling Technique

Benin Metropolis was purposely chosen from Edo State, because of the dominance of snail farming in the area. Snow balling sampling technique, also known as chain sampling or network sampling technique was used to reach the desired number of samples (respondents) which was thirty (30).

The scope of the study covered 30 privately-owned snail farms, their management practices and outputs in Benin Metropolis of Edo State. Nineteen (19) snail farms in Benin Metropolis which were already known were the starting point. Some of them are;

1. Kalin Brig Fish/snail farm Ltd 24 Okundaye Street, off Adolor Street, Siluko Road, Benin City. (Egor LGA)
2. Vicomo Snail Farms Ltd. No 8, Ewuabogun Road, Ewuabogun, Sapele Road, Benin City, (Ikpoba-Okha LGA)
3. John Holt farm Ltd. No 8, Otbohor Street Off Country Home Motel Road, Sapele Road, Benin City. (Ikpoba Okha LGA)
4. The King's Farm- Oza community, Benin-Agbor Road, Benin City (Uhumwonde LGA)
5. Imastex Snail Farm- Ewuabogun Road, Sapele Road, Benin City (Ikpoba-Okha LGA)

Referrals were gotten from some of the 19 respondents on other snail farms in Benin Metropolis, which in turn gave other referrals. By this, the desired number of respondents which is thirty (30) was gotten.

3.3 Data Collection

Data required for this study were both primary and secondary. Primary data were collected by means of structured and pre-tested questionnaire complimented by personal interview. Data were collected on

1. Socio-economic characteristics of the respondents
2. Management practices, based on management systems of the respondents in the study area, which includes management systems, land acquisition, housing, skill development,

farm records keeping, security challenge, hygiene, snail feeding practices, level of pests infestation and diseases severity and their control etc

3. Management practices, based on cultural practices of respondents in the study area such as culture practices, preferred snail type, stock size, soil sanitization, etc .
4. Level of output from management practices of respondents in the study area.
5. Costs, returns and profitability of snail farms in the study area.
6. Constraints to snail production in the study area.

The secondary data which were used mainly for literature were obtained from previous research works; journals, scholarly articles, textbooks and other materials, relevant to the study. The study was carried out in January and February, 2024.

3.4 Measurement of Variables

A reasonable number of variables were deployed in the study. These variables were measured as follows;

i. Socio-economic variables

Gender: The sex of the respondents was assigned to nominal values; the value I was assigned to males while 2 was assigned to females

Age: this was measured in years

Marital status: this was assigned to nominal values; 1 to single, 2 to married, 3 to divorced, 4 to widowed and 5 to separated.

Household size: the respondents were asked to indicate the total number of family members living together and eating from the same pot. It was measured using interval values of 1,2,3,4…n

Farming experience: This was measured in the number of years

Level of education: this was assigned to nominal values; 1 to non-formal, 2 to primary school, 3 to secondary school, 4 to tertiary education and 5 to others.

Source of capital: 1 to personal savings, 2 to loans, and 3 to relatives and friends.

If by loan, from what source: 1 to banks, 2 to government 3 to cooperatives, 4 to local money lenders and 5 to others

ii. Management Practices Variables

Snail Production Inputs:

Management system adopted: 1 to extensive, 2 to semi extensive and 3 to intensive.

Culture practices: 1 to monoculture, 2 to polyculture and 3 to integrated snail farming.

Method of acquisition of land for farming: 1 to rented, 2 to lease, 3 to inherited and 4 to purchased.

Preferred types of snail reared: 1 to *Achatina achatina*, 2 to *Archachatina marginata*, 3 to both, 4 to others.

Number of snails present in your farm: this represented the size of the farm and was measured in number.

Frequency of soil sanitization in a year: this was measured in number.

Training and retraining in a year: 1 to none, 2 to once, 3 to twice, 4 to thrice, 5 to more than thrice.

Record keeping: 1 to farm diary, 2 to farm inventory, 3 to input record, 4 to production record, 5 to consumption records, 6 to sales record.

Security challenge: 1 to human theft, 2 to snakes, 3 to scorpions, 4 to kidnapping, 5 to robbery, 6 to others.

Feeding Practices

Feedstuff materials used: 1 to vegetables (to specify), 2 to fruits (to specify), 3 to both, 4 to concentrates, 5 to kitchen waste, 6 to tubers, 7 to others.

Frequency of feeding in a day: 1 to once, 2 to twice, 3 to thrice and 4 to none.

Frequency of feed remnant removal: 1 to everyday, 2 to once in 2 days, 3 to once in, 3 days and 4 to others (to specify).

Frequency of provision of water in a day: 1 to none, 2 to once, 3 to twice, 4 to more than twice.

Source of water: 1 to borehole, 2 to streams, 3 to others (to specify).

Supply of lime to snails: respondents was to briefly comment to this.

Pests and Disease Information

Pests and predators encountered: 1 to 15 was assigned to various pests and predators encountered on the snail farm.

Level of these pests/predator attack: 1 to insignificantly mild, 2 to significantly mild, 3 to moderate, 4 to serious and 5 to very serious.

Effects of these attacks: 1 to reduced production 2, to mortality, 3 to reduced profits, 4 to high cost of arresting them, 5 to others (to specify).

Control of pests- respondents were to briefly comment on this.

Disease encountered: 1 to fungi, 2 to nematodes, 3 to others (to specify).

Level of disease attacks: 1 to insignificantly mild, 2 to significantly mild, 3 to moderate, 4 to serious and 5 to very serious.

Effects of these attacks: 1 to reduced production, 2 to mortality, 3 to reduced profits, 4 to high cost of arresting them, 5 to others (to specify).

Control of disease: respondents were to briefly comment on this.

iii. Snail production output

The output of snails was measured as the total quantity in numbers of live snails from the production unit(s) of the farmers for a production period of 12 to 18 months.

iv. Costs and returns: The average current market prices of snail inputs and outputs were employed in working out the revenue and cost figures for data analysis.

v. Snail farming constraints variables

A list of possible constraints to the economics of snails production was presented to the respondents to indicate on four point likert-types scale the degree of seriousness of the constraints. Their response categories were very serious 4, serious 3, somewhat serious 2 and not serious 1

1+2+3+4/4=2.5 cut-off point.

Using the cut-off point 2.5 for decision rule, constraints with mean value greater than or equal to 2.5 was considered as constraints facing snail farmers in the study area. On the other hand, items with mean values less than the cut-off point value of 2.5 were considered as not been constraints to snail farming in the study area.

3.5 Method of Data Analysis

Objectives 1,2,3 and 4 were achieved with the use of descriptive statistics such as means, frequency distribution, percentages and tables.

Objective 5: was achieved using budgetary analysis such as gross margin and net profit. This involves determining the profitability of snail production in the short-run when fixed costs are considered negligible using gross margin, and the net profit in the long-run by incorporating fixed costs into the analysis. The gross margin is given as

GM=GI-TVC

Where GM=Gross margin, GI=Gross income and TVC=Total variable cost (which is total Cost (TC)-Total Fixed Cost (TFC))

The net profit is given as

π=GM-TFC

Where π =Net profit, TFC=Total fixed cost and GM=Gross margin

Objective 6: was achieved using the likert scale as previously explained under snail farming constraints variables.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION.

4.1 RESULTS

Table 1: Socio economic characteristics of snail farmers in Benin Metropolis

Variables	Frequency n =30	Mean	Percentage (100%)
Sex			
Male	25		83.4
Female	5		16.6
Age in (years)			
21-30	1		3.3
31-40	7		23.3
41-50	12	45	40
51 and above	10		33.4
Marital status			
Single	5		16.9
Married	22		73.4
Divorced	1		3.3
Widowed	1		3.3
Separated	1		
Household size			30
1-3	9		53.3
4-6	16	5	10
7-9	3		6.7
10-12	2		
Years of farming experience			70
0-4	21		26.7
5-9	8	2	3.3
10 and above	1		
Level of education			3.3
Primary school	1		40
Secondary school	12		56.7
Tertiary education	17		
Source of capital			
Personal savings only	27		90
Personal savings + loan	1		3.3
Relatives and friends	1		3.3

From all the above sources	1	3.3
If by loan from what source		
Bank (LAPO Microfinance bank)	2	6.7
Government	0	0
Cooperatives	0	0

Source: Field survey, 2024

Table 2a: Management systems, land acquisition, housing, skill development, farm records and security challenges information

Variables	Frequency n=30	Percentage (100%)
Management system adopted		
Extensive	0	0
Semi intensive	1	3.3
Intensive	29	96.7
Method of land acquisition		
Rented	4	13.3
Lease	1	3.3
Inherited	3	10
Purchased	22	73.4
Types of housing		
Trench pen	13	43.4
Tyres	6	20
Free range	9	30
Tent	1	3.3
Hutch boxes	1	3.3
Skill development by snail farmers per year		
None	11	36.7
Once in 2 years	1	3.3
1	6	20
2	5	16.7
3	4	13.3
More than 3 times	3	10
Keep farm records		
Yes	28	93.3
No	2	6.7
Types of records kept		
Farm diary	13	43.4
Farm inventory	17	56.7
Input record	12	40
Production record	12	40

Variables	Frequency n=30	Percentage (100%)
Consumption record	8	26.7
Sales record	10	33.3
Keeps all records	8	26.7
None	2	6.7

Table 2a. Cont'd

None	17	56.7
Human theft	13	43.3
Control of security challenge		
Human theft		
Fencing	11	36.7
CCTV camera and good relationship with neighbours	1	3.3
Use of dogs	1	3.3

Source: Field survey, 2024

Table 2b: Snail feeding practices information of snail farmers in Benin Metropolis

Variables	Frequency n=30	Percentage (100%)
Feed stuffs used to feed snails		
Use of vegetables	25	83.3
Fruits	29	96.6
Both vegetables and fruits	25	83.3
Concentrates	7	23.3
Kitchen waste	6	20
Tubers	3	10
Frequency of feeding in a day		
1	22	73.4
2	7	23.3
2 times in a week	1	3.3
Frequency of remnant removal		
Everyday	15	50
Once in 2 days	3	10
Once in 3 days	1	3.3
None	11	36.7
Frequency of provision of water per day		
None	0	0
1	23	76.7
2	1	3.3
More than 2	5	16.7
3 times a week	1	3.3
Source of water		
Borehole	30	100
From the 30 borehole source		
One boils its water before administering it		
Do you supply calcium to snail		
Yes	13	43.3
Lime	11	36.7
Bone meal + snail shell meal	1	3.3
Charcoal	1	3.3
No	17	56.7
Frequency of supply of lime		
None	17	56.7
4 times in a month	4	13.3
Twice in a month	4	13.3
Once in 2 months	1	3.4
Once in 3 months	4	13.3

Source: Field survey, 2024

Table 2c: Pests and diseases information

Variables	Frequency n=30	Percentage (100%)
Pests		
Lizards	8	26.7
Frogs	2	6.7
Army ants	17	56.7
Termites	5	16.7
Cockroaches	5	16.7
Ground beetles	2	6.7
Centipedes	4	13.4
Rats	4	13.4
Mice	2	6.7
Drillus caterpillar	8	26.7
Toad	1	3.4
Level of pest attack		
Insignificantly mild	5	16.7
Significantly mild	19	63.3
Moderate	6	20
Serious	0	0
Very serious	0	0
Effects of pest attack		
Reduced production	13	43.3
Mortality	13	43.3
Reduced profits	9	30
Incurred cost	4	13.3
Nil	5	16.3
All	4	13.3
Control of pest attack		
Use of gutter	14	46.6
Use of net	5	16.6
Use of insecticides	1	3.3
Planting of repellant plants	4	13.3
Killing the pests manually	4	13.3
Weeding, good sanitation	2	6.6
Treating the soil	1	3.3

Table 2c: Cont'd

Variables	Frequency n=30	Percentage (100%)
Nothing done	3	10
Diseases		
Fungi	1	3.3
Bacteria	2	6.7
Nematodes	1	3.3
No disease	26	86.7
Level of disease attack		
Fungi	Insignificantly mild	
Bacteria	Significantly mild and Moderate	
Nematode	Moderate	
No disease and therefore no disease level	26	
Effects of disease attack		
Reduces production	2	6.7
Mortality	0	0
Reduces profit	0	0
Incurs additional costs	0	0
All	1	3.3
No disease effects	27	90
Control of disease attack		
Sanitize equipment and workers +good sanitation	1	3.3
Use of antibiotics on bacteria	2	6.7
No disease and therefore no disease control	27	90

Source: Field survey, 2024

Table 3 Cultural practices. Preferred snail types, stock size and soil sanitization information

Variables	Frequency n=30	Percentage (100%)	Mean
Culture practices			
Monoculture; A. marginata	28	93.3	
Polyculture; A. marginata + a archatina	2	6.7	
Integrated snail farming (ISF)	11	36.7	
A monoculture + ISF	9	30.1	
B Polyculture + ISF	2	6.6	
Preferred type of snail reared			
A marginata only	28	93.3	
A archatina only	0	0	
Both	2	6.7	
Number of snails present in the farm (stock size)			
100 and below	4	13.3	
101 to 500	9	30	4317.8 snails (This is mean of 30 farms)
501-1000	8	26.7	
1001-1500	3	10	
1501-2000	2	6.7	
2001-2500	1	3.3	
2501 and above	3	10	
Number of times soil is sanitized in a year			
None	8	26.7	
1	6	20	
2	12	40	
3	3	10	
4	1	3.3	

Source: Field survey, 2024

Table 4. Output of snails from management practices of snail farmers in the Benin Metropolis.

Variables	Frequency n=30	Percentage (100)	Mean
Output of snails produced from hatchery unit after 6 months			
No hatchery unit	10	33.3	
Has hatchery unit but kept no record	1	3.3	
101 to 500	5	16.7	1,721.1 snailets (This is mean of 19 farms)
501 to 1000	3	10	
1001 to 1500	4	13.3	
1501 to 2000	1	3.3	
2001 to 2500	1	3.3	
2501 to 3000	4	13.3	
3001 and above	1	3.3	
Output of POL snails after 6 months of production or that is purchased as foundation stock			
Do not produce POL but purchase POL	10	33.3	
Produce POL, but no output yet	2	6.7	
101 to 500	8	26.7	790.3 POL (This is mean for 18 farms)
501 to 1000	5	16.7	
1001 to 1500	3	10	
1501 to 2000	1	3.3	
2001 to 2500	0	0	
2501 to 3000	0	0	
3001 and above	1	3.3	
Output of table sized (TS) snails after 12 months or 18 months of production			
Still at early stage, no output yet	10	33.4	
101 to 500	6	20	
501 to 1000	7	23.3	3,589.2 TS (This is mean for 20 farms)
1001 to 1500	3	10	
1501 to 2000	1	3.3	
2001 to 2500	0	0	
2501 to 3000	1	3.3	
3001 and above	2	6.7	

Source: Field survey, 2024

Table 5: Costs, returns and profitability of farms that are 2-3 years old .

Variables	Frequency n =9	Mean	% of TC (100%)
Output of POL snails after a production period of 6 months	8	600.7 POL	
Cost required to raise 1 snails to POL	8	N 604.90	
Selling price/POL snail	8	N 987.50	
Respondent produced POL but no output yet	1	N 0.00	
Output of TS snails after a production period of 12 or 18 months	9	1,105.9 TS (This is mean for 9 farms)	
Cost required to raise 1 snail to TS	9	N1084.10	
Selling price/TS snail	9	N1495.5	
Variable cost (VC)₦			
Foundation stock	9	N143,450.00	12.4
Labour	9	N 143,450.00	12.4
Feeding	9	N209,712.20	18.1
Transportation	9	N88,073.40	7.6
Water	9	N112,409.20	9.7
Others like pest control, medication etc	9	N42,776.70	3.7
Rent	1	N20,000.00	1.7
Total variable cost (TVC)₦	**9**	**N930,377.20**	**80.4**
Fixed cost (FC) N			
Items ₦			
Land	5	N133,430.00	11.5
Housing for snails	6	N83,534.50	7.2
Tax	0	N0.00	0
Others like equipment, (Depreciation value)	8	N10,289.30	0.9
Total fixed cost (TFC)₦	**9**	**N227,253.80**	**19.6**
Total cost (TC)=TVC+TFC₦	**9**	**N1,157,631.00**	**100**
Total Revenue (TR)₦	**9**	**N2,225,861.20**	
Gross margin (TR-TVC)₦	**9**	**N1,295,484.00**	**111.9**
Net profit₦ (TR-TC)	9	N1,068,230.20	92.2
Net return on investment (NROI)N (NP/TC)	9	N0.92	

Source: Field Survey, 2024

Note: POL=Point-of-Lay snail, TS= Table Sized snail

Table 6: Costs, returns and profitability of snail farms that are 4 years and above.

Variables	Frequency n =11	Mean	% of TC (100%)
Output of POL snails after a production period of 6 months	10	894 POL	
Cost required to raise 1 snails to POL	10	N367.00	
Selling price/POL snail	10	N995.00	
Respondent does not produce POL for sale	1	N0.00	
Output of TS snails after a production period of 12 or 18 months	11	10,166.4 TS (This is mean TS for 11 farms)	
Cost required to raise 1 snail to TS	11	N630.00	
Selling price/TS snail	11	N1500.00	
Variable cost (VC)₦			
Foundation stock	11	N2,672,921.40	41.7
Labour	11	N1,859,837.80	29.1
Feeding	11	N1,134,543.70	17.7
Transportation	11	N322,480.00	5.1
Water	11	N309,264.10	4.8
Others like pest control, medication etc		N90,505.00	
Rent	1	N15,288.70	0.2
Total variable cost (TVC)₦	**11**	**N6,404,840.70**	**100**
Fixed cost (FC)			
Items ₦			
Land	0	N0.00	0
Housing for snails	0	N0.00	0
Tax	0	N0.00	0
Others like equipments etc	0	N0.00	0
Total fixed cost (TFC)₦	**0**	**N0.00**	**0**
Total cost (TC)=TVC+TFC₦	**11**	**N6,404,840.70**	**100**
Total Revenue (TR)₦	**11**	**N16,138,530.00**	
Gross margin (TR-TVC)₦	**11**	**N9,733,689.30**	**152.0**
Net profit₦	11	**N9,733,689.30**	152.0
Net return on investment (NROI) TR/TC	11	N1.52	

Source: Field Survey, 2024

Key: POL=Point-of-Lay snail, TS= Table Sized snail

Table 7: Constraints to snail production in Benin Metropolis

Constraints to snail production	Total	Mean score	Decision
Slow growth	5	1.25	Reject
Pests and predators attack	15	1.37	Reject
Disease attack	3	1.5	Reject
Human theft	13	1.18	Reject
Feed unavailability	11	1.38	Reject
Limited source of foundation stock	27	1.8	Reject
Mortality of snails	22	1.16	Reject
Low or lack of capital	67	2.68	Accept
Unstable markets	8	1.15	Reject
Inexperience of snail farmers	18	1.2	Reject
Epileptic power supply	11	2.75	Accept
Inaccessibility to land	3	3	Accept

Source : Field Survey, 2024.

4.2 DISCUSSION

4.2.1 . Socio economic characteristics of snail farmers in the study area

Sex

The results of the socio economic characteristics of the respondents presented in table 1 shows that majority (83.4%) of the respondents were males implying the dominance of males in the snail production industry. This is in line with the assertions of Ahmadu and Ojogho (2012) who stated that heliculture is mostly dominated by men.

Age

Age percentage (40%) of snail farmers in the study fell within the age bracket of 41-50 years, (33.4%) fell within 51 years and above,(23.3%) fell within 31-40 years, while (3.3%) fell within 21-30 years. The average age being 45 years. This age bracket is a productive or active age which pretends better future for snail production. It is considered as economically active age. This is in line with the findings of Ngenwu, Mafeni, Etchu and Oben (2010)

Marital status

The marital status of the respondents shows that 73.4% are married 16.7% are single, 3.3% is divorced, 3.3% is widowed while 3.3% is separated. This shows that married people are more involved in snail famring, and this might be due to the desire to cater for their family. This study is in line with findings of Yahaya (2012).

Household size

Table 1 shows that most (53.3%) of snail farmers had household size of 4-6 persons, 30% had household size of 1-3 person, 3% had household size of 7-9 persons, while 2% had household size of 10-12 persons. This implies that snail farmers in the study area had medium household size within an average household size of 5 persons.

Years of experience in snail farming

The distribution of the farmers according to the number of years spent on snail rearing is shown in table 1. Those that have 0-4 years are 70%, those that have 5-9 years are 26.7%, while the person having 10 years and above experience is 3.3%. The average years of experience is 4.1 years. As a result, the respondent with the highest number of years of experience should have good skills and better approaches to snail farming business; while those having 0-4 years, may have faced many risks in the early day of their snail farming. The low years of experience in snail farming is in line with the findings of Ahmadu and Ojogho (2012).

Level of education

The educational level of respondents shows that majority (56.7%) of the snail farmers had tertiary education, 40% had secondary education, while 3.3% had primary education as shown in table 1. This aliens with the findings of Ahmadu and Ojogho (2012) who stated that majority of snail farmers had tertiary education. Education is important in snail rearing especially in the area of book keeping and proper management.

Source of capital

The data in Table 1 shows that 90% of the source of capital used in setting up and running their snail farm in the study area are from personal savings alone. 3.3% from personal savings and loans, 3.3% from relatives and friends, while 3.3% from all source viz; personal savings, loans, friends and relatives. From the 3.3% each who added loans to personal savings and from all sources of loan were the banks i.e LAPO microfinance bank. The implication of majority of the respondents starting and running their farms with personal savings is that they were determined to start snail farming business without external assistance. This findings also agrees with the finding of Raheem (2001) that 96% of snail farmers used personal savings as source of capital.

4.2.2 Management practices, based on management systems of snail farmers in Benin Metropolis

4.2.2.1 Management system, land acquisition, housing, skill development, farm records keeping and security challenges

Management system adopted

The data in Table 2a. shows that 96.7% of snail farmers adopted the intensive system of production, 3.33% adopted the semi intensive system, while none adopted the extensive system of production. Snail farmers in the study area prefers the intensive system to extensive because snails grow very well under the intensive system. This was also supported by Bayode (2009) who stated that snails grow better and to its biggest size when reared under intensive system.

Method of land acquisition

73.4% of the snail farmers in the study area purchased the land they are using for snail farming, 13.3% rented the land, 10% got the land through inheritance, while 3.3% got the land on lease.

Type of housing

Table 2a. shows that majority (43.4%) of the snail farmers reared their snails in trench pen, followed by free range system which is 30%,tyres which is 20% and then tent and hutch boxes which are 3.3% and 3.3% respectively. The use of trench pen by majority of the farmers is in line with the findings of Raheem (2001).

Skill development per year

The data in Table 2a. revealed that 36.7% of the respondents did not conduct training and retraining at all, 20% conducted training and retraining once in a year, 16.7% did so 2 times in a year, 13.3% did so 3 times in a year, 10% did so more than 3 times in a year, while 3.3% did so once in 2 years. This implies

that the rate of training and retraining of the respondents is low. Training is vital to snail rearing improvement and profitability.

Farm records keeping

Data in Table 2a. shows that 93.3% of the respondents kept farm records while 6.7 did not keep farm records. This may be due to the fact that 56.7% and 40% of the respondents had tertiary and secondary education respectively, prompting them to recognize the importance of record keeping in proper management and profitability.

Types of farm records kept

43.4% of the respondents kept farm diary in their farm records, 56.7% kept farm inventory in their farm records, 40% kept inputs records, 40% kept production records, 26.7% kept consumption records, 33.4% kept sale records 26.7% kept all the above records, while 6.7% kept no records at all. (Mind you, a respondent could keep one or two or more of the above types of farm records)

Security challenge

The data in Table 2a. showed that 56.7% of the snail farmers had no security challenge at all, while 43.3% had the security challenge of human theft.

Control of security challenge

36.7% of the respondents that had human theft (43.3%) as a challenge controlled this by fencing round the snailery. 33% controlled his with the use of CCTV camera and having good relationship with his neighbours, while 3.3% controlled his with the use of dogs

4.2.2.2 Snail feeding practices

The data in table 2b. shows that 83.3% of the snail farmers in the study area fed their snails with vegetables, 96,6% fed their snails with fruits, 83.3% fed their snails with both vegetables and fruits,

23.3% fed their snails with concentrates, 20% fed their snails with kitchen waste and 10% fed their's with tubers. (Mind you, a snail farmer could feed his snails with one or more of these feed stuffs at a time). The above data shows that snail farmers in the study area fed their snails with a variety of recommended diet especially pawpaw which serves as a feed stimulant. This is supported by Okafor (2001).

Frequency of feeding in a day

Table 2b. reveals that 73.4% of snail farmers fed their snails once in a day (Ebenebe, 2013), 23.3% fed their's 2 times a day, while 3.3% fed his 2 times in a week. This implies that snail farmers in the study area gave adequate feeding attention to their snails, which will make them grow fast and record marketable size in expected time.

Frequency of remnants removal

50% of the snail farmers removed their feed remnants everyday, 10% once in 2 days, 3.3% once in 3 days while 36.7% did not practice frequent removal of feed remnants. It is good practice to remove feed remnants from your snailery everyday, as failure to do this will attract pests such as army ants termites, rats, cockroaches, centipedes etc.

Frequency of provision of water in a day

76.7% of the snail farmers provided water once in a day for their snails, 3.3% provided water 2 times in a day, 16.7% provided water more than 2 times in a day, while 3.3% provided water 3 times in a week. Data from the above shows that snails farmers in the study area gave adequate water to their snails, which is a vital requirement for snails.

Source of water

Data from the table shows that 100% of the snail farmers got their water supply form borehole, and out of this 3.3% went a step further to boil the water before administering it to his snails. The implication of this

is that the snail farmers will incur additional cost to power their boreholes either through the electricity company or generators.

Supply of calcium to snails

43.3 of snail farmers in the study area supplied calcium to their snails and out of this, 36.7% supplied lime to their snails, 3.3% supplied bone meal + snail shell meal, while 3.3% supplied charcoal to his snails. Majority (56.7%) did not practice supplying of calcium to their snails. The implication of this, is that the snail will grow at a slower rate compared to those fed with calcium.

Frequency of supply of calcium to snails

Out of the 43.3% of snail farmers that supplied calcium to their snails, 13.3% supplied calcium 4 times in a month, 13.3% supplied calcium 2 times in a month, 3.4% supplied once in 2 months, while 13.3% supplied once in 3 months.

4.2.2.3 Health management practices of snail farmers in Benin Metropolis

Pests

Data in Table 2c. shows that 56.7% of the respondents in the study area were affected by army ants, 26.7% were affected by drillus caterpillar, 26.7% by lizards, 16.7% by termites, 16.7% by cockroaches, 13.4% by centipedes, 13.4% by rats, 6.7% by mice, 6.7% by ground beetles, 6.7% by frogs and 3.4% by toads. These findings are in agreement with Ogunniyi (2009). (Note, that some of the respondents had 2 or more pests attack at once).

Level of pest attack

Data in Table 2c. shows that 63.3% of the respondents in the study area had their level of pests attack as significantly mild, 20% had their level of pests attack as moderate, 16.7% had theirs as insignificantly mild, while none had serious or very serious level of pests attack.

Effects of these pest attacks

43.3% of the respondents had reduced production, 43.3% had mortality, 30% had reduced profits, 13.3% incurred additional cost to arrests the pest attacks, 13.3% of the respondents had all the above named effects on their farms, while 16.3% had no effect on their farms, (Ogunniyi, 2009).

Control of the pests attacks

Data from the respondents in the study area shows that 46.6% of them made use of gutter filled with engine oil to control pests like army ants and termites, 16.6% make use of nets to control pest like army ants, termites, lizards, cockroaches, drillus caterpillar etc. 13.3% controlled their pest attacks like army ants and termites, by planting repellant plants around the snailery. 13.3% killed the pests manually on the farm, 6.6 did regular weeding and good sanitation, 3.3% treated the soil, while 10% did nothing to control their pests attacks.

Diseases

Data from Table 2c. shows that majority (86.7%) of the snail farmers had no disease of snails on their farms. 6.7% had bacterial disease on their farms, 3.3% had fungal disease, while 3.3% had diseases caused by nematodes on his farm. This implies that in the study area disease attack is not a major problem, and therefore it is insignificant

Level of disease attack

Data from the Table also shows that level of bacterial disease attack was considered significantly mild and moderate. Fungal disease was considered insignificantly mild while nematode disease was moderate.

Effects of disease attack

90% of the snail farmers had no disease effect since they had no disease attack, 6.7% of the snail farmers had reduced production, none of the snail farmers had mortality, reduced profits or incurred high cost to arrest them. 3.3% of the snail farmers had all of the above named disease effects.

Control of disease attack

90% of the snail farmers had no need for disease control since they had no disease attack 6.7% of the snail farmers made use of antibiotics to control bacterial attack. 3.3% employed sanitization of equipment and workers + good sanitation to control disease problems.

4.2.3 Management practices, based on cultural practices of snail farmers in Benin Metropolis.

Culture practices adopted

The data in Table 3. shows that 93.3% of snail farmers in the study area adopted monoculture of Archachatina marginata only and none of Achatina achatina only, while 6.7% adopted polyculture of both Archachatina marginata and Achatina achatina. Majority of the farmers went for monoculture of A. marginata only over A. achatina only or both. This is so because A. marginata has larger body size, its easier to manage and it gets to marketable size in about 18 months compared to A. achatina which is slow growing and requires nearly 24 months to reach marketable size (Raheem, 2001).

The table further shows that 36.7% of the farmers practiced integrated snail farming which is an integration of snail farming and crop production. Under this, 30.1% of farmers practiced monoculture+ integrated snail farming and 6.6% of farmers practiced polyculture + integrated snail farming

Preferred type of snail reared

Respondents from the study area showed that majority (93.3%) of them preferred to rear the Archachatina marginata species because of the reasons stated above under culture practices adopted, which includes bigger body size, and reaching marketable size in 18 months. 6.7% of the respondents reared both Achachatina marginata and Achatina achatina, while none went for Achatina achatina only. The preference of the A. marginata species is also in line with the findings of Raheem (2001).

Number of snails present in the farm (stock size)

Table 3. shows that majority (30.0%) of respondents in the study area had stock size of 101 to 500, 26.7% had stock size of 501 to 1000, 13.3% had stock size of 100 and below, 10% had 2501 and above, another 10% had 1001 to 1500 stock size, 6.7% had 1501 to 2000 and then 3.3% had stock size of 2001 to 2500. The respondents therefore had average stock size of 4317.8 snails. This is rather low and might be the key reason for the wide gap between supply and demand for snails.

Frequency of soil sanitization in a year

Majority (40%) of the respondents sanitized their soils 2 times in a year, 26.7% did not sanitize their soils at all, 20% sanitized once in a year, 10% sanitized their soils 3 times in a year, while 3.3% sanitized his 4 times in a year.

4.2.4 Output from management practices of snail farmers in Benin Metropolis

4.2.4.1 Number of snails produced from hatchery unit for a production period of 6 months

Table 4. shows that majority (33.3%) of the respondents in the study area had no hatchery unit and therefore do not produce their own foundation stock. 16.7% of the respondents had hatchery output size of 101 to 500, 13.3% had hatchery output size of 1001 to 1500, another 13.3% also had hatchery output size of 2501 to 3000, 10% had hatchery output size of 501 to 1000, 3.3% had size of 1501 to 2000, 3.3% had size of 2001 to 2500, 3.4% had size of 3001 and above while 3.3% had hatchery unit but his output size is not known by him. Average number therefore was 1,721.1 snailets. This is a low production rate.

4.2.4.2 Number of point of lay (POL) snails produced from farm after a production period of 6 months or that is purchased as foundation stock

Data from table 4. also shows that majority (33.3%) of the respondents do not produce POL snails neither do they purchase POL as foundation stock. 26.7% of respondents had POL output size of 101 to 500, 16.7% had POL output size of 501 to 1000, 10% had size of 1001 to 1500, 3.3% had output size of 3001 and above, while 6.7% had POL being reared but no output yet. Average number therefore was 790.3 POL. This is a low production also compared to current demand for snails.

4.2.4.3. Number of table sized (TS) snails produced from farm after a production period of 12 or 18 months

Data from table 4. shows that majority of the respondents which is 33.4% had no output yet because they were still new in the snail production business. 23.3% had TS snail output size of 501 to 1000, 20% had output size of 101 to 500, 10% had output size of 1001 to 1500, 6.7% had output size of 3001 and above, 3.3% had output size of 1501 to 2000 while another 3.3% had output size of 2501 to 3000. Average number therefore was 3,589.2 TS. This is also a far cry from the current demand of TS snails to meet the protein need of the populace.

4.2.5 Cost, returns and profitability analysis of snail farming in Benin Metropolis

Table 5. and 6. show the results of the costs involved and the returns and profitability in snail production in the study area. Table 5. reveals the costs, returns and profitability of snail farms that are 2 to 3 years old. At this stage, total fixed cost is still being recovered from total revenue and therefore, net profit is low.

On the other hand, table 6. reveals the costs, returns and profitability of snail farms that are 4 years and above. At this stage, total fixed cost would have been fully recovered, and the snail farms would be running on total variable cost. This would give a better reflection of the profitability of snail farms compared to other livestock production.

Table 5. and 6. show that variables considered are total variable cost (TVC), total fixed cost (TFC), total cost (TC), total revenue (TR), gross margin (GM), net profit (NP), net return on investment (NROI) and others.

4.2.5.1 Costs, returns and profitability of snail farms that are 2 to 3 years old

Table 5 reveals that the mean output of point-of-lay (POL) snails after a production period of 6 months was 660.7 snails. Mean cost required to raise 1 snail to POL was N604.90 and mean selling price/POL snail was N987.5. Mean output of table sized TS snails after a production period of 12 and 18 months was

1105.9, mean cost required to raise 1 snail to TS was N1084.10 while mean selling price/TS snail was N1495.50.Among the TVC which are foundation stock, labour, feeding, transportation, water, others (like pest control and medication etc) and rent, labour constituted the highest (27.2%) followed by feeding (18.1%). Followed by this, is foundation stock (12.4%), water (9.7%), transportation (7.6%), others (3.7%) and rent (1.7%). TVC was therefore 80.4%. Among the TFC which are land, housing for snails, tax and others like equipment, etc, land constituted the highest (11.5%), followed by housing for the snails (7.2%), others (0.9%) and then tax (0%). Tax was 0% because the Federal government through the Federal Inland Revenue (FIRS) gave a concession of zero tax payment to all agricultural enterprises for the first 8 years of their enterprises. TFC was therefore 19 6%. TC constituted 100%. GM fell at 111.9%, NP or NFI was 92.2% while NROI was N0.92 meaning that for every N1 invested into the snail farm, a return of N0.92 was made. This shows that snail production is a profitable business in the study area.

4.2.5.2 Costs, returns and profitability of snail farms that are 4 years and above.

Table 6 shows that the mean output of POL snails after a production period of 6 months was 894 snails. Mean cost required to raise 1 snail to POL was N367.4, mean selling price per POL snail was N995. Mean output of TS snails after a production period of 12 or 18 months was 10,166.4, snails mean cost required to raise 1 snail to TS was N630, while mean selling price per TS snail was N1500.

Among the TVC which are foundation stock, labour, feeding, transportation, water others (like pest control, medication, etc) and rent, foundation stock constituted the highest (41.7%), followed by labour (29.1%), feeding, (17.7%), transportation (5.1%) water (4.8%), others (1.4%) and rent (0.2%). TVC therefore fell at 100%. For the TFC which are land, housing for the snails, tax and others like equipment, etc, they all fell at 0%. TC was 100%. TR was N16,138,530.00. GM was 152.0%, NP or NFI was also 152.0%, while NROI was N1.52 which means that for every N1 invested into the snail farm, a return of N1.52 was made. This shows that snail production is a profitable business in the study area.

For the remaining 10 respondents among the 30 respondents, their farms were just at 1 year and below, meaning that there was no output yet, since the Archachatina marginata snails takes about 18 months to get to table size. While the Achatina achatina snail takes about 24 months to get to table size.

4.2.6. Constraints facing snail farmers in Benin Metropolis

Table 7 shows the mean distribution of the snail farmers according to constraints faced. Only 3 out of the 12 presented were rated as serious constraints facing snail farmers in the study area. These were; low or lack of capital for business expansion (2.68), epileptic power supply (2.75) and inaccessibility to land (3.0). The combined effects of these factors is capable of affecting the economics of snail production by farmers. This is in line with the findings of Baba and Adeleke (2006) who reported that low or lack of capital for business expansion high cost of feed, and other factors were responsible for the low rate of snail production by snail farmers in Nigeria. Baba and Adeleke (2006) also noted that the farmers in the rural areas are not financially buoyant enough to venture into commercial farming as a result of poor income from subsistence farming system practiced by them. The findings also collaborates with that of Alamu (2004) who posited that majority of the farmers do not have enough money to procure facilities and other needs in the farm because of their expensive nature.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

The main objective of the study was to appraise the management practices of snail farming in Benin Metropolis of Edo State. The specific objectives were to describe the socio-economic characteristics, examine the management practices, according to management systems and culture practices, ascertain the level of snail output, determine the cost,returns, profitability, and ascertain the constraints of snail farming the study area.

The study population consisted of 30 privately-owned snail farms and the sampling technique used was the show balling technique. Data collection was done through the use of structured questionnaire, direct observations, and personal interview. Data analysis was done using descriptive statistics, budgetary analysis, likert scale and the summary of the findings includes the following; majority (83.4%) of the respondents were males, majority of the respondents (40%) fell within the age bracket of 41 to 50 years. 73.4% of the respondetns were married with an average household size of 5 persons. Most (70%) of the respondents had 0-4 years of snail farming experience with a mean of 4.1 years. Greater percentage (56.7%) of the snail farmers had tertiary education which may have contributed to good output .90% of them used personal savings as seed money (capital).

Almost all (96.7%) of the snail farmers practiced intensive system of management because snails grow well under this system. 93.3% of them adopted monoculture of *Achachatina marginata* only. This is because *A. marginata* has larger body size, easier to manage and gets to table size in 18 months. 73.4% of the respondents had already purchased their land, reducing cost of production in the long run. Majority (43.4%) of them reared their snails in trench pens and also majority (93.3%) preferred to rear the *Archachatina marginata* species over the *Achatina achatina* species because of the reasons stated above. Greater percentage (30%) of respondents had stock size of 101 to 500 with an average stock size of

4317.8 snails. This is rather low. Most (40%) of them sanitized their soils 2 times in a year. 36.7% of the snail farmers did not conduct training and retraining at all, while 20% conducted once in a year. 93.3% of the respondents kept farm records which may be due to the fact that 56.7% and 40% of them had tertiary and secondary education respectively. 56.7% of them had no security challenge at all, while 43.3% had the challenge of human theft. 36.7% of this controlled theirs by fencing, 3.3% by the use of CCTV camera, while 3.3% controlled his with the use of dogs. Majority (83.3%) fed their snails with both vegetables and fruits especially pawpaw which serves as a feed stimulant, 73.4% of the respondents fed their snails once in a day, making them to grow fast and reach marketable size in record time. 50% of the respondents removed their feed remnants everyday, while 76.6% provided water once in a day for their snails. 100% of the snail farmers got their water supply from boreholes, 43.3% of them supplied calcium to their snails, and out of this 13.3% supplied it 4 times in a month. The results from the study also showed that 56.7% of the respondents were affected by army ants and 26.7% by drillus caterpillar, but were all significantly mild. Results also showed that majority (86.7%) of respondents had no disease attack.

Output from management practices shows that 33.3% of the snail farmers did not have hatchery unit, but 16.7% had hatchery output of between 101 to 500 snails. 33.3% of the respondents did not produce POL snails but purchased from other sources, while 26.7% produced between 101 to 500 POL snails for sale. Also, for TS snails output after 12 months or 18 months of production, majority (23.3%) of them had output of between 501 to 1000 snails. Mean of TS snails was 3589.2. Results of costs and returns from the management practices shows that for snail farms that are 2 to 3 year old, average total cost incurred during the production period was ₦1,157,631.00 (100%), while total revenue of ₦2,225,861.20 was realized with a net farm income or net profit of ₦1,068,230.20 (92.2%) and the rate of return on investment was ₦ 0.92. For snail farms that are 4 years and above, average total cost incurred during the production period was ₦6,404,840.70 (100%), while total revenue was ₦16,138,530.00 and net profit

was ₦9,733,689.30 (152.0%). Therefore, the net return on investment was N1.52. This shows that snail farming is a very profitable business to invest in.

Results from the study on constraints facing snail farming the study area shows that only 3 out of the 12 constraints presented were rated as serious and they were; low or lack of capital for business expansion (2.68), epileptic power supply (2.75) and inaccessibility to land (3.0). The combined effects of these factors is capable of affecting the economics of snail production by farmers.

5.2 Conclusion

An appraisal of the management practices of snail farming in the Benin metropolis of Edo State of Nigeria had been carried out in this study. It was found that the management practices adopted by most of the snail farmers in the study were in line with best standard practices which are; a very great percentage (96.7%) of the respondents chose intensive system of management and 93.3% chose monoculture of *A. marginata* species only, over *A. achatina* because the species is easier to manage, grows faster and records marketable size in 18 months 73.4% of the respondents had already purchased their lands for production, thereby reducing cost of production. 43.4% of respondents chose trench pen housing over others since it is about the best type of housing for snails, 40% sanitized their soils 2 times in a year, 93.3% kept farm records but only 20% conducted training and retraining once in a year which was rather low. 56.7% had no security challenge at all, but 43.3% had the challenge of human theft. Out of this 43.3% of human theft, 36.7% used fencing as a control measure. For feeding, 83.3% fed their snails with both vegetables and fruits especially pawpaw. 73.4% fed theirs once in a day, 50% removed feed remnants everyday and 43.3% of the respondents gave calcium to their snails, 76.7% gave water once a day to their snails, otherwise they would go into aestivation. 100% of the respondents had boreholes as their source of water and not rivers or well which could be a source of infection. 56.7% had army ants as their major pests, but it was significantly mild because of good control measure such as use of gutter filled with engine oil (46.6%) and nets (16.6%). 86.7% had no disease on the farm because of frequent removal of feed remnants, good sanitation and use of antibiotics. To crown up all these data, 56.7% and

40% of the respondents had tertiary and secondary education respectively and had an average of 4.1 years in snail farming, which all contributed majorly to their good management practices.

It was also established that snail farming in the study area is a very profitable venture as justified by the net farm income generated by the farmers and high return on every one naira spent, regardless of the constraints they faced. For snails farms that are 2 to 3 years old, average TC incurred was N1,157,631.00 (100%), NFI was 92.2% and NROI was N 0.92. For snail farms that are 4 years and above, average TC incurred was N6,404,840.70 (100%), NFI was 152.0% and NROI was ₦1.52.Therefore, the business of snail production could serve as veritable enterprise for uplifting the standard of living of its producers and consequently advance the economy of the nation.

5.3 Recommendations

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

1. It is strongly recommended that low income earners and women be sensitized continuously to go into snail farming through supported extension services, government advertisements and it's inculcation as a vocation into the secondary and tertiary education. This will increase snail production and improve standard of living.
2. There is the need for government at all levels to establish research and breeding institutes for snails where farmers can acquire foundation stocks to address the issue of it's scarcity and other inputs such as compound rations to address the issue of slow growth rate. This should be at subsidized rates.
3. It is recommended that snail farmers restock foundation stock on their farms every two months or so, so that at the end of the 18 months production period, farmers will start raking in regular income on a 2-month basis. This will encourage snail farmers to be on a full time production basis and also on a large scale.

4. There is the need for government to make funds readily available, specifically to snail farmers in the form of grants and loans through credit institutions like Bank of Agriculture and others in order to address the issue of capital to start and expand their snail farms. This should be at 0% interest rate.
5. It is recommended that public and private partnership through the creation of business-friendly environment by the government, be encouraged to address the issue of low capital in snail production.
6. It is also strongly recommended that government encourages and intensifies as well as put in place systems or programs that provides free farm inputs to practicing snail farmers, fund the farming operations by themselves and then government buys the produce from the farmers. But government must monitor the disbursement of these funds or inputs so that it does not get hijacked. This will address the issue of cost of production, snail marketing and help to stabilise prices of snails.
7. Finally,there is the need for policy formulation drive of the government such as investor-friendly policy formulation, to be channeled specifically towards achieving large scale production in Nigeria.

All these will be in a bid to bridge the gap between demand and supply of snails and consequently advance the economy of the nation.

REFERENCES

Adebayo, O.M. (2012). "Attitude of house hold in Niger Delta Zone toward snail Meat Consumption". In Ukachukwu S.N. (eds) *annual production in the new millennium: challenges and options, Zaria:* NSAP secretariat. Pacter publication, 54-59

Adeleke L.O. (2006). Snail rearing: A new oppourtunity for small and medium scale enterprises (2nd ed), Ibadan University Press.

Afolabi J.A. (2013). Snail farming as an environment friendly and viable enterprise in Ondo State, Nigeria, Journal of Human Ecology, 42(3):289-293.

Aguaguiyi, Offia, Ebere, Fortune, N. Emegha Kate, Umebali and Emmanuel E. (2022). Determinants of snail production in Delta State. *GOUni Journal of Faculty of Management and Social Sciences,* 10(1):97-118.

Ahmadu, J. and Ojogho, O. (2012). Economics of snail production in Edo State, Nigeria. *International Journal of Agriculture Science* 45223-237.

Ahmadu. J. and Ida-Ogbomo E.O. and Oyoboh D.E. (2021). Contribution of snail production to income status of snail farmers in Edo South, Edo State, Nigeria. Agro-Science, 20(2):49-52.

Aiyeloja A.A., Ogunjimi A.A (2010). Poverty Alleviation potentials of snail farming in Ondo State, southwest Nigeria. *International Journal of Agricultural and Biological Sciences,* 1:56-74.

Ajibefun I.A. (2000). Economic Analysis of Contribution to Livestock Produciton to Household Income in Ondo State, Nigeria. in : proceedings of 27th Annual Conference of Nigeria pp 362-363.

Akanni K.T. (2012). Genetic characterization of Indigenous and Exotic Rabbits and Their Crosses. (PhD. Thesis, Federal University of Agriculture, Abeokuta)

Akinnusi, F.A.O. (2004). Introduction to Snails and Snail Farming (2nd Ed) Triolas Exquisite Venture Abeokuta, Nigeria.

Akinnusi, O. (2013). Snail rearing case study of Abeokuta Ogun State, Nigeria *in proceeding 13th Annual Conference animal Science Association, of Nigeria (ASAN),* sept. 15th – 19th 2013. A.B.U. Zaria. 307-311.

Akintomide I.A. (2004). Tropical Snail Farming, Oak Ventures' Publishers. Lagos.

Akinnusi O. (1998). Introduction to snail farming. Omega publishers, Lagos, Nigeria.

Alio, A.N. (2008). Fundamentals of educational research Enugu Samireen Nigeria Ltd.

Amao, J.O. Adesiyan, O.I and Salako B.A. (2007). Economics of Snail production in Enugu State East Agricultural Zone of Enugu State, Nigeria. Retrieved at https://eduproject.com.ng. On 14th April, 2022.

Aminu F.O., Edun, T.A. and Abiodun (2020). Analysis of the determinants of technical efficiency of snail farmers in Ogun State, Nigeria. *Nigerian Journal of Animal Science,* 2020, 22(1):233-240.

Amusan J.A. and Omidiji M.O. (1999). Edible Land Snail: An Introduciton Guide to Snail Farming in the Tropic. Ibadn: Verity printer LTD Pp 4-12.

Anochili I.C. and Aneke J.A. (2022). Economic Implications of snail production in Enugu State. *Academic Journal of Agricultural and Horticultural Research,* 2(2):1-12.

Asheye O.A., Omole, J.A. Adetoro, F.O. and Kehinde, O.F. (2001). Effect of processing on chemical and sasory properties of two West African Snails. *Moore Journal of Agricultural Research* 2(5):1-10.

Baba K.M. and Adeleke M.T. (2006). Profitability of snail production in Osun State, Nigeria. *Journal of Agriculture and Food Sciences,* 4(2):147-155.

Bayode O.T. (2009). Snail production techniques: An opportunity for self sustenance in the face of economic recession. Cedar consult-seminar paper.

Blessing G. (2023) A simple formula to making millions in snail farming, 2023.

Cobbinah, J.R. (2001). Snail Farming in West Africa, A practical Guide 1-6, Food and Agricultural Organisaiton.

Cobbinah J.R. (1993). Snail farming in West Africa: A practical guide Technical center for agricultural and rural cooperation p1-49.

Cobbinah J.R. (2003). Snail farming in West Africa: A practical guide. CTA Publication's Pp 7-12.

Cobbinah, J.R. (1992). *Snail Farming in West Africa: A Practical Guide.* Technical Center for Agricultural and Rural Cooperation (CTA), 49.

Cobbinah, J.R. Vink A. and Onwuka B. (2008). *Snail Farming: Production, Processing and Marketing. Agrodok* 47 and CTA.

Ebenebe C.I. (2000). Mini livestock production in Nigeria. The present and future, in Proceedings of 5th Annual Conference of Animal Science Association of Nigeria, Port Harcourt, Nigeria September, Pp 19-22

Ebenebe, C.I. (2013). "Mini Livestock Production in Nigeria the present and future". *In procedure 13th Annual Conference animal Science Association, of Nigeria (ASAN),* sept. 15th – 19th 2013. A.B.U. Zaria. 389 - 396.

Ejidike B.N., Afolayan, T.A., Aloka J.A. (2004). Observation on some climatic variables and dietary influence on the performance of cultivated African giant land snail (A. marginata): notes and records *Parkistan J. Nutr.* 3:362-364.

Efarmspro, (2016). Snail Farming and Management Retrieved from www. Efarmspro.com. on 29th of December 2019.

Ejidike R.N. (2002). Snail Rearing Pracitces in Southern Nigeria. In: Proceedings of 27th Annual Conference of the NSAP held in Akure, 307-310

Ekunwe P. and Enato O., (2016). Profitability of snail Marketing in Benin Metropolis, Edo State, Nigeria. Agricultural and Food Science, Business 2016.

Food and Agricultural Organization, (2002). Modern Snail farming technology. Rome FAO of the United Nation.

Food and Agriculture Organization (FAO) (2011). *World Development Report*, FAO, Rome. 109-110.

Hamzat O.A. (2014). Use of Fresh Kola testa in Breeding giant land snail under kola plantation in: 15th Ann. Conf. ASAN. 13th-15th September, 2010. University of Uyo, Nigeria Pp 369-371.

Hamzat O.A. and Omole A.J. (2003). Growth performance of Africa Giant Land Snails (*Archachatina marginata*) on dried kola nut testa and palm kernel cake mixture agricultural and food sciences, *African Journal of Livestck Extension.*

Hatziioannou, M., Issari, A., Neofitou, C., Aifadi, S. and Matsiori, S. (2014). Economics analysis and production techniques of snail farms in southern Greece. *World Journal of agriculture Research* 2(6) 276-279

Idayat, A.K. Michael F.A., Folasade O.O., Busirat O. (2021). Economic Analysis of two giant land snail marketing in Ibadan, Oyo State, Nigeria. agricultural Tropical et subtropical, 54, 238-246, 2021.

Imerbore E.A. and Ademosun A.A. (1988). The Nutritional Value of the African Giant Land Snails, Archachatina marginate. *Journal of Animal Production and Research Management* 2(7).

Munonye J.O. and Moses P. (2019). Profitability of snail production in Osun State, Nigerian Journal of Agriculture and Food Sciences, 4(2):147-155.

Money, K.A. (1994). Notable notes on giant African Snails. *Snail farming research* 5:1-13.

National Bureau of Statistics (2012). Annual abstract of statistics retrieved from http://www.nigerianstat.gov.ng/pd/uploads/annualabstract 2012 pdf

National Populaiton COmission (2006). Census provisional result, Nigeria

National population Commission of Nigeria (web) National Bureau of Statistics, (2018). Retrieved at: http://www.citypopulation.de>php.nig... on 25th April, 2022.

Nigerian forum for Agricultural Advisory Services (2016). (NIFAAS).

Nworgu, B.G. (2015). Educational Research; basic issues and methodology, Nsukka; University Truest Publishers.

Ngenwi, A.A. Mafeni J.M., Etchu K.A. Oben F.T. (2010). Characteristics of snail famers and constrains to increased production in West and Central Africa. *African Journal of Enviornmental Science and Technology* 4:274-278.

Obeteru, T. (2008). Utilization of Giant Land Snail (Archachantina maginata) in Oshimili South Local Government Area of Delta State. University Press, Asaba.

Obinah, J.r. (1992). *Snail Farming in West African: A Practical Guide.* Technical center for agricultural and Rural Co-Operation (CTA), 49.

Odunnaiya, O. (2011). Studies on the Growth Rate A marginata Fed Pawpaw Leaf, Waterlead and Maize chaff. *Unpublished B. Agriculture Project,* Ogun state University, Agro-Iwoye, Nigeria. 63.

Ogunniyi L.T. (2009). Economic Analysis of Snail Production in Ibadan, Oyo State, Nigeira. *International Journal of Food Science* 4:147-155.

Ojo, V.A. and Zira, B.D. (2017). Economics Analysis of edible land snail (*Archachatina marginata*) production in Jos North Local Government Area of Plateau State, Nigeria. *Applied Tropical Agriculture* 22(2) 150 – 155.

Okafor F.U. (2001). Edible Land Snails: A Manual of Biological Management and Farming of Snails. Spendid Publishers; Lagos.

Okorie A. (2012). The Study of Snail Production in Anambra State, Nigeria.

Oni, O.O. Akanni, K.T. and Akinnusi, F.A.O. (2012). Sire strain influence on the reproductive performance of two strains of giant African land snails (GALS) in south western Nigeira. *Proc. 1st International Conference of Giant African Land Snails* held between 12th -15th Feb., 2012 at Federal University of Agriculture, Abeokuta, Ogun State.

Raheem A.A. (2001). Economic Analysis of Snail Production in Nigeria. A Study in Ogmoso North and South Local Government Areas in Oyo State of Nigeria. unpublished PhD Thesis, Department of Agricultural Economics and Extension, Ladoke Akintola University of Technology, Ogomoso, Oyo State.

Thompson R. (1996). Raising Snail: Alternative Farming System Information Center.

Uche Okeke (2015). Economics of snail rearing in Ndukwa West Local Government Area of Delta State, Nigeria.

Ugwu, S.O.C. Ogbu, C.C. and Ikechiano, I.K. (2011). Reproductive characterization of Three Species of Giant African Land Snails, (GALs) in captivity. *African Journal of Biotechnology* 10(50):10315-10319.

Usman J.S., Kehinde A.S., Ojo M.O. Akinyemi O. and Adebayo O. (2003). *Proceedings of the 28th Annual Conference of the Nigerian Society for Animal Productionn.* 411-412.

Uzoagulu, A.E. (2011). *Practical Guide to Writing Research Report in Tertiary Institutions.* Enugu: John Jacobs Classic Publishers Ltd.

Uzor, I.A. (2012). "Economic Analysis of Contribution of Livestock Production to Household Income in Ondo State, Nigeria *in proceeding of 1ith Annual Conference of ASAN* September *l*15-18th 2012. Fed. Univ. Technology, Minna. 79-82.

Wosu L.O (2003). Commercial Snail Farming in West Africa. A Guide Express Publishers Nig. Nsukka.

Yahaya, M.A. (2012). Economic analysis of Snail Production and Marketing in Jos Metropolis. *Journal of Forestry and Environment,* 9(2): 56-64.

Yusuf O.A. (2002). Economic Analysis of Snail Production and Marketing in Ibadan Metropolis. Unpublished B. Tech. Project, Department of Agricultural Economics and Extension. Lakode Akintola University of Technology. Ogbomoso, Oyo State.

DEPARTMENT OF ANIMAL SCIENCE

FACULTY OF AGRICULTURE
UNIVERSITY OF BENIN, BENIN CITY, EDO STATE

Dear Sir/Madam,

I am a post graduate student (M.Sc) of the above named Department carrying out a research on the topic "Appraisal Of Management Practices of Snail Farming in Benin Metropolis, Edo State, Nigeria".

I kindly request your assistance in answering the following questions as this research work is solely for academic purpose and information supplied will be treated with utmost confidence.

Please tick (`) or fill the necessary space given appropriately. Thanks for your anticipated cooperation.

_____
Ebiyon J. Ekengbuda

SECTION A: SOCIO-ECONOMIC CHARACTERISTICS

1. Sex:……..
2. Age of Respondent:…….
3. Marital status: (a) single ( ); (b) married ( ); (c) divorced ( ); (d) widowed ( ); (e) separated ( ).
4. Household size (number):……..
5. Years of experience in snail farming:……..
6. Level of Education: (a) Non formal Education ( ); (b) Primary School ( ); (c) Secondary School ( ); (d) Tertiary Education ( ); (e) Others (specify):……..
7. Source of capital" (a) personal savings ( ); (b) loans ( ); (c) relatives and friends ( )
8. If by loan, from what source? (a) Banks ( ); (b) Government ( ); (c) Cooperatives ( ); (d) Local money lenders ( ); (e) others (specify):…….…….

SECTION B: MANAGEMENT PRACTICES INFORMATION

9. Management system adopted by snail farm: (a) Extensive ( ); (b) Semi-intensive ( ); Intensive ( ).
10. Culture practices adopted by snail farm:

i. Monoculture: (a) *Archatina archatina* only ( ); (b) *Archachatina marginata* only ( ) others specify:……

ii. Polyculture: (a) *Archatina archatina* + *Archachatina marginata* only ( ) (b) *Archatina archatina* + others (specify):…… ( ); (c) *Archachatina marginata* + other (specify):…….. ( )

iii. Intergated snail farming: snail (specify):……. + crop (specify):…….

11. Method of acquisition of land for farming: (a) rented ( ); (b) lease ( ); (c) inherited ( ); (d) purchased ( ).
12. Type of housing used by farm: (a) Trench pens ( ); (b) drums or pots ( ); (c) tyres ( ); (d) free range ( ); (e) tent ( ) (f) others (specify):……
13. Preferred types of snail reared: (a) *Archatina archatina* ( ); (b) *Archachatina marginata* ( ); (c) both ( ); (d) others (specify):……
14. Number of snails present in your farm:…….
15. How often do you sanitize the soil in a year: (a) none ( ); (b) 1 ( ); (c) 2 ( ); (d) 3 ( );
16. How often do you conduct training and retraining in a year: (a) none ( ); (b) 1 ( ); (c) 2 ( ); (d) 3 ( ); (e) more than 3
17. Do you keep records of your farm activities (a) yes ( ); (b) no ( ).
18. If you keep records, what records do you keep? (a) farm diary ( ); (b) farm inventory ( ); (c) Input records ( ); (d) production records ( ); (e) consumption records ( ); (f) sales records
19. What insecurity challenge are you faced with? (a) human theft ( ); (b) presence of snakes ( ); (c) presence of scorpions ( ); (d) kidnapping ( ); (e) robbery ( ); (f) other (specify):…… (g) none ( ).
20. How do you tackle any of the above named insecurity:……

SECTION C: FEEDING PRACTICES INFORMATION

21. What feedstuff materials do you feed your snails with: (a) vegetables (specify):……. (b) fruits (specify):……. (c) both (specify):…….. (d) concentrates ( ); (e) kitchen waste ( ); (f) tubers ( ); others (specify):……..

22. How often do you feed your snails in a day: (a) 1 ( ); (b) 2 ( ); (c) 3 ( ); (d) none ( );
23. How often do your remove the feed remnants from your farm: (a) everyday ( ); (b) once in 2 days ( ); (c) once in 3 days ( ); (d) others (specify):…….
24. How often do your provide water for your snails: (a) none ( ); (b) 1 ( ); (c) 2 ( ); (d) more than 2 ( ).
25. What is the source of water for your snails: Borehole ( ); (b) Stream ( ); (c) others specify):……
26. Do you supply lime to your snails: (a) yes ( ); (b) no ( ):…….…….
27. How often do you supply lime to your farm:……

SECTION D: PESTS AND DISEASES INFORMATION

28. What are the pests/predators that you encounter in your snail farm: (a) lizard ( ); (b) snakes ( ); (c) frogs ( ); (d) birds ( ); (e) army ants ( ); (f) termites. ( ); (g) cockroaches ( ); (h) ground beetles ( ); (i) crickets ( ); (j) centipede ( ); (k) rats ( ); (l) mice ( ); (m) caterpillar of moth (n) toads ( ); (o) others (specify):…….
29. What is the level of these pests/predator attack: (a) Insignificantly mild ( ); (b) significantly mild ( ); (c) moderate ( ); (d) serious ( ); (e) very serious ( ).
30. What is the effect of these attacks: (a) reduces production ( ); (b) causes mortality ( ); (c) reduces profits ( ); (d) incurs high cost to arrest them ( ); (e) others (specify):……..
31. How do you control these attacks:…….
32. What are the diseases that you encounter on your farm: (a) fungi ( ); (b) nematodes ( ); (c) specify name if your know it:……..
33. What is the level of these disease attack: (a) insignificantly mild ( ); (b) significantly mild ( ); (c) moderate ( ); (d) serious ( ); (e) very serious.
34. What is the effect of these disease attack: ( ) reduces production ( ); (b) causes mortality ( ); (c) reduces profits ( ); (d) incurs high cost to arrest them ( ); others (specify):……
35. How do you control any of these disease attack:……..

SECTION E: OUTPUT FROM MANAGEMENT PRACTICES

36. What is the number of snails produced from your hatchery unit for a production period:……...
37. What is the number of point-of-lay snails for sale for a production period:…….
38. What is the number of table-sized snails produced from your farm at point of sales:……

SECTION F: COSTS AND RETURNS INFORMATION

39. Variable costs after production period	
Items (₦)	
1. Foundation stock	
2. Labour	
3. Feeding	
4. Transportation	
5. Water	
6. Others like pest control, medications etc	
7. Rent	
Total variable cost (₦)	
40. Fixed cost after production period	
Items (₦)	
1. Land	
2. Housing for snails	
3. Tax	
4. Others like equipments, etc	
Total fixed costs (₦)	
41. Total cost (₦)	
42. Total revenue	
43. Cost of one (1) foundation stock snail	
44. Selling price/point-of-lay snail	
45. Selling price/table-sized snail	

46. What is your level of profitability: (a) low ( ); (b) moderate ( ); (c) high ( ); (d) please kindly specify range of profit for the production period:……

SECTION G: SNAIL FARMING CONSTRAINTS INFORMATION

47. What are the constraints militating against your snail farming:

i. None ( )

ii. Slow growth: (a) mild ( ) (b) moderate ( ); (c) serious ( ).

iii. Pests/predator attacks: (a) mild ( ) (b) moderate ( ); (c) serious ( ).

iv. Disease attack: (a) mild ( ) (b) moderate ( ); (c) serious ( ).

v. Human theft: (a) mild ( ) (b) moderate ( ); (c) serious ( ).

vi. Feed in availability: (a) mild ( ) (b) moderate ( ); (c) serious ( ).

vii. Source of foundation stock: (a) mild ( ) (b) moderate ( ); (c) serious ( ).

viii. Mortality or death: (a) mild ( ) (b) moderate ( ); (c) serious ( ).

ix. Capital: (a) mild ( ) (b) moderate ( ); (c) serious ( ).

x. Marketing: (a) mild ( ) (b) moderate ( ); (c) serious ( ).

xi. Inexperience: (a) mild ( ) (b) moderate ( ); (c) serious ( ).

xii. Others (specify):……

48. How do you control any of the above named constraints:……
……