Asian Journal of Agricultural Extension, Economics & Sociology
12(4): 1-8, 2016; Article no.AJAEES.17878
ISSN: 2320-7027

SCIENCEDOMAIN *international*
www.sciencedomain.org

Adoption of Snail Production Technologies by Farmers in Onicha Local Government Area (LGA) of Ebonyi State, Nigeria

S. I. Ume[1*], N. C. Onuh[1], B. N. Onunka[1] and S. O. Ucha[1]

[1]Federal College of Agriculture, Ishiagu, Ebonyi State, Nigeria.

Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJAEES/2016/17878
Editor(s):
(1) Anthony N. Rezitis, Department Business Administration of Food and Agricultural Products, University of Western, Greece.
(2) Zhao Chen, Department of Biological Sciences, College of Agriculture, Forestry and Life Sciences, Clemson University, USA.
Reviewers:
(1) Klára Kosová, Crop Research Institute, Prague, Czech Republic.
(2) Mevlut Gul, Suleyman Demirel University, Turkey.
Complete Peer review History: http://www.sciencedomain.org/review-history/15983

Original Research Article

Received 28th March 2015
Accepted 2nd December 2015
Published 30th August 2016

ABSTRACT

Adoption of snail production technologies by farmers in Onicha L.G.A of Ebonyi State, Nigeria**,** was studied. Percentage response and frequency distribution were used to address objective I, part of 2 and 3, while part of objective 2 was addressed using logit model analysis. Multi stage random sampling technique was used to select 100 farmers from 20 villages. Information for the study was collected from primary and secondary sources. The results showed that 80% of the respondents were above the age of 50-years, while the least (2%) were less than 30-years. 78% of the sampled famers had one form or the other of formal education, while 22% had no formal education. 59% of the respondents had household size of 6-8 persons, while least, 20%; 1-5 persons. Nevertheless, 94% of the respondents had no access to credit and 6% had access. On adoption of technology, 60% of respondents were high adopters, while 40%; low adopters. Logit model result of rate of adoption of snail production technologies revealed that the coefficients of age of the farmer and educational level were positive and significant at 1% and 5% probability level respectively, while the coefficients of credit and extension contacts were negatively signed. The constraints to snailry

**Corresponding author: E-mail: umesmilesi@gmail.com;*

enterprise were; poor access to credit (80%), slow rate of snail growth (70%), high mortality (60%), pest problem (50%), theft problem (50%), high cost of building material (50%) and inadequate information (60%). Enhance farmers' access to credit and use of wire gauge to ward off theft and predators were among the recommendations proffered the reasercher.

Keywords: Adoption; snail; production technologies; farmers.

1. INTRODUCTION

The per capital consumption of animal protein in Nigeria is only 9.3 g/day as against 34 g/day recommended by FAO to be the minimum requirement for growth and development of the body [1]. Snail, a hermaphrodite, of gastropoda class and belonging to the *Phylum Mollusca* (a classification of invertebrate animals with soft unsegemented body and which is often covered with calcareous shell) could be used to address the protein deficiency [2]. Snail is derived from wild life bank with meat often considered "game meat" or" bush meat" which commands higher price than conventional animal meat. Snail meat has been consumed by human throughout the world since prehistoric time. In West Africa, Snail meat, popularly called "Congo meat" in Nigeria has been traditionally a major ingredient in the diet of people living in the high forest belt [3]. Snail meat is high in protein (37-51%) compared to that of poultry (8.3%), fish (18%), cattle (17.5%) and sheep (6.4%) and its meat contains all amino acid needed for human nutrition [4]. Apart from nutritive value, snail has medicinal value, including alignment against; whooping cough, high blood pressure, ulcers and asthma. [3]. [5] observed that crushed snail may be used in chicken feed and to improve the quality of acidic soil in fish pond.

Many species of edible land snail are recognized but the most popular species of economic interest are the West African giant snail, *Archachatina marginata* and *Archatina achatina* [2]. *Archatina achatina* and *Archachatina marginata*, belong to the family of Archatinidae, a group of large land snails that originated from Western, Eastern and South Africa with long slender shells [1]. This family of sail is highly prolific and could lay up to 1,000,000 eggs per annum [3,5].

In West Africa, snails dwell mainly in the humid forest regions where it is traditionally gathered according to [5] by rural folks during the rainy season for sale and domestic consumption. However, there is a decline in the population of snails in the wild as result of human factors (including deforestation, pesticide use and burning) and other anthropogenic factors. These consequently result in rural folks to scout for periods in search of snails with attendant indiscriminate collection of inmature snails in an attempt not to come back empty [6].

However, with continuation of those environmental and anthropogenic factors of snail production, high cost of conventional animal protein sources and flourishing international trade for snail in Europe and America as asserted by [1] necessitated interest in snailery or heliculture. To boost snail production, Forestry Research Institute of Nigeria (FRIN) has developed snail production technologies such as use of hutch cage or open drum, fenced pen, climatic measuring devices, water regulator, pests and predator scarier, formulated feed, feeding material and breed types [3]. Nevertheless, the farmers' access to and use of these impressive research results is still limited. This remains a discrepancy to what is feasible or available and what the farmers know and use to increase their snail production in Nigeria. Consequently, it becomes necessary to access the adoption of the improved management and production practices among small holder snail farmers in Onicha local government area of Ebonyi state with a view of making appropriate policy recommendations that would promote agricultural development in the state in particular and the nation in general. Specifically, the objectives are to: describe the farmers' socio economic characteristics, determine the adopters and their level of adoption and identify limiting factors to snail production in the study area.

2. RESEARCH METHODOLOGY

The study was conducted in Onicha local Government Area (LGA) of Ebonyi State. Onicha LGA lies between latitude 6° 15' and 7° 27'N of the equator and longitude 8° 17 and 12° 38 ^{i}E of the Greenwich meridian. Onicha LGA consists of five autonomous communities; Isu, Oshiri, Ukawu, Abonmege and Onichalgboeze with headquarter located at Isu. The LGA is bounded in the North by Nkanu East local government

Area, in the East by Ezza South local government and in the West by Ohaozara local government area and in the East by Afikpo north.

Onicha LGA covers a vast landmass of approximately 315 square kilometers with annual rainfall of 1250 mm – 1350 mm, atmospheric temperature ranges of 26℃ – 30℃ and relative humidity of 70%. It has a population of 236,828 people (NPC, 2006). Farming is the predominant occupation of the people and majority of who are small holder farmers. Five communities out of seven were randomly selected. In the second stage, four villages out of six were randomly selected from each of the community. This brought to a total of twenty villages. Finally, four farmers were randomly selected from each of the villages and these totaled to one hundred (100) farmers for detailed study.

Data for this study were collected from two methods; primary and secondary sources. Primary data was collected using a set of structured questionnaire which was administered to the farmers. The questionnaire was designed to collect information on the socio-economic characteristics of snail farmers such as farm size, age, sex, farming experience and level of formal education. Morso, information was collected on farmers' production constraints. Secondary data was obtained from internet, journals, textbooks, word bank publication, seminar, Agriculture Development Program reports and other published and unpublished materials related to the study and other periodicals.

Descriptive statistics such as frequency distribution and percentage was used to analyze the data and draw conclusion on objectives 1, part of objective 2 and 3, while the remaining part of 2 was analyzed using logit model analysis. The logit model can be explicitly represented by taking 'Y' as a probability and making its logarithm to depend linearly on the independent variables.

The probability is expressed as:

$$\text{Prob}\ (y_i=1) = 1\ F(Z_1)$$

$$1 = e^{zt} \quad \frac{= e^{zt}}{e^{zt} + 1} \qquad (1)$$

Z_0 is a theoretical variable (observable variable). To obtain the values of Z^+, the likelihood of observing the simple needs to be formed by introducing a dictomous response variable Y_i such that:

$Y_i = E_i$= if the farmer is higher adoption of snail production technology.

E_0= it the farmer is a slow adopter.

For this study Z_i will be expressed as

$$Z_i = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 \ldots\ldots\ldots\ldots\ldots b_8x_8\ldots\ldots\ldots\ldots \qquad (2)$$

Z_1= communicative logistics distribution
X_1= age of the farmers (years)
X_2= level of formal educations (years)
X_3= house hold size (no)
X_4= credit access (N)
X_5= extension contact (no)
X_6= farming experience (year)
e_i= stochastic error
b_i-b_8 = regression coefficient
a= constant term.

3. RESULTS AND DISCUSSION

Table 1 indicated that 70% of the respondents were above 50 years, while the least (2%) were less than 30 years. The average minimum age of the respondent was 19 years, while the maximum age was 74years. The domination of old aged people in the study area could be due to the fact that snailery is less labour intensive compare to other livestock production and as such age may not be a barrier [7,3].

Majority (78%) of the respondents had one form or the other of formal education, while only 22% had non-formal education. Educated people are more likely to be acquainted with the nutritive value of the mini-livestock and hence embark on the enterprise in order to enhance their nutritive status. Furthermore, [8,9] viewed that education makes one very innovative and adoptive. Also, Table 1 revealed that 50% of the respondents had household size of the range 6-10 persons, followed by 30%; 11-15, while 20%; 1-5 persons. The average minimum house hold size per house hold was 4 persons, while the maximum was 15 persons. Large household size according to [10] implies higher access to labour, especially where they are of labour age and as well available for use [2] concurs to this finding.

Majority (54%) of the respondents had farming experience of 1-5 years as shown in Table 4, while the least (2%); 11-15 years. The average minimum years of farming experience was 2 years, while the maximum was 15 years. The low number of years of farming experience could be an indication of the newness of the enterprise in

the study area. However, [10,11] opined that the number of years of farming experience helps farmers to set realistic goals. Nevertheless, [12] was of the view that farmers count more in farming experience than level of educational attainment. Table 1 furthermore revealed that 94% of the respondents had no access to credit either formally or informally. Low access to credit could be related to ignorance of credit availabilty and short time repayment of loan [10]. Credit is very crucial in purchasing improved production inputs and payment of labour [13].

The improved Snail production technologies as developed by Forestry Research Institute of Nigeria (FRIN) were use of hutch cage or open drum, fenced pen, climatic measuring devices, water regulator, pests and predator scarier, formulated feed, feeding material and breed type to enhance the farmers' output. Hence to categorize the farmers into two adoption groups as shown in Table 2, any farmers whose adoption score (i.e number of innovation adopted) was above 3 was considered as high adopters, while any farmer whose adoption score was below 3 was considered as low adopters. Similar methods have been used by [7,14]. Table 2 shows that most (60%) of the respondents were high adopters, while 40% were low adopters of snail production technology. The low adoption could be attributed to non-availability, scarcity and unaffordability of inputs and farmers' economic situation [12].

Table 3 showcased that the coefficient of age of the respondent was positive and significant of 1% alpha level. This result is contrary to *a prior* expectation that production decline with advancing in age. The positive relationship between age and snailery is in agreement with the finding of [3,15] who opined that snailery is less labour intensive and hence age cannot be a barrier to its production. The estimated statistic of the coefficient of credit was negative, contrary to *aprori* knowledge and significant at 5% alpha level.

Table 1. Distribution of respondents according to their socioeconomic characteristics

Socioeconomic characteristics	Frequency	Percentage (%)
Age		
Less than 30	2	2
30 – 40	8	8
41 – 50	20	20
51 – 60	33	33
64 – 74	37	37
Education		
Non – formal education	22	22
Primary education	18	18
Secondary education	22	22
Tertiary education	38	38
Household size		
1 – 5	20	20
6 – 10	50	50
11 – 15	30	30
Farming experience (yrs)		
1 – 5	54	54
6 – 10	44	44
11 – 15	2	2
Credit access		
No access	94	94
Access	6	6

Source: Field survey, 2014

Table 2. Adoption category by respondents

Category	Frequency	Percentage (%)
Low adopters (3 innovation and below)	40	40
High adopters (above 3 innovation)	60	60
Total	100	100

Source: Field survey, 2014

Table 3. Maximum likelihood estimate of the logit model

Explanatory variable	Coefficient	t-ratio
Age	1.728	3.22***
Farming exp.	0.381	0.001
Household size	0.792	0.281
Educational level	2.017	3.07**
Credit	1.334	-1.720*
Extension contact	2.172	-2.41**
Coop. membership	0.181	0.774

s*, ** and *** implies significant at 10%, 5% and 1% respectively, figures in parentheses are the t-ratio
Source: Field survey, 2014

[5,16] observed that snail production requires very little capital and low running cost and these could attest for farmers' being averse to procuring loan in order to execute the business. This could be the reason for the negative sign of the coefficient. However, [16] revealed that generally farmers' reluctance to obtain loan could be associated with high interest rate as charged by lending agencies and as well as the location of most banks in urban areas where the farmers could hardly have access to. The coefficient of education had positive effect on adoption of new technologies in snailery and significant at 1% alpha level. Snail production is always compatible with other work responsibilities. This is especially for people who has other means of livelihood but engage into agriculture on part time basis [4]. Educated people as reported by [12] are better adoptive individual. Household size coefficient was negative and is against *a priori* expectation that the larger the household size, the more the farmers' output as they serve as source of labour to reduce cost of production. The variable was significant at 10% alpha level. The negative sign of the coefficient could be related to the fact that the household members could be dependent population or of school age and living in the school, hence do not contribute to the households' production. This finding is synonymous with [8]. The sign identity of the extension contact was negative and significant of 5% probability level. The indirect relationship between adoption and extension contact could be related to the wide ratio between extension contact and farmers which could translate to negative impact to agricultural growth.

Poor access to credit was complained by 80% of the respondent as reported in Table 4. The poor access to credit as reported by [10] could be as a result of high interest rate as charged by leading institutions as well as short repayment period of such loan. Furthermore, 70% of the sampled farmers complained of slow growth rate of snail. However, [3,17] suggested on the use of Archatina archatina whose maturity is at 6months old especially where feeding is extended to night through artificial light compare to other land snails that mature especially for breeding at 7 - 11months of age. Several factors influence snail growth and these include; population density, stress, (snails are sensitive to noise, light vibration, unsanitary condition, irregular feeding, being touched, temperature and moisture) and breeding technology [13].

Moreso, high mortality rate of snail was encountered by 60% of the population of the farmers studied. The high mortality of snail could be chiefly associated with among others; low humidity. High humidity is often addressed through forestry but unfortunate, deforestation is a common place in our society [18]. Also, 50% of the sampled farmers incurred the problems of snail as pests. Snail is generally destructive to crops [19], vector of bilharzias and Schistosoma diseases and host of liver flukes [20]. 50% of the respondents complained of the problem of theft. This is severe when the pen is not well protected with wire gauge. High cost of building materials for the snail pen construction as revealed by 50% of the respondents as indicated in Table 4. [2] observed that locally made pen have proved to be successful as it corresponds with the people's resource technology and culture. Table 4 showcased that poor laying of egg by snail was encountered by 40% of the respondents. This corresponds to the findings of [17,9], who reported that egg production in snail could be improved through addition of extra amino acid (especially lysine and methonine) and appropriate egg formulae to add to the feed given to snail. Scarcity and high cost of formulated feed for snail production was complaint by 40% of the sampled population as contained in Table 4. [19] opined that snail thrives on diets of 15-17% crude protein, carbohydrate with additive of calcium carbonate

Table 4. Distribution of respondents according to constraints to snail production

Variable	Frequency	Percentage
Poor access to credit	80	80
Slow rate of growth	70	70
High mortality	60	60
Pest problem	50	50
Problem of theft	50	50
High cost of building material	50	50
Poor laying of egg	40	40
Scarcity and high cost of feed	40	40
Inadequate management information	60	60
Problem of predator	40	40

**, Multiple response*
Source: Field survey, 2014

which is good for shell growth. He highlighted that such protein requirements of snail can be sourced locally through among other leaves of; cocoyam, cassava and pawpaw. [7,18] reported that carbohydrate nutrition could be enhanced through cassava roots, corms and cormels of cocoyam.

Inadequate information on management of snailery enterprise was encountered by 60% of the respondents. The negative attitude of extension agents to their duties could be responsible for such communication gap and in effect, depolarizes the growth of the enterprise. Most(40%) of the respondents complained of predators problem. [3] reported that bacterium pseudomonas *genuginous* causes intestinal infection that can spread when snail population is crowded in their pens. Nevertheless among snail predators according to [5,11] are centipede, carnivorous snail species such as Copillacea, birds, frogs, toads, lizards and walking insects. In order to efficiently control the predators, snail pens should be wire gauged and environment often spread with pesticide to scare and kill a times these predators.

4. CONCLUSION AND RECOMMENDA-TIONS

4.1 Conclusion

The following conclusions were deduced from this study; most of the respondents were not youth, highly educated and had poor access to credit. Furthermore, most respondents were high adopter of technology. More so, age and educational level were the major determinants to snail production technology adoption in the study area. The major constraints to snailery enterprise in the study area were; poor access to credit, slow growth rate, high mortality, inadequate information and high cost of building materials.

4.2 Recommendations

Based on the result of the study, the following recommendations were proffered;

i. There is need to strengthen the current national policies on education such as universal basic education, adult and nomadic educations.
ii. Education of farmers should also be enhanced through aggressive awareness campaign, seminar and workshop.
iii. Credits should be made available to the farmers through microfinance banks, commercial banks and other government leading agencies at reduced interest rate and affordable collateral.
iv. As majority of the farmers were old people as revealed from the result, there is need to encourage this age class through provision of improved production inputs at subsidized price.
v. Snail pen should wire gauge to prevent theft and entering of predators.
vi. On the problem of slow rate of growth of snail, *Archatina archatina* is advocated as it matures at 6-8 months with artificial light for feeding at night.
vii. The problem of high cost of building materials can be addressed by using local materials which has been proved to be efficient.
viii. On lack of information on production and management of snailery, extension agents should be motivated to disseminate such

information from research institution to the farmers.

ix. Pesticides should be spread around the environment of snail pen in order to scare predators.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Food and Agricultural Organization (FAO). Snail production series 11-29 Rome City; 1989.
2. Amutan OM. Attitude of household in Nigeria Delta zone towards snail meat consumption in: SN Ukachukwu (ed). Animal production in the new millennium: Challenges and options. Proceeding of the 5th annual conference of Animal science Association of Nigeria, Port Harcourt, September 19th – 22nd. 2000;42-47.
3. Afolabi MO. Reducing poverty through snail farming in Nigeria. Agriculture and Biological Journal of North America. 2011;2(1):169-172.
4. Abere SA, lameed GA. Medicinal utilization of snails in some Selected states in Nigeris. In J.C Onyekwelu, V. Adekunle, D.O Oke (eds) proceeding of the First National Conference of the Forest and Forest Products Society (FFPS) held in Ahure, Ondo State between 11th and 18th of April. 2008;233-237.
5. Cobinnah JR. Snail farming in West Africa. Apractical guide. CTA Publication. 2005; 48-54.
6. Baba KM, Adeleke MT. Profitability of snail production in Osun State, Nigeria. Jounal of Agricultural Food Science. 2006;4:147-155.
7. AFAS. Agronomic foundation agrodok series: Snail farming. IFAD/FNC/NDDC and CBN RMP (2012): A practical guide to improved package of practices for increased productivity of snail farming in Niger Delta. I.D Printers. 2004;78-81.
8. Iheke RO. Gender and resource use efficiency in rice production system in Abia State. M.Sc. Thesis, Michael Okpara University of Agriculture, Umudike of Abia State. 2006;34.
9. Ume SI, Okelola O, Kadunmba C, Ogwulamba SI. Tobit analysis of extent of adoption cocoyam production among farmers in Nsukka local Government area of Enugu state, Nigeria. Proceedings of the proceeding of the 44th Annual Conference of Agricultural Society of Nigerian (ASN) held at Ladoke Akintola University of Technology, Ogbomso, Oyo state, Nigeria held from 18th - 22nd October. 2013;345-350.
10. Onyenweaku CE. Policy issues and strategies for agricultural production in Nigeria. A paper presented at the National workshop on enhancing research and development in agricultural root crops towards poverty alleviation and rural development in Nigeria. NRCRI Umudike, 22 – 26 May. 2000;23.
11. Pindyck RS, Rubin F. Econometric models and economic forcast Mc. Grawhill book company, New York USA. 1976;45-47.
12. Nwaru JC. Rural credit market and resource use in arable crop production efficiency in Imo State of Nigeria. Ph.D Thesis, Michael Okpara University of Agriculture, Umudike Abia State. 2004; 67-70.
13. Eze CT, Akpa CE. Analysis of technical efficiency of National Fadama II facility on arable crop farmers in Imo State, Nigeria. Nigeria Agricultural Journal. 2010;41(1): 109-115.
14. Okezie CA. Adoption of improved rabbitary technology mong youth in Umuahia south local government area of Abia State, Nigeria. Proceeding of 20th Annual Conference of Farm Management Association of Nigeria. 2006;234-238.
15. Ume SI. Technical efficiency of Snail production in Imo State, Nigeria. Journal of Agricultural Society of Nigeria. 6(4)11-16.
16. Goodman AK. Giant African land snails; 2008.
    Available:http:/www.geocities.com/heartland/valley/6210/index i. htm
    (Retrieved on October 29th 2012)
17. Akinnusi O. Snail Rearing. A case study of Abeokuta, Ogun state, Nigeria. In SN Ukachukwu (Ed): Animal Production in the New millenium: Challenges and options. Preceeding of the 5th Annual conference of Animal Science Association of Nigeria. 2000;120-126.
18. Agbogidi OM, Okonta BC, Ezeani EL. Effects of two Edible Fruits on the Growth Performance of African Giant Land snail (Archatma Marginata Swainson). Journal

of Agricultural and Biological Sciences. 2008;3(3):26-29.

19. Efamsporo. Snail Farming and management. 2006;34-37. Available: www.efamsporo.com (Retrieved on 29th of August, 2008)

20. Amusan JA, Oluokun JA, Ogundolna FI, Omole AJ. Snail farming guide. Technical Bulletin of Obafemi Awolowo University. Institute of Agricultural Research and Training, Moor plantation, Ibadan. 2003; 34-37.

Peer-review history:
The peer review history for this paper can be accessed here:
http://sciencedomain.org/review-history/15983