

Characteristics of snail farming in Edo South Agricultural Zone of Edo State, Nigeria

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Abstract The study was carried out to determine the characteristics of snail farming in Edo South Agricultural Zone of Edo State Nigeria. The interview schedule was used to collect data from 60 snail farmers randomly selected from six cells in the study area. Information on the socioeconomic status of the farmers, production system, management practices and production constraints in the snail farms were elicited. The constraints were determined using a four-point Likert-type scale; a mean score of ≥ 2.5 was considered as a production constraint. Majority (85.0 %) of the respondents were part-time snail farmers. The major species of snails reared were *Achatina achatina* and *Archachatina marginata*, reared by 43.3 and 26.7 % of the farmers, respectively. Semi-intensive system of production was practised by 40.0 % of the farmers. Majority (78.0 %) of the respondents used car tyres to house their snails. About 56 % of the respondents kept their snails for 1–2 years before sale. Up to 51.7 % of the respondents separated their snails into different pens according to their size/age. The most commonly used feeds were vegetables (71.2 %), plant leaves (67.8 %) and kitchen waste (59.3 %). Records of snail production activities were kept by 75.0 % of respondents. The major constraints identified were lack of capital (3.31), inability to get good laying stock (3.00), lack of formulated feed to buy (2.98) and slow growth rate of snails (2.52). The potentials of snail farming in the study area have not been fully exploited as farmers produced at subsistence level.

Keywords Snail · Management practices · Constraints · Nigeria

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Introduction

Snails are soft-bodied invertebrates belonging to the phylum Mollusca. Traditionally, snail meat has been a major ingredient in the diet of people living in the high forest zone (Agbogidi and Okonta 2011, pp. 169–172). The meat is a highly priced delicacy in many cities in Nigeria where it is popularly called “Congo meat”. Snail meat is an excellent source of animal protein in many parts of West and Central Africa (Blay et al. 2004, pp. 203–214), with protein content (20.7 %) higher than that of conventional food animals (Malik et al. 2011, p. 3). The meat is also rich in iron (Agbogidi et al. 2008, pp.26–29), potassium, phosphorous, essential amino acids and vitamins C and B complex (Baba and Adeleke 2006, pp. 147–155; Okpeze et al. 2007, pp. 1959–1962) and low in fat (Cobbinah et al. 2008). Apart from its excellent nutritional value, snail meat has also been reported to be of good medicinal value. The low cholesterol level of the meat has made it useful in the treatment of arteriosclerosis and other heart-related diseases (Aberé and Lameed 2008, pp. 233–237). In Ghana, the bluish liquid obtained when the flesh is removed from the shell is believed to be good for infant development (Cobbinah et al. 2008).

In West Africa, snails dwell mainly in humid forest regions where they are traditionally gathered by rural folks during the raining season for sale and domestic consumption (Ngenwi et al. 2010, pp. 274–278). However, there is a considerable decline in the population of snails in the wild as a result of human and other anthropogenic factors such as use of agrochemicals, deforestation for urban development, burning and clearing for agricultural purposes and collection of immature snails by the farmers/dwellers of the rainforest belt (Cobbinah et al. 2008).

Recent changes in climatic conditions have resulted in an increase in outdoor temperature in most countries of the

world including West Africa and a reduction in the duration of the rainy season. This has consequently led to a reduction in the population of snail species in the wild (Ngenwi et al. 2010, pp. 274–278). This steady decline has led rural folks to scout for longer periods in search of snails, with its attendant indiscriminate collection of immature snails in an attempt not to come back empty.

The impact of environmental and anthropogenic factors on the populations of wild snails, coupled with the increase in the cost of conventional animal protein sources, has necessitated renewed interest in snailery or heliciculture. Snail farming has several advantages over most conventional livestock, and these include: low capital requirement, less demand for professional skill, high fecundity and low mortality, less labour requirement, noiseless nature of the animals, adaptation to various environmental conditions and availability of ready market (Baba and Adeleke 2006, pp. 147–155; Agbogidi et al. 2008, pp. 26–29). Despite the numerous advantages of snail production, Agbogidi and Okonta (2011) were of the opinion that the potentials for snail domestication and commercialization in Nigeria have not been fully exploited. In Nigeria, snail production has been reported to be a profitable business (Ogunniyi 2009, pp. 26–34; Ahmadu and Ojogho 2012, pp. 233–237). However, snail production is still a less-recognized aspect of livestock production in Nigeria. This study was therefore designed to determine the production characteristics of snail farming, assess the management practices of the snail farmers and ascertain the constraints affecting snail farming in Edo South Agricultural Zone of Edo State, Nigeria.

Methodology

This study was carried out in Edo State of Nigeria between April and June 2011. The state occupies a land area of about 17,802 km² and has an estimated population of 3,218,332 people as of 2006 (edopeopleforum.com/index.php?topic=223.0). Edo State is located between longitude 6°04' E and 6°43' E and latitude 5°44' N and 7°34' N and has a humid tropical climate in the south and sub-humid tropical climate in the north with an average rainfall ranging from 1,500 mm (59") in the extreme north of the state to 2,500 mm (98") in the south (edopeopleforum.com/index.php?topic=223.0). The temperature averages about 25 °C (77 °F) in the rainy season and about 28 °C (82 °F) in the dry season. Edo State possesses a diverse vegetation ranging from derived savannah in the north to rainforest in the south and mangrove swamp vegetation found also in the south among the riverside communities to fertile clayey soil in the northwest (edopeopleforum.com/index.php?topic=223.0).

The state is divided into three agricultural zones, namely, Edo Central, Edo North and Edo South zones. The zones are

further divided into five, six and seven blocks, respectively. The population of the study was purposively selected from Edo South Agricultural Zone due to its humid tropical climate with an average rainfall of 250 mm when compared to the north which has a sub-humid tropical climate with an average rainfall of 1,500 mm (edopeopleforum.com/index.php?topic=223.0). This environmental condition makes Edo South conducive for snail rearing, and thus, a concentration of snail farms is found in the area. Three blocks were randomly selected from the seven blocks in Edo South Agricultural Zone. Two cells were selected from each block, making a total of six cells. From each cell, ten snail farmers were randomly selected giving 60 respondents. Data were collected with the use of a structured interview schedule. Questions were designed to provide background information on socioeconomic status of the farmers, production system of snail farming in the study area, management practices in the snail farms and production constraints. The constraints were determined by asking respondents to indicate on a four-point Likert-type scale of strongly agree, 4; agree, 3; disagree, 2, and strongly disagree, 1. A cut-off point of 2.5 was determined by adding 4+3+2+1 and dividing by 4. Any response option ≥ 2.5 was considered as a major production constraint on snail farming. Descriptive statistics (means, frequency and percentage) were used to analyse the data.

Results and discussion

Socioeconomic characteristics of respondents

Snail farmers in the study area were predominantly (76.7 %) male (Table 1). This finding is in tandem with those of Adinya et al. (2011), Aiyeloja and Ogunjinmi (2010) and Ogunniyi (2009) in Cross River, Ondo and Oyo states of Nigeria, respectively. The finding, however, contrasts with the observation of Ngenwi et al. (2010) who found that snail farming in Volta and Great Accra, Ghana, and Southwest Region, Cameroon, was predominantly in the hands of female farmers. Majority (34.0 %) of the respondents were within the age bracket of 46–50 years; this being similar to the findings of Aiyeloja and Ogunjinmi (2010) and Ogunniyi (2009). However, the mean age of 50.2 years recorded in the present study is higher than the 38.5 years recorded by Aiyeloja and Ogunjinmi (2010). Snail farming requires little labour with no strenuous physical exertion (Goodman 2008), and this may explain why majority of the snail farmers were above 45 years of age. Majority (96.7 %) of the respondents were married, with a mean family size of about six. This finding is similar to those of other previous studies (Aiyeloja and Ogunjinmi 2010, pp. 614–617; Ogunniyi 2009, pp. 26–34; Adinya et al. 2011, pp.

Table 1 Percentage distribution of respondents according to socioeconomic characteristics ($n=60$)

Socioeconomic characteristics	Frequency	Percentage	Mean (M)
Sex			
Male	46	76.7	
Female	14	23.3	
Age			
35–40	4	7.1	
41–45	9	16.1	
46–50	19	34.0	50.2
51–55	12	21.4	
56–60	12	19.6	
61–65	1	1.8	
Marital status			
Single	1	1.7	
Married	58	96.7	
Widowed	1	1.7	
Size of household			
2–4	20	33.9	
5–7	31	50.8	6
8–10	8	13.6	
11–13	1	1.7	
Level of education			
No formal education	3	5.0	
Primary education	12	20.0	
Secondary education	31	51.7	
Tertiary education (NCE/OND/HND/B.Sc.)	14	23.3	
Major occupation			
Crop farming	38	63.3	
Civil servant	8	13.3	
Trading	5	8.3	
Teaching	6	10.0	
Artisan	2	3.3	
Farmer and trading	1	1.7	
Years of experience in snail farming			
0–12 months	1	1.6	
1–3 years	25	41.8	
4–6 years	20	33.4	
7–9 years	9	15.0	4.6
10–12 years	4	6.6	
13 years and above	1	1.6	
Status of snail farmers			
Full time	9	15.0	
Part time	51	85.0	

274–282). Their engagement in snail farming is probably to increase household income. Seventy-five percent of the respondents had at least secondary education. This finding is similar to Aiyeloja and Ogunjinmi (2010) but contrasts

the findings of Ogunniyi (2009) and Adinya et al. (2011) who reported that majority of snail farmers were first school leavers. The implication of this observation is that information on improvement of snail production can easily be adopted by farmers in Edo South Agricultural Zone.

About 42 % of the respondents had 1–3 years of experience in snail farming (Table 1). A mean farming experience of 4.6 years recorded in this study is similar to the 5 years reported by Ogunniyi (2009). Majority (63.3 %) of the snail farmers in the studied area had crop farming as their major occupation. Integration of snail farming with crop farming can improve soil quality.

Eight-five percent of the respondents were part-time snail farmers, a finding similar to that of Ogunniyi (2009, pp 26–34). This indicates that snail farming gives ample opportunity to be engaged in other business ventures. Since heliculture has been reported to be a profitable and low-cost operation (Ogunniyi 2009, pp. 26–34; Ahmadu and Ojogho 2012, pp. 233–237), snail farmers in the study area should be encouraged/supported to go into full-time snail farming.

Majority (75.9 %) of the respondents were involved in snail farming for sale and home consumption while 13.8 % produce snails for consumption only and 10.3 % for sale only. Thus, snail farming was to generate income as well as to provide a source of animal protein for the family.

Production characteristics

Species of snails reared

About 43.0 and 27.0 % of the respondents reared *Achatina achatina* and *Archachatina marginata*, respectively, while about 27 % reared both species (Table 2). This is similar to the finding of Egbule (2006) in Delta State. Cobbinah et al. (2008) observed that the most popular edible snails in West Africa are the giant land snails (*A. achatina* and *A. marginata*). Respondents' reasons for rearing the two species were based on the fast growth rate, high meat/flesh and high fecundity of these species.

Number of workers in the farm

Most (64.1 %) of the respondents had between zero and three persons working in their farm, while 28.3 and 7.6 % had 4–7 and 8–12 persons, respectively, with a mean of three persons (Table 2). This is similar to the findings of Aiyeloja and Ogunjinmi (2010) who had a mean value of about four people employed in snail farms in Ondo State. This suggests that snail farming has the potential of becoming a major source of employment in the study area.

Table 2 Percentage distribution of respondents according to production characteristics ($n=60$)

Characteristic	Percentage (%) of respondents
Species of snail reared	
<i>Achatina achatina</i>	43.3
<i>Archachatina marginata</i>	26.7
<i>Achatina achatina</i> and <i>Archachatina marginata</i>	26.7
<i>Achatina fulica</i>	3.3
Number of people that work in the farm	
0–3	64.1
4–7	28.3
8–12	7.6
Location of farm	
Back yard	55.2
On a land separate from your home	44.8
Nature of farm	
Snail farm only	12.1
Snail farm with other agricultural activities	87.9
Type of snail housing/enclosure ^a	
Car tyres	78.0
Drums or pots	55.9
Concrete trench	1.7
Wire gauze pen	40.7
Raised wooden cage	25.4
Hutch box	23.7
Moveable pens	6.8
Pens in enclosed buildings	18.6
Fenced pens	35.6
Mini-paddock pens with plants inside	39.0
Age of snail at the start of production	
Eggs/hatchlings	3.4
2–6 months	96.6
Farmers' source of snail	
Picked from wild	18.3
Purchase from market	30.0
Purchase from another snail farm	45.0
From wild and purchase from the market	3.3
From wild, purchase from market and another snail farm	1.7
Purchase from the market and another snail farm	1.7
Production duration	
>1 year	40.9
1–2 years	55.7
3–4 years	3.4

^a Multiple responses

Location of farm

Majority (55.2 %) of the respondents operated their snail farm from the backyard (Table 2). As pointed out by

Agbogidi et al. (2008), snails are noiseless animals and easy to handle, and as such, they can be reared in back yards or residential quarters without infringing on the peace of residents.

Nature of farm

About 12 % of the respondents farm snails only, and this contrasts with the 50 % recorded in Ondo State by Aiyelaja and Ogunjinmi (2010). Thus, snail rearing as a sole farming activity is not yet popular in Edo State, Nigeria.

Housing type

The most preferred housing types for snail production in the study area (Table 2) were car tyres (78 %), drums or pots (55.9 %), wire gauze pen (40.7 %) and mini-paddock pens with plants inside (39 %). This is similar to the finding of Ogunniyi (2009) in Oyo State. However, the type of housing used is a reflection of the scale of production (Akinnusi 2002).

Age and source of snails at start of production

Majority (96.6 %) of the respondents started the production process with 2–6-month-old snails (i.e. part-life cycle farming) while 3.4 % started with eggs/hatchlings (complete life cycle farming) (Table 2). As shown in the table, 45, 30 and 18.3 % of the respondents obtained snails to start their snailery from another snail farm, market or from the wild, respectively. This may explain why majority of farms are engaged in part-life cycle farming. There is therefore a need to encourage setting up of parent stock/hatchery units to provide farmers with hatchlings. This will improve production and curtail gathering of snails from the wild. The observation that fewer farmers (18.3 %) sourced snails from the wild to start up their farms implies that one of the reasons for heliculture, which is to reduce the number of farmers gathering snails from the wild, is gradually being achieved.

Production duration

The time taken for snails to reach desired weight varied (Table 2). Majority (55.7 %) of the respondents reared their snails for 1–2 years, while 40.9 % kept them for 6–11 months before sale or consumption. The recommended duration for raising snails to attain the desired weight of 120–450 g is 1–2 years. However, as pointed out by Cobbinah et al. (2008), this depends on feeding management and stocking density as well as on the species of snail. The observed differences in time of maturity may not be unconnected to differences in the feed and feeding practices employed by the respondents.

Management practices in snail farming in Edo South Agricultural Zone

Feed and feeding management

Type of feed used in the snail farm

Respondents indicated that they used a variety of ingredients to feed their snails (Table 3). The most commonly used feeding materials were vegetables (71.2 %), leaves of plants (67.8 %) and kitchen wastes (59.3 %). This finding confirms the fact that snail production is a low-cost operation, making use of locally available feeds at relatively no cost to the farmer. Snails are capable of converting low-quality feed such as green leaves and domestic waste into high-quality animal protein thereby reducing the cost of feeding (Ogunniyi 2009, pp. 26–34).

Frequency and time of feeding

About 42 and 31 % of respondents in the study area fed their snails once and twice a day, respectively, with the mean frequency of feeding per day being approximately 2 (Table 3). This is higher than the 1.05 feeding frequency recorded by Ogunniyi (2009) in Ibadan. The reason for feeding snails more frequently might be to increase the rate at which snails grow. However, it is recommended that snail feed be placed into the pens 2 h after sunset and the leftover removed the next day (Cobbinah et al. 2008).

About 47 % of respondents indicated that they feed their snails early in the morning while none do so at night (Table 3). This is in contrast with recommended practices, that the snails should be fed at night due to their nocturnal nature (Cobbinah et al. 2008). Feeding snails early in the morning may be because of respondent's previous experience/knowledge in rearing of other livestock such as poultry or goats, which requires that they are fed first thing in the morning after observation, and cleaning of the animal pens. It is therefore necessary for extension workers to educate the farmers on the proper feeding regimen in order to minimize wastage.

Source/type of water used in the farm

Majority (63.3 %) of the snail farmers used water supplied by commercial operators while 20.0 % sourced their water from nearby streams. These are the major sources of clean water in most communities in Edo State. Just like any other domestic livestock, clean water is necessary for maintaining good herd health. Water from commercial operators increases cost of production especially during dry season when cost of water supply is high. Snail farmers in the areas are therefore encouraged to dig wells as this will be a cheaper source of water in the long run.

Table 3 Percentage distribution of respondents according to management practices in the snail farm

Characteristic	Percentage (%)
Type of feed ^a	
Vegetables	71.2
Leaves of plant	67.8
Kitchen waste, e.g. leftover food	59.3
Household waste	37.3
Fresh fruits	33.9
Fruit peel	28.8
Tubers	22.0
Market waste	22.0
Frequency of feeding per day	
1	42.4
2	30.5
3	27.1
Time of feeding	
Early morning	46.6
Afternoon	0.0
Evening	5.2
At night after sunset	0.0
Early morning, afternoon and evening	22.4
Early morning and evening	24.1
Early morning and night after sunset	1.7
Source/type of water used in the farm	
Well water	5.0
Stream	20.0
Rain water	11.7
Supplied water	63.3
Reasons for giving snail this type of water	
None	29.2
Help build body	6.2
Gives energy	12.5
Most available	52.1
Record keeping	
Yes	75.0
No	25.0
Causes of snail death ^a	
Unknown causes	12.5
Pest (termites)	83.9
Salty food	1.8
Accidents	3.6
Infection	3.6
Hot weather	1.8
Predators	39.3
Frequency of changing the soil/beddings in the snail pens	
Once a month	81.4
Once in 2 months	11.9
Once in 3 months	5.1
Once in every 10 month	1.7
Separation of snails into different pens based on their size/age	
Yes	48.3
No	51.7

^a Multiple responses

Record-keeping practices of the farmers

A greater (75.0 %) proportion of the respondents kept records of their snail production activities (Table 3). Thus, the farmers are aware of the importance of keeping records of their farming activities. Records kept by the farmers were in the areas of population of snails in the farms, survival/mortality rate and possible causes of mortality. Comprehensive records are essential for the economic analysis of the profitability of the snail business.

Causes of snail death

Termites were reported by majority (83.9 %) of the respondents to be responsible for deaths of snails, while 39.3 and 12.5 % of the respondents attributed death to predators and unknown causes, respectively. This shows that high proportions of deaths were caused by pest and predators. Ogogo et al. (2011) identified pest infestation as the major constraint of snail farming in Akwa Ibom State, Nigeria. The finding in this study as well as that of Ogogo et al. (2011) may be attributed farmers' lack of knowledge of methods of controlling pests and predators in their farms. Efforts should be made to reduce snail mortality through training of snail farmers on pest/predator control practices.

Frequency of changing soil in the snail pens

Majority (81.4 %) of respondents indicated that they change the soils in their pens once a month. Cleanliness in snail pens has been identified as one of the ways of controlling diseases and pest in snail farms (Awah et al. 2010). Majority of the respondents in the present study were aware of this important management practice, and this might have contributed to the high survival rate recorded in this study.

Separation of snails into different pens according to size/age

Data in Table 3 show that 51.7 % of the respondents separated their snails into different pens according to their size/age while 48.3 % did not. This separation is necessary because snails of different sizes/ages have different nutrient and space requirements that should be met for optimum growth. The 48.3 % of respondents who indicated that they do not separate their snails may not be aware of the importance of this practice.

Constraint to snail farming

Lack of capital/money (3.31), inability to get good laying stock (3.00), unavailability of formulated feed to buy (2.98) and slow growth rate of snails (2.52) were the major constraints identified by the farmers (Table 4). Ogogo et al.

Table 4 Constraints to snail farming in the study area

Limiting factors	Mean score
Lack of capital/money	3.31 ^a
Unable to get good stock of snail for laying	3.00 ^a
Lack of formulated feed to buy	2.98 ^a
Slow growth rate of snails	2.52 ^a
Inadequate information on management practices	2.48
Predators	2.35
Lack of land/space	2.32
Inexperience/lack of knowledge	2.28
Theft (human)	2.23
Access to water	2.00
Pest infestation	1.95
High mortality rate	1.71

^a Significant, mean score >2.5

(2011) and Ogunniyi (2009) also reported lack of capital as one of the constraints to snail production in Akwa Ibom and Oyo States of Nigeria, respectively. Snail farming is known to be primarily a low-cost operation. It is rather surprising that snail farmers in the present study as well as previous studies in Nigeria identified lack of capital as a constraint. Although the respondents identified lack of formulated feed as a limiting factor on snail production, Eze et al. (2010) reported that poultry waste-based diet is ideal and more profitable for commercial snail production as it is affordable and readily available. Leaves of some tropical plants such as mulberry (*Morus alba*) and Siam-weed (*Chromolaena odorata*) were found to be good substitutes for replacing soya and fish meals in the diet of young snails (Imran et al. 2011, pp. 836–837).

Conclusion

Potential of snail farming in the study area has not been fully exploited as farmers produced at subsistence level. This may be attributed to the fact that snail farmers in the area do not have adequate knowledge on the production and management practices involved in snail rearing. Since the farmers are relatively educated, they should be encouraged to read books on snail farming. There is a need for extension units in the study area to organize training workshops and seminars for snail farmers on best practices in snail production. Such workshops and seminars will go a long way to curb most of the problems encountered by the snail farmers.

Conflict of interest None to declare

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