Journal of Research in Forestry, Wildlife & Environment Vol. 11(1) March, 2019
http://www.ajol.info/index.php/jrfwe
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E-mail:jfewr@yahoo.com
ISBN: 2141 – 1778
Dododawa and Adeyemo 2019

EFFECTS OF TWO MANAGEMENT SYSTEMS ON THE GROWTH PERFORMANCE OF JUVENILE AFRICAN GIANT LAND SNAILS (*Archachatina marginata*)

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ABSTRACT

The study of the effects of two management systems on the Growth Performance of juvenile African Giant Land Snails (Archachatina marginata) was carried out in the wildlife domestication unit of the Department of Forest Resources and Wildlife Management, University of Benin, Benin City, Nigeria. One hundred and twenty (120) African giant land snails (Archachatina marginata) of average body weight 36.35g ± 0.32g were used for the study. Sixty (60) snails were raised in an intensive system of management while sixty (60) snails were raised in an extensive system of management. Each of the system of management served as the treatment and each treatment was replicated three (3) times with twenty (20) snails per replicate and sixty (60) snails per treatment in a Completely Randomize Design. Results showed that there was a significant difference at (p<0.05) in the weight gain of the Archachatina marginata of the two management systems. The intensive management system had a higher weight gain of 136.53g with mean value of 5.25 while the extensive management system had a weight gain of 106.53g with mean value of 4.10. There was also a significant difference at (p<0.05) in the shell length increment and shell width increment of the Archachatina marginata of the two management systems. The snails in the extensive management system had a higher shell length increment of 9.94cm with mean value of 0.38 while the snails in the intensive management system had a shell length increment of 8.02cm with mean value of 0.31. The snails in the extensive management system had a higher shell width increment of 10.46cm with mean value of 0.40 while the snails in the intensive management system had a shell width increment of 9.02cm with mean value of 0.35. The Feed Conversion Ratio (FCR) of the snails in the intensive system of management was 1.99. It was concluded that formulated feed used in feeding the snails in the intensive system of management contributed to the higher weight gain.

Keywords: Juvenile, *Archachatina marginata*, intensive system, extensive system, weight gain

INTRODUCTION

Snails are bilaterally symmetrical invertebrates with soft segmented exoskeleton in the form of calcareous shells (Agbogidi and Okonta, 2011). Snails generally are hermaphroditic animals that dwell in nearly all the habitats or ecosystems (Okon and Ibom, 2012). Snails are invertebrate shell bearing animal that are passive or inactive during the day but very active in the night, at dusk or when it rains. They are usually found in cool environment (Omole, 2001). Snails are the largest group of molluscs constituting the largest animal group next to arthropods. They have high rate of productivity or fecundity, although they are hermaphrodite, and practice sexual reproduction (Akinnusi, 2004). The giant land snails are non-conventional protein sources whose meat is a highly relished delicacy (also known as *'Congo meat'*) and constitutes an important source of animal protein in many coastal communities of Nigeria and other parts of Africa (Omole et al., 2007**)**. Snail meat is regarded as a form of bush meat or game meat to be eaten occasionally instead of being a nutritious meat to be relished on a daily basis just like the meat of other

conventional livestock (Malik and Dikko, 2009). Some ethnic groups even have superstitious beliefs that discourage the eating of snail meat or the eating of certain species of snails to the detriment of others. Uboh et al. (2010) observed *Archachatina marginata* to be generally accepted for consumption, and strong cultural discrimination in the consumption of *Achatina achatina* by some tribes in Southern Nigeria. Studies by Omole et al., (2000) have shown that different breeds of snails can be found in Nigeria and they are characterized by high efficiency of nutrient transformation into quality protein. The African giant land snail (*Archachatina marginata*) is the largest known snail in Africa (Omole, 1998; Olawoyin and Ogogo, 2006) and dwells naturally in the forest litters of the tropical rainforest zone of Nigeria (Adedire et al., 1999). Omole (1998) stated that the African giant snail (*Archachatina marginata*) is the most common edible land snail found and reared in Nigeria. The increase in Population of the West African Nations and the rest of the developing world and decrease in food supply has put great pressure on the available food supply. Most staple foods are carbohydrates, thus food problems are more pronounced when there is inadequate consumption of protein especially animal protein because the protein from plant sources are usually insufficient to provide man with the necessary protein requirements (Akinnusi et al., 2007). In Nigeria, successive governments had embarked on policies and programmes aimed at boosting sustainable macro-livestock and micro/mini-livestock production (Effiong and Onyenweaku, 2006). Animal proteins are more biologically complete than vegetable protein because they contain a complete range of amino acids that are essential for maintenance of health (FAO, 2005).

MATERIALS AND METHODS

Study Area

The experiment was carried out in the Wildlife domestication unit of the Department of Forestry and Wildlife, University of Benin, Benin City, Nigeria. The Ugbowo main campus of the University of Benin has a total land area of 1,748 hectares. It is located between latitude 6.1^0 N and 6.8^0N of the equator and longitude 5.4^0E and 6.0^0E of the Greenwich meridian. The altitude is 74.5m above sea level.

Experimental snails

One hundred and twenty (120) African giant land snails (*Archachatina marginata)* of average body weight 36.35g ± 0.32g were used for the study. The snails were grouped into group A and group B. Sixty (60) snails in group A were raised in an intensive system of management while 60 snails in group B were raised in an extensive system of management.

Housing for snails

Wooden cage of dimension 4.5m × 0.6m × 0.5m (Ejidike, 2001) was constructed and used to house the snails in group A. The cage was divided into three (3) parts with each part of dimension 1.5m × 0.6m × 0.5m. The cage stood 40cm off the ground. Sixty (60) snails in group A were grouped into twenty (20) snails per replicate (replicate I-III) and stocked randomly in each part of the cage. The cage was filled with loamy soil up to 18cm thickness. The other sixty (60) snails in group B were housed in an extensive system of management. The snails were placed in a free-range pen. An area of 9m x 3m x 2m was established, cocoyam and pawpaw plants were planted within the enclosure to serve as snail plant food materials and shelter plants. The snails were allowed to move over the entire area-free range. The area was divided into three (3) parts (three replicates) each of dimension 3m × 3m x 2m. Twenty (20) snails were stocked in each of the part.

Experimental design and treatment

A Completely Randomize Design (CRD) was used in the experiment. The one hundred and twenty (120) snails were randomly distributed to two (2) treatments - the intensive management system and extensive management system. Each of the treatment was replicated three (3) times, with twenty (20) snails per replicate and sixty (60) snails per treatment.

Feeding and Watering

Feed were supplied to the snails in the intensive management system at 1800hours. Feeding was done in the evening and the left over feed in the subsequent evening was weighed. This was to ensure that their food is always fresh at the time of feeding as snails are nocturnal animals. The weight was subtracted from the initial weight of the feed supplied to estimate the feed intake. The Feed

Conversion Ratio was calculated as the ratio of feed intake to weight gain. Formulated feed of 25% crude protein was also used to feed the snails. Natural feeds like fruits of pawpaw, watermelon, pineapple and leaves of pawpaw and cocoyam were used to feed the snails. The natural and formulated feed was given to the snails at alternate days. Water was provided to the snails by making the soil moist as snails have the ability to obtain water from moist soil. Regular cleaning of the snailery and utensils as well as routine management practices was ensured. The snails in the extensive management system were allowed to feed naturally on the plant materials planted within the enclosure. Pawpaw and cocoyam plants were planted within the enclosure to serve as source of food and shelter for the snails.

Data collection

Data were collected on the weight gain, shell length increment, shell width increment, feed intake and Feed conversion Ratio (FCR) for a period of 52 weeks. The snails were marked with a permanent marker for easy identification. The weight gain, shell length increment and shell width increment of the snails were measured once every two weeks. The weight of the snails were measured using an electronic weighing balance, the shell length was measured by using a measuring tape from the tip of the shell to the base and measured to the nearest centimeter, the shell width was measured by using a thread to measure the broad circumference of the shell and the values were read off on a ruler to the nearest centimeter.

Analysis

The data collected on weight gain, shell length increment and shell width increment during the experiment were subjected to student t-Test at 5% significant level.

RESULTS

Percentage composition of the formulated feed with 25% crude protein

The result of the percentage composition of the formulated feed with 25% crude protein revealed that maize had the highest composition of 50% while vitamin premix and limestone had the least composition of 2.5% each. This is represented in Table 1.

Table 1: Percentage composition of the formulated feed with 25% crude protein

Ingredients	Percentage (%) composition
Maize	50.00
Soyabean meal	15.00
Groundnut cake	15.00
Fishmeal	5.00
Bonemeal	10.00
Vitamin premix	2.50
Limestone	2.50
Total	**100**

Proximate composition of feed given to *Archachatina marginata*

The result of the proximate composition of feed given to *Archachatina marginata* revealed that the crude protein had 24.5% composition, Nitrogen Free Extract (NFE) 51.57% composition, dry matter 90.73% composition and lipids had the least composition of 3.14%. This is represented in Table 2.

Table 2: Proximate composition of feed given to *Archachatina marginata*

Composition	Percentage (%)
Ash	8.25
Dry matter	90.73
Lipid	3.14
Crude fibre	3.27
Moisture content	9.27
Crude protein	24.50
Nitrogen Free Extract (NFE)	51.57

***Archachatina marginata* mean weight gain in feeding trials**

The result of the *Archachatina marginata* mean weight gain revealed that there was a significant difference at ($p<0.05$) in the weight gain of the two management systems. The intensive management system had the higher weight gain of 136.53g with mean value of 5.25 while the extensive management system had a weight gain of 106.53g with mean value of 4.10. This is represented in Table 3.

Table 3: *Archachatina marginata* mean weight gain (g) in feeding trials

Weight of Samples	Intensive system	Extensive system
Initial body weight	36.35g ± 0.32g	36.35g ± 0.32g
Final body weight	172.88	142.88
Total Weight gain	136.53	106.53
Mean weight gain	**5.25^{a} ± 0.56**	**4.10^{b} ± 0.57**

Means with different superscript indicated that they are significantly different at ($p<0.05$)

***Archachatina marginata* mean Shell length increment**

The result of the *Archachatina marginata* mean Shell length increment revealed that there was a significant difference at ($p<0.05$) in the shell length increment of the two management systems. The snails in the extensive management system had the higher shell length increment of 9.94cm with mean value of 0.38 while the snails in the intensive management system had a shell length increment of 8.02cm with mean value of 0.31. This is represented in Table 4.

Table 4: *Archachatina marginata* mean Shell length increment (cm)

Shell length	Intensive system	Extensive system
Initial shell length	5.48cm ± 0.15cm	5.48cm ± 0.15cm
Final shell length	13.50	15.42
Total shell length increment	8.02	9.94
Mean shell length increment	**0.31^{b} ± 0.03**	**0.38^{a} ± 0.03**

Means with different superscript indicated that they are significantly different at ($p<0.05$)

***Archachatina marginata* mean Shell width increment**

The result of the *Archachatina marginata* mean Shell width increment revealed that there was a significant difference at ($p<0.05$) in the shell width increment of the two management systems. The snails in the extensive management system had the higher shell width increment of 10.46cm with mean value of 0.40 while the snails in the intensive management system had a shell width increment of 9.02cm with mean value of 0.35. This is represented in Table 5.

Table 5: *Archachatina marginata* mean Shell width increment (cm)

Shell width	Intensive system	Extensive system
Initial shell width	11.46cm ± 0.24cm	11.46cm ± 0.24cm
Final shell width	20.48	21.92
Total shell width increment	9.02	10.46
Mean shell width increment	**0.35^{a} ± 0.03**	**0.40^{b} ± 0.02**

Means with different superscript indicated that they are significantly different at ($p<0.05$)

***Archachatina marginata* Feed Conversion Ratio (FCR)**

The result of the Feed Intake and Feed Conversion Ratio (FCR) of the snails in the intensive system of management revealed that the feed intake value was 271.44g while the Feed Conversion Ratio (FCR) was 1.99. This is represented in Table 6.

Table 6: *Archachatina marginata* Feed Conversion Ratio (FCR)

Weight of Feed	Intensive System
Total Feed Intake (g)	271.44
Total Weight Gain (g)	136.53
Feed Conversion Ratio (FCR)[1]	1.99

[1]FCR = Total Feed Intake/ Total Weight Gain

DISCUSSION

The growth performance *Archachatina marginata* in the intensive and extensive management systems were measured by the weight gain, shell length increment and shell width increment. The snails in the intensive management system had a higher weight gain than the snails in the extensive management system. This was a result of the formulated feed of 25% crude protein in addition to the natural feed used in feeding the snails. This agrees with the findings of Omole (2002) that weight gain of snail is directly proportional to the level of protein in the diet. This is also in agreement with Akintomide (2004), that African land giant snails like other farm animals prefer to be fed on a combination of feeds rather than just feeding on a particular type of food. The snails in the extensive management system had higher shell length and shell width increment than the snails in the intensive management system. The increase in shell length and shell width occurred throughout the year even in the dry season. This is an indication that snails grow in shell size even during the dry season, though the growth rate was reduced. The higher shell length and shell width increment of the snails in the extensive management system could be due to the spacious environment in which the snails in the extensive management system were exposed to. Snails grow well when the environment is spacious and have free access to their feed. This is in agreement with the findings of Ayodele and Asimalowo (1999) that the performance of snails is affected by space and number. The lower feed conversion ratio of the juvenile snails is expected because the growth of snail tissues is rapid at young age. This indicates that African giant land snails utilized the nutrients available in the 25% crude protein diets more efficiently. This is in accordance with Ademolu et al. (2014) who reported FCR range of 1.33 to 4.84 for one month old snails.

CONCLUSION

From these results, it could be deduced that formulated feed used in feeding the snails in the intensive system of management contributed to the higher weight gain while the snails in the extensive system of management had a higher shell length and shell width increment. The Feed Conversion Ratio was low indicating that the snails utilized the nutrients available in the diets more efficiently.

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