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Abstract

In Nigeria, the farming of the giant land snail, *Archachatina marginata* in captivity is now on the increase. However, no appropriate stocking density has been established Farmers stock arbitrarily any number they deem necessary. This militates against growth and survival. This study was therefore undertaken to address the problem. Three different stocking densities in cages of the same size were carried out to find their effect on growth and survival of the snails reared in captivity and fed same supplemented diet. The three stocking densities represented as D_1, D_2 and D_3 had 10, 15 and 20 Snails per cage, respectively. The highest mean daily growth rate of 0.07g was observed in $D_{1,}$ followed by 0.05g in D_2. The lowest mean daily growth rate of 0.01g was seen in D_3. The highest survival rate of 90% was also recorded in D_1, followed by 87% in D_2. D_3 had the lowest survival rate of 75%. Statistically, at the highest stocking density D_3 with 20 Snails per cage, growth and survival were low and significantly different ($P<0.05$) from D_1 and D_2. We therefore recommend that farmers stock at stocking density of 10 or 15 snails per cage of the size used in this study.

Keywords: Archachatina Marginata, Stocking Density, Survival, Supplemented, Captivity

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Introduction

In animal production, growth and survival of the farm animals are paramount and are of great interest to the farmer. This is because if his animal does not grow well or survive rearing processes especially in captivity under intensive/semi intensive culture system, he suffers loss and could even be out of business and could suffer economic doom. In Nigeria, the farming of the giant land snail, *A. marginata* is now on the increase. Many farmers have ventured into it. Nwachukwu (2007) affirmed that the addition of feed supplements as in livestock and fisheries to its essentially vegetarian diets has enhanced its growth, fecundity, maturity and survival far above what obtains in the wild. However, another problem that affects growth and survival of animals reared in captivity besides nutrition, is stocking density (that is, number of animals in a unit area of space). In snail farming, this has not been established. Odaibo, (1997) asserted that high stocking density in snails stunted growth and accelerated shell rasping. Akegbejo-Sampson and Akinnusi, (2000) corroborated this report. They observed that growth among snails is density dependent. Rearing snails in captivity in an over-crowded enclosure due to no appropriate established stocking density leads to cannibalism (Omole, *et al.*, 2006; Nwachukwu, 2007). Cannibalism affects growth and survival of snails as seen in fish culture. This study therefore investigated the effect of three (3) different stocking densities on growth performance and survival of *A. marginata* reared in captivity and fed supplemented leafy diet.

Materials and Methods

The snails were reared in wooden cages built with hardwood and placed in a well ventilated house in Abia State University Teaching and Research Farm, Umudike, Umuahia, Abia State, Nigeria. Each wooden cage measured 90.0cm x 50.0cm x 70.0cm. The tops were covered with nylon mosquito gauze- framed lids that could open and close as well as locked at will. The floors of the cages were covered with humus soil 15cm thick. In the centre of each cage was placed a flat feeding tray for the snail feed and a shallow water trough at one corner of the cage for water for the snails. A popular leaf- paw-paw (*Carica papaya*) greatly utilised in the wild as food for *A. marginata* was used to formulate the supplemented leafy diet. The leaves were collected from the wild and sun-dried. The dry leaves were squeezed between the palms to near milled products; bagged and kept in a cool dry place for feed formulation. Proximate analysis of the leaves was determined by the methods of AOAC, (1995) before being combined with the feed supplements. 10g paw-paw leaf, 25g soyabean as protein source, 60g wholecorn as carbohydrate source (both ground to powder) and 5g growth additives (vitamins, minerals and antibiotics) were thoroughly mixed to produce 100g supplemented diet.

Three stocking densities – 10, 15 and 20 snails per cage, represented as D_1, D_2, and D_3, respectively, were in a completely randomized design(CRD) assigned to the experimental cages (Gomez and Gomez, 1981). One hundred and thirty-five (135) breeder snails with a mean weight of 82.2g were stocked in the appropriate cages at the appropriate stocking densities in three replicates at 1600hours. D_1 had 30 snails, D_2 had 45 snails, while D_3 had 60 snails. After stocking, they were covered with wet dry plantain leaves to provide cool cage environments. The supplemented diet was fed to the snails at 100g initially, then multiplies or fractions later, depending on consumption rate in each cage. Feeding was daily in the evenings since snails are essentially nocturnal. Each cage environment was watered daily with three litres of water during the dry months but less during the dry spells, to provide optimum humidity and temperature in the cages for good growth and survival of the snails. Both the atmospheric and soil temperatures in the cages were monitored daily with Celcius thermometer. At a bi-weekly interval throughout the culture period of four (4) months, snail weights as growth indices were measured with Ohaus sensitive laboratory balance. Snail heavier than what the balance could carry were weighed with the triple beam balance. Length measurements as growth indices were also taken with Vernier calipers.

Results and Discussion

The proximate compositions of the leafy diet (Table1) showed that the paw-paw leaf had crude protein content of $4.48 \pm 0.01\%$, fat content of $3.64 \pm 0.02\%$, crude fibre content of $16.71 \pm 0.01\%$, ash content of $2.46 \pm 0.03\%$, moisture content of $10.30 \pm 0.02\%$, and carbohydrate content of $62.41 \pm 0.01\%$. The feed supplements added to these as nutrients. The highest mean daily growth rate of 0.07g was observed in D_1, followed by 0.05g in D_2. The lowest mean daily growth rate of 0.01g was seen in D_3 (Table 2). Statistical analysis showed that there was no significant difference ($P>0.05$) between the mean daily weight gains in D_1 and D_2. However, there was a significant difference ($P<0.05$) in the daily mean weight gains in D_1, D_2 and D_3. The lowest weight gain (growth) in D_3 is in agreement with Ayodele and Asimalowo, (1999) who recorded low feed intake and low weight gain at higher stocking rates. They inferred that snails are affected by space and number. At a higher stocking density, growth is slower and breeding is hindered or delayed. Space and feed competition highly affected the physiological state of snails, as it can in any other animal reared in capacity (Akinloye and Olorode, 2000). The survival rates were also in line with the stocking rates. The highest survival rate of 90% was recorded in D_1, followed by 87% in D_2. D_3 had the lowest survival rate of 75% (Tables 3). Statistically, there was no significant difference ($P>0.05$) between the percentage survival rates in D_1 and D_2. However, there was a significant difference ($P<0.05$) in the survival rates in D_1, D_2 and D_3. This could be attributed to over-crowding that leads to shell rasping and cannibalism reported by Odaibo, (1997) and Nwachukwu (2007), respectively. This agrees with Jess and Marks, (1994) that the lowest snail mortality was consistently observed at the lowest population density. The high percentage survival rates in D_1 and D_2 could also be attributed to regularly available and nutrient enriched diet (Bunnce, *et- al.*, 2005). They also asserted that food availability is a density dependent factor regulating snail populations. Geisser and Reyer, (2005) showed that a combination of regular food availability and optimum temperatures helped to sustain the population density of wild boar snails; where population is lower, survival is enhanced as it was seen in this study where quality feed was regularly available especially at the lower stocking densities D_1 and D_2 and temperatures were optimum.

Conclusion and Recommendations

At the highest stocking density D_3 with 20 snails per cage, growth and survival were low and significantly different ($P<0.05$) from D_1 and D_2 with 10 and 15 Snails per cage, respectively. Since other culture conditions were the same except stocking densities, variations in growth and survival are density dependent. The lower the population density in a given area, the higher the growth and survival rates. We therefore recommend that farmers stock at stocking densities of 10 or 15 snails per cage of the size used in this study for better growth and survival.

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Tables

Table 1: Proximate Compositions of the Leafy Diet Used In Feed Formulation.

Sample	Mean % Crude Protein	Mean % Fat	Mean % Crude Fibre	Mean % Ash	Mean % Moisture	Mean % Carbohydrate
Paw-paw (*Carica payaya)*	4.48± 0.01	3. 64±0.02	16. 71± 0.01	2.46±0.03	10.30±0.03	62.41±0.01

Table 2: Daily Mean Weight (g) Grains (Growth) At Three Different Stocking Densities.

Parameter	Stocking Densities		
	D_1	**D_2**	**D_3**
Final Mean Weight	0.21	0.16	0.09
Initial Mean Weight	0.14	0.11	0.08
Mean Weight Grain	0.07^{a*}	0.05^{q}	0.01^{b}

* Means across same row with the same superscript are not significantly different (P>0.05).

Table 3: Percentage Survival Rates among *A. marginata* At Three Different Stocking Densities

Parameter	Stocking Densities		
	D_1	**D_2**	**D_3**
Total Stocked	30	45	60
Total Surviving	27	39	45
% age Survival	90^{*}	87^{*}	75^{b}

* Means across same row with the same superscript are not significantly different (P>0.05)