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The Effects of Different Stocking Rates on Growth and Reproductive Performance of Breeding Snail (*Archachatina marginata*) under Intensive System of Production in the Humid Tropics

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Abstract: The effect of five stocking densities (T_A, T_B, T_C, T_D and T_E with 5, 10, 15, 20 and 25 snails per square metre, respectively) on growth and reproductive performance of breeding snails (*A. marginata*) of mean weight 379.4 g (range: 350-401.5) were studied for a period of six months in a Completely Randomized Design. The highest mean monthly feed intake of 149.42 g was recorded in T_B, while the lowest mean feed intake of 100.3 g was recorded in T_E ($p<0.05$). There were significant differences in monthly weight gain ($p<0.05$ with T_E having lowest weight gain of 2.42 g. No significant differences were obtained in mean monthly shell length, width and thickness increment ($p<0.05$). Mortality was highest in T_D (13.3%) and T_E (25.3%), while no mortality was recorded in T_A and T_B ($p<0.05$). Mean total eggs collected for the six months were 32.61, 31.4, 23.2, 19.29 and 8.15 for T_A, T_B, T_C, T_D, and T_E respectively ($p<0.05$). The mean weight of eggs, incubation period and mean weight of hatchlings were not affected by stocking rate ($p>0.05$). It is suggested that 10-15 breeding snails (*A. marginata*) per square should be the maximum numbers under intensive system of snail production.

Key words: *Archachatina marginata* · stocking rate · growth and reproductive performance

INTRODUCTION

There is a renewed interest in snail production and in fact it is becoming one of the fastest growing source of protein in Nigeria. As people run away from red meat for health reason, a lot of snail meat is being sold in restaurants and hotels in many urban centers. With a crude protein content of 16.18%, it compares favourably with other conventional source of animal protein like beef pork and poultry meat[1-3]. Snail farming is even an important source of income to farmers.

The African giant land snail (*Archachatina marginata*) is the commonest in the rain forest belt of Southern Nigeria and can reach a weight of 500-800 g, when fully mature and has high commercial value than other species [4,5]. Snail can be reared successfully under intensive management using tiers of tyre, cage, low and high fenced pen, etc. with good management practices such as proper feeding, good ventilation, provision of shade and optimum stocking densities [3, 5, 6]. However, these recommendations have not been validated and there is no agreement among these researchers as to minimum and maximum stocking rate. However some farmers were complaining about the slow growth and high mortality among their snails despite the fact that they were following the recommended farming practices. This trial was conducted to establishthe appropriate stocking rate to address the above problem.

MATERIALS AND METHODS

The experiment was carried out at the snailery Unit of the Institute of Agricultural Research and Training, Moor Plantation, Ibadan, Nigeria which is located on Longitude 03° 51'E, Latitude 07° 23'N and it lies in the humid zone of the rain forest belt of 0703.25 of South-western Nigeria with mean annual rainfall of 1220 and mean temperature of 26°C. A total number of two hundred and twenty-five breeding African giant land snails (*Archachatina marginata*) without any shell damage were selected for the research, which lasted 6 months. The snails have an average live weight of 379.41 g (range: 350.1 to 401.05 g). They were randomly allotted to 5 different treatments A, B, C, D and E with stocking rates of 5, 10, 15, 20 and 25 snails per square meter, respectively. Each treatment was replicated thrice in a Completely Randomized Design. T_A (5 snails/m^2) was used as a control as suggested by Amusan *et al*. [7]. The snails in all the treatments were fed daily with a combination of pawpaw fruits and leaves at 5 o'clock in the evening. The feeds and water were served in flat containers. The amount of feed intake was obtained by deducting the leftovers from the given on a daily basis with the use of electric weighing balance. The weight gain was measured on weekly basis with the use of electric weighing balance. Other parameters such as shell length and width were measured with the use of vernier caliper while micrometer screw

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gauge used to measure shell thickness. The number and weight of the eggs collected, incubation period, mean weight of hatchlings at day old and mortality were among the parameters taken in the course of present reserach. The proximate composition of the experimental diet was determined according to the method of AOAC [8]. All data were subjected to Analysis of variance using SAS [9].

Table 1: Proximate composition of the experimental diets (% Dry matter basis)

(%)	Pawpaw fruit (Green)	Pawpaw leaf
Dry matter	9.81	13.98
Crude protein	13.41	22.41
Crude fibre	5.80	7.89
Ash	5.80	7.89
Ether extract	1.34	9.48
Nitrogen free extract	72.24	58.27

RESULTS

The determined crude protein of pawpaw leaf was higher than that of pawpaw fruit however the latter had lower crude fibre compared to the former (Table 1). The feed intake was affected by the stocking density. The highest mean monthly feed intake of 149.42 g was recorded in T_B, while the lowest feed intake (102.28 g) was obtained in T_E ($p<0.05$) as shown in Table 2. There were significant differences in the mean monthly weight gain with T_E having lowest 2.42 g, while T_A had the highest weight gain of 8.14 g. No significant differences were obtained in the mean monthly shell length, width and thickness increment in all the treatment ($p>0.05$) as shown in Table 2. The highest mortality of 25.3% was recorded in T_E with 25 breeding snails per square meter ($p<0.05$). No mortality was recorded in T_A and in T_B. The result in Table 3 showed significant differences in the mean total number of eggs collected ($p<0.05$). The mean total eggs collected in T_A was 32.61 for the whole six months while 31.40, 23.2, 19.29 and 8.15 eggs were collected in T_B, T_C, T_D and T_E, respectively, the mean weight of the eggs and incubation period were relatively the same ($p>0.05$). The mean weight, shell length and shell width of the hatchlings in all treatments were not affected by stocking density ($p<0.05$) as shown in Table 3.

DISCUSSION

The low feed intake and weight gain recorded at higher stocking could be attributed to over population resulting in competition which did not allow the snails free access to feed and water. The observation was in agreement with the report of Ayodele and Asimalowo [10] that snails are affected by space and number and at higher density, the growth is slower and breeding is hindered. The low weight gain recorded in present research could also be attributed to non-supplementation of concentrates.

Non-significant differences observed in shell length, width and thickness could be as a result of the old age of the snails in which the snails had developed harden shell mouth. Amusan and Omidiji [5], hardened shell mouth mark the termination of shell growth and development. The low mortality recorded at lower density could be attributed to good ventilation, less competition for feed and water and reduce cannibalism as a result of over crowding. The mean total eggs collected was higher at low stocking density and was in line with the observation of Ayodele and Asimalowo [10] that the amount of egg laid and the frequency of laying is reduced at higher stocking density. The mean weight of hatchlings in all the treatment was higher than the mean live weight of 2.3 g reported by Akinnusi [3] and this could be due to the big size of the snails used by present

Table 2: Growth performance of breeding snails (*A. marginata*) under different stocking density

Paramaters (Mean values)	T_A 5	T_B 10	T_C 15	T_D 20	T_E 25	± SEM
Monthly feed intake (g/snail)	143.72^a	149.42^a	120.50^a	119.80^b	100.28^c	8.92
Initial live weight (g/snail)	439.13^a	436.18^a	438.41^a	434.11^a	436.99^a	12.19
Final live weight (g/snail)	487.97^a	484.72^a	464.09^a	452.89^b	451.51^c	23.41
Monthly weight gain (g/snail)	8.14^a	8.09^a	4.28^a	3.13^b	2.42^c	1.48
Monthly shell length increment (mm)	2.41^a	2.41^a	2.38^a	2.37^a	2.37^a	0.23
Monthly shell width increment (mm)	1.91^a	1.90^a	1.89^a	1.89^a	1.87^a	0.19
Monthly shell thickness increment (mm)	0.10^a	0.10^a	0.11^a	0.10^a	0.11^a	0.03
Mortality (%)	0.00	0.00	6.67^c	13.30^b	25.30^a	1.41

Table 3: Reproductive performance of breeding snails (*A. marginata*) under different stocking rate

Paramaters (Mean values)	T_A 5	T_B 10	T_C 15	T_D 20	T_E 25	± SEM
Total eggs collected	32.61^a	31.40^a	23.2^a	19.29^c	8.15^d	2.14
Weight of the eggs (g)	4.80^a	4.78^a	4.81^a	4.76^a	4.81^a	0.91
Incubation period (days)	31.90^a	32.40^a	31.89^a	32.51^b	32.18^c	1.42
Weight of hatchling (g)	4.10^a	4.00^a	4.11^a	3.10^a	4.11^a	0.26
Shell length of the hatchling (mm/day-old)	13.21^a	13.20^a	13.24^a	13.20^a	13.26^a	0.81
Shell width of the hatchling at day-old (mm)	11.15^a	11.28^a	11.22^a	11.19^a	11.18^a	0.67

Means with different superscripts in the same row are significantly different ($p<0.05$)

research. It was reported that the size of hatchlings produced had correlation with the size of the snails that laid the eggs [4, 7]. The mean monthly feed intake and weight gain were higher in T_A and T_B and Tc Furthermore, no mortality was recorded and the number of eggs produced were at higher rate in treatments stocked with 5 and 15 snails/m^2; therefore for optimum performance, it is suggested that 10-15 breeding snails should be stocked in a metre square compartment under intensive system of production.

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