COMPARATIVE STUDY OF SNAIL PRODUCTION SYSTEMS USING CROPS AS COVER: GROWTH PARAMETERS AS INDICATORS

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ABSTRACT
This study was carried out to evaluate the different snail production systems using crops as cover. Open and screened paddocks systems of rearing snails were compared with the conventional snailery. The conventional system involved raising snails in pens. In the open and screened paddocks, leaves from four different plants (Pueraria phaseoloides, Centrosema mole, Calapogonium mucunoides and Manihot esculenta) commonly called Puereria, Centrosema, Calapogonium and Cassava, respectively. were cultivated to simulate the natural environment of the snails. A total number of three hundred and twenty (320) apparently healthy Archachatina marginata with liveweight between 50 to 60 g were used in the study, which was laid out in a 2 X 4 factorial in Randomized Complete Block Design with four replicates. Data collected on body weight changes were subjected to Analysis of Variance (ANOVA) using GenStat version 12.0 statistical software. Significant level was taken at P < 0.05. The conduct of the study spanned through three climatic conductions (0 week -Cold wet; 6 weeks -Cold dry; 12 weeks - Hot dry). There was a significant difference (P < 0.05) in the body weight of the snails among the four cover treatments when compared on the basis of the production systems. The snails in the Calapogonium, Centrosema, Puereria and Cassava screened paddock recorded 10.75, 5.90, 5.63 and 4.43 g body weight gain, respectively while the snails reared under the open paddock in Calapogonium, Pueraria, Centrosema and Cassava had weight gain of 4.28, 3.7, 2.9 and -2.8 g, respectively. The snails in the conventional paddock had an average weight gain of 6.5 g. It is therefore evident that weight gain and other performance indices of snail is a function of the nutritional composition of their diet and the environment in which they are reared.
Key words:, *P*roduction system, growth indicator, *Archachatina marginata,* physiological season classification

INTRODUCTION

The snail production systems used in Nigeria are far from the standard obtained in developed world as the developed production technologies currently being deployed have not been able to produce the expected results when compared with other conventional livestock. The deployment of these technologies such as the use of drench pens and tyres only advances small scale productions that struggle to survive rather than make profits (Omoyakhi and Osinowo, 2010). Previous research have centred on conventional snail production system which is capital intensive, expose snails to the effect of inclement weather and do not give opportunity for the snail to exhibit their natural characteristics for optimum performance. This research however focused on alternative housing system that simulate the wild and easy to adopt by snail farmers.

MATERIALS AND METHODS

The study was carried out in the Teaching and Research Farm, Faculty of Agriculture, University of Benin, Benin City, Edo State, Nigeria. The three production systems involved first, the use of Trench pens raised above the ground with well-drained floor. The second system involved a semi free range pen made of a fenced area. The third system involved the construction of a screen house with galvanized pipes, wire mesh, snail net and anti UV ray net. Four different plants Centrosema, Pueraria, Calapogonium and Cassava leaves were used to provide cover in the open and screened paddocks. Each system was equipped with irrigation facilities to provide water for the plants, the snails and to regulate the environmental humidity and temperature.

RESULTS AND DISCUSSION

The Screened and Open paddock were individually analyzed in comparison with the conventional paddock on the bases of snail growth in key performance indicator (aperture, length, thickness, width and weight) as presented in tables 1 - 6.

Table 1: The mean changes in the aperture of *Archachatina marginata* at 0, 6 and 12 weeks

Treatment	Aperture (cm)		
Open Paddock	**0 week**	**6 weeks**	**12 weeks**
Centrosema	4.90 [a]	5.15 [a]	5.05 [a]
Cassava	4.93 [a]	5.00 [a]	5.15 [a]
Calapogonium	5.25 [a]	5.88 [b]	5.20 [a]
Puraria	4.98 [a]	5.05 [a]	5.00 [a]
Screened Paddock			
Centrosema	4.90 [a]	5.00 [a]	5.10 [a]
Cassava	4.95 [a]	5.10 [a]	5.10 [a]
Calapogonium	4.83 [a]	5.15 [a]	5.30 [a]
Puraria	4.95 [a]	5.90 [b]	5.40 [a]
Conventional Paddock	**4.95**	**5.08**	**5.08**

[ab] Means with different superscripts within the same parametric column differ significantly ($P < 0.05$).

Table 2: The mean changes in the length of *Archachatina marginata* at 0, 6 and 12 weeks

Treatment	Length (cm)		
Open Paddock	0 week	6 weeks	12 weeks
Centrosema	9.10 [a]	9.55 [a]	10.00 [b]
Cassava	8.95 [a]	9.55 [a]	9.40 [a]
Calapogonium	9.10 [a]	9.55 [a]	10.00 [b]
Puraria	9.05 [a]	9.65 [a]	9.40 [a]
Screened Paddock			
Centrosema	9.05 [a]	8.65 [a]	10.00 [b]
Cassava	8.98 [a]	9.95 [a]	10.00 [b]
Calapogonium	9.05 [a]	9.65 [a]	10.00 [b]
Puraria	9.08 [a]	9.60 [a]	9.80 [b]
Conventional Paddock	**9.08 [a]**	**9.83 [a]**	**9.70 [b]**

[ab] Means with different superscripts within the same parametric column differ significantly ($P < 0.05$).

Table 3: The mean changes in the thickness of *Archachatina marginata* at 0, 6 and 12 weeks

Treatment	Thickness (mm)		
Open Paddock	0 week	6 weeks	12 weeks
Centrosema	0.03 [a]	0.03 [a]	0.07 [a]
Cassava	0.03 [a]	0.14 [b]	0.10 [b]
Calapogonium	0.04 [a]	0.04 [a]	0.13 [b]
Puraria	0.04 [a]	0.03 [a]	0.05 [a]
Screened Paddock			
Centrosema	0.03 [a]	0.03 [a]	0.07 [a]
Cassava	0.03 [a]	0.04 [a]	0.09 [a]
Calapogonium	0.04 [a]	0.03 [a]	0.14 [b]
Puraria	0.04 [a]	0.03 [a]	0.05 [a]
Conventional Paddock	**0.03 [a]**	**0.03 [a]**	**0.06 [a]**

[ab] Means with different superscripts within the same parametric column differ significantly ($P < 0.05$).

Table 4: The mean changes in the width of *Archachatina marginata* at 0 , 6 and 12 weeks

Treatment	Width (cm)		
Open Paddock	0 week	6 weeks	12 weeks
Centrosema	6.00 [a]	9.60 [a]	10.75 [a]
Cassava	6.15 [a]	9.55 [a]	11.00 [a]
Calapogonium	6.10 [a]	9.35 [a]	11.15 [a]
Puraria	6.13 [a]	9.35 [a]	10.50 [a]
Screened Paddock			
Centrosema	5.98 [a]	9.65 [a]	10.80 [a]
Cassava	6.20 [a]	10.00 [a]	11.20 [a]
Calapogonium	6.13 [a]	9.70 [a]	11.15 [a]
Puraria	6.13 [a]	9.35 [a]	10.50 [a]
Conventional Paddock	**6.23 [a]**	**9.63 [a]**	**10.78 [a]**

[a] Means with same superscripts within the same parametric column have no significant difference (P > 0.05).

Table 5: The mean changes in the liveweight of *Archachatina marginata* at 0, 6 and 12 weeks

Treatment	Liveweight (g)		
Open Paddock	0 week	6 weeks	12 weeks
Centrosema	56.10 [a]	57.00 [b]	59.00 [b]
Cassava	57.30 [a]	56.50 [b]	54.50 [b]
Calapogonium	54.73 [a]	57.50 [b]	59.00 [b]
Puraria	56.30 [a]	59.50 [b]	60.00 [b]
Screened Paddock			
Centrosema	56.60 [a]	59.75 [a]	62.50 [a]
Cassava	57.58 [a]	61.00	62.00 [a]
Calapogonium	55.75 [a]	60.00 [a]	66.50 [a]
Puraria	57.38 [a]	62.00 [a]	63.00 [a]
Conventional Paddock	**56.75 [a]**	**60.12 [ab]**	**63.25 [a]**

[ab] Means with different superscripts within the same parametric column differ significantly (P<0.05)

Table 6: Mean Weight gain of *Archachatina marginata* at the end of experiment in the four treatment groups within the two systems of production

Housing System	Cover Crop/ Feed					P value	SEM
	Centrosema	Puereria	Calapogonium	Cassava	Conventional		
Open Paddock	2.90[ab]	3.70[a]	4.28[ab]	-2.80[b]	6.50[a]	0.007	1.49
Screened	5.90[ab]	5.63[ab]	10.75[a]	4.43[c]	6.50[ab]	0.10	1.58
Conventional	6.50[a]	6.50 [a]	6.50 [a]	6.50 [a]	6.50 [a]		
P-value	0.07	0.59	0.08	<.001			
SEM	1.02	1.91	1.78	1.07			

[abc] Means with different superscripts within the same parametric row differ significantly (P<0.05)

The mean aperture changes at 0, 6 and 12 weeks showed that there was no significant difference observed in the open and screened paddock in comparison to the conventional paddock. The four crops supported the growth in aperture at 6 weeks more than at 12 weeks. This could be as a result of the physiological season at 12 weeks that coincided with harsh environmental condition thereby posing stress on the snails.

The mean length changes at 0, 6 and 12 weeks showed that there was no significant differences in the screened and open paddocks in comparison with the conventional paddocks (P > 0.5). Although there was increase in the length of all the snails subjected to the various treatments but the increase in length was more appreciable at 6 weeks than at 12 weeks. This could be that they were undergoing

induced physiological stress. This corroborates with the findings that there is reason to believe that there is more to aestivation than the mere existence of certain external factors (Barrows, 2001) in view of which Kokori (1992) stated that snails are governed not only by climatic conditions but by the internal rhythms that are not fully understood.

The shell thickness of snails in Cassava pen under the open paddock (0.14 mm) was significantly higher than the thickness recorded by other snails in the cover crops at 6 weeks. However, the snails in the four treatments under the open and screened paddocks recorded a higher shell thickness at 12 weeks than the snails in the conventional paddock (0.06 mm). This could be as a result of accumulation of Calcium in the snails occasioned by the physiological season corroborating the findings that higher Calcium secretion is associated with aestivation for the formation of cyst to ameliorate water loss (Cobbinah, 1993). It could also be that the feed consumed by snails in open and screened paddock were higher in Calcium content than the conventional paddock.

There was an appreciable width change in all the snails in the four treatments under the open and screened paddock at 6 weeks and 12 weeks in comparison with the conventional paddock.

The width increment was not significantly different among the paddock. The rate at which the width increased was higher in 6 weeks than 12 weeks in all the treatments. The highest width increment (3.6) was recorded in the snails in the Centrosema pen among the treatments in the open paddock while the highest increment (3.8 cm) was recorded by the snails in the cassava pen under the screened paddock. This could be as a result of hormonal regulation. The associated metabolic changes in animals are regulated by hormones and in various seasons, the condition and behavior of the animal change; accumulation or consumption of reserve substance may occur (Cobbinah, 1992). Therefore the increase at six weeks is an indication of accumulation of reserve to be used during aestivation but due to the fact that they were prevented from observing their physiological rest at twelve weeks, there was a drop in width increment performance.

The snails reared under the screened paddock fed Centrosema and Pueraria recorded a significant weight gain of 5.9 g and 5.63 g, respectively and these were signficantly different from the body weight gained (6.5 g) by the snails in the conventional paddock. The weight gained by snails in Calapogonium treatment in the open paddock (4.28 g) was similar the weight gained (4.43 g) by the snails in Cassava screened paddock. However, the snails in Calapogonium screened paddock had the highest weight gain of 10.75 g. Lower weight gain were recorded in Centrosema and Pueraria in the open paddock (2.9 g and 3.7 g) respectively compared to other snails with exception to the snails in Cassava open paddock which recorded weight loss (-2.8 g). It could therefore be said that the snails in Calapogonium screened paddock did better than the snails in the conventional paddock and that snails in Centrosema and Pueraria under the screened paddock favourably competed with the snails in the conventional paddock. From this result, the cover crops can replace conventional feeding to reduce cost of feeding the snails in corroboration with the Omole *et al.* (2013). The nutritional composition of the cover crops could have imparted on the performance recorded and this is in line with the report by Ademolu *et al.* (2012) and Okonkwo *et al* (2000) that growth performance is influenced by dietary composition.

CONCLUSION

The snails reared in Calapogonium treatment under the screened paddock was seen to have attained a higher weight gain than the snails in other treatments and even the conventional paddock. The snails under the cover crops within the screened paddock were able to measure up to the snails in the conventional paddock unlike the snails that were reared under Cassava treatment in the open and screened paddocks. Due to the high temperature that was associated with the periods of between six and twelve weeks of the experiment, the leaves of Cassava were shed despite irrigation. The inclement weather posed physiological stress on the snails that were reared especially in the open paddock. Screening did not only regulate the degree of sun penetration to the paddock but also provided some level of security for the snails from external predators and escape proof. Therefore, the screened paddock with the cultivation of cover crops to simulate the natural environment can replace the conventional paddock if snails are to be reared all year round.

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