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Technical Sheet of the Breeding Substrate Amendment in Oysters Shells Flour and Meat Yield of the Snails (*Archachatina marginata*) Produced

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Abstract: ***This study aims to describe the protocol for making a substrate suitable for the production of snails in a short time with a large amount of consumable flesh. So, snails were raised from the spat stage on different substrates made by soil amendment at different rates (0%, 5%, 10%, 20%, 30% et 40%) out of powder of oyster shells until the end of their growth cycle. On each type of substrate, snails were collected at the end of their growth cycle and their soft tissues were removed from the shell to assess their meat yield. Substrate amended at a rate of 30% allowed the production of snails with the highest amounts of meat (84.13 ± 31.65g).***

Keywords: Substrate, Amendment, Oysters shells Flour, Meat yield, *Archachatina marginata*

1. Introduction

The snail is a means for developing countries to locally produce animal protein and quality minerals for human and animal consumption (**[1], [10]**). The development of breeding techniques to regulate or even increase supplies is therefore of great interest to our countries. This is justified by the numerous works carried out to look for the reduction of the cycle of growth and reproduction of these animals in captivity (**[6], [8], [2], [9] …etc**). Knowing that the snail draws about 40% of its nutrients from the soil on which it lives transcutaneously using its foot **[5]**, it appears essential to complete this work by developing a suitable substrate for the success of snail farming in Côte d'Ivoire. This is why this study aims to describe how the *Archachatina marginata* rearing substrate is made by soil amendment with oyster shell powder. The main objective is to produce snails in an acceptable time with large quantities of consumable flesh.

2. Material and Method

Material

Biological Material

Animal

The biological material is essentially snails *Archachatina marginata* with black pigmented flesh. The snails used at the beginning of the experiment are juveniles of about one week old and a mean live weight of 1.44 ± 0.23 g with an average shell length of 1.91 ± 1.9 cm (figure 1).

Animal's food

The animals were fed exclusively with a concentrated food in the flour form formulated on the basis of the work of **[3]**.

Breeding matérial

Breeding enclosure

The animals were raised in parallelepipedal enclosures of dimensions 0.8 m × 0.75 m × 0.8 m, a base area of 0.6 m^2 for a volume of 0.48 m^3 (figure 2). These enclosures are provided with mosquito-net type blanket constituting the anti-leak device and allowing the circulation of air. They were installed in a building with a sheet metal roof equipped with an asymmetrical skylight.

Technical material

Measuring tool

A Sartorius brand electronic scale with 0.1g accuracy was used to weigh the animals, their eggs and the constituent elements (powder of calcium sources and compost) of breeding substrates. A 0.1 mm precision mechanical caliper was used for the measurement of animal shell lengths and egg diameters.

Equipment for the breeding substrate confection

Potting soil

The basic element used for making the substrates is potting soil taken from the forest of Nangui Abrogoua University.

Calcium source

The calcium source used for the amendment of potting soil consists mainly of oyster shells.

Method

Preparation of the soil

The potting soil is sieved to get rid of dead wood pieces, roots and stones. After sieving the moist potting soil is heated in an aluminum basin on charcoal for 20 minutes. During heating, the soil is regularly stirred for even heating. Heating is used to disinfect the soil.

Preparation of the calcium source

The oyster shells after being collected in the wild, were properly cleaned and heated in an oven at 70°C for 8 hours

before being crushed. They were then made into powder with grinding machine.

Potting soil amendmnt
Five (5) types of substrates were made by soil amendment at different rates (0%, 5%, 10%, 20%, 30% et 40%) with the oyster shell powder. Unamended substrate (0%) was considered a control substrate. The method of making the substrate is summarized by the figure 3.

Breeding technique
The snails were randomly distributed at a density of 25 individuals/m^2 on the 6 types of substrates because of three replicates per substrate. These snails were fed every two days and their breeding grounds watered daily.

Determination of meat yield
After 80 weeks of breeding, thirty snails were randomly sampled from each type of substrate for evaluation of their meat yield After 24 hours of fasting, the selected snails were marked, measured and weighed before being euthanized by scalding (immersion in boiling water for 15 min). After cooling, the soft tissues were removed from the shells and then drained on wire mesh.

For each snail, the weight of the whole of the flesh, that of the foot, the visceral mass and the weight of the empty shell, were determined by means of an electronic balance of Sartorius brand to the nearest half gram, after dissection.

Statistical treatment
The STATISTICA version 7.1 software was used to perform the various statistical treatments. The average live weight and the amount of meat produced as a function of the rearing substrate amendment rate were compared by a variance analysis (ANOVA) according to the LSD test at a confidence level of 5%.

3. Results

The variation in the fasting weight of the animals selected for the study of the meat yield as a function of the substrate amendment rate is summarized in Figure 4.

The fasting weight of snails increases with the rate of amendment of the substrate up to an amendment rate of 30%. Beyond this rate of amendment (30%), live weight of animals is significantly reduced.

Figure 5 shows the quantities of meat produced on each type of substrate.

The largest amount (84.13 ± 31.65g) of meat is offered by substrate snails amended to 30%. Those produced on substrates amended to 10% (75.81 ± 10.85g), 20% (76.7 ± 20.59g) and 40% (73.6 ± 37.07g) are identical.

The lowest amount of meat is provided by the animals in the unamended substrate (61.28 ± 23.51g).

The proportion of consumable meat produced by snails decreases with the increase in the rate of substrate amendment in calcium source while the proportion of shell increases (Figure 6).

4. Discussion

The oyster shell is an important source of calcium; a very important mineral for snail growth (**[4], [11]**).

The optimal oyster shell powder content of the substrate inducing better growth performance in A. marginata is 30%. Beyond this rate in the substrate, this calcium source induces a decrease in growth performance. This decrease in growth rate would be the consequence of the texture of the substrate. Indeed, with a high content of oyster shell powder, the substrate becomes light and too porous. This texture promotes the rapid leaching of the substrate and the precipitation of soil minerals at the bottom of bins under the effect of daily watering, making them almost inaccessible to snails **[7]**. The amendment of oyster shell powder substrate induces significant meat production in A. marginata. However, the optimal rate of this calcium source in the substrate for this purpose is 30%. Beyond 30%, snails tend to produce much more shell than meat. Similar results have already been reported by **[8]** who showed that in Achatina fulica and Achatina achatina, an increase in dietary calcium results in a decrease in the proportion of flesh in favor of that of the shell.

5. Conclusion

The oyster shells encountered in abundance on the Ivorian coast and little used, find here a great importance in snail farming. This important source of calcium is suitable for the amendment of the rearing substrate of this snail, with a view to improving its zootechnical performance. The rate suitable for this purpose for snails fed on the compound feed (12.02% calcium) is 30%.

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Figure 1 : *Archachatina marginata about a week old*

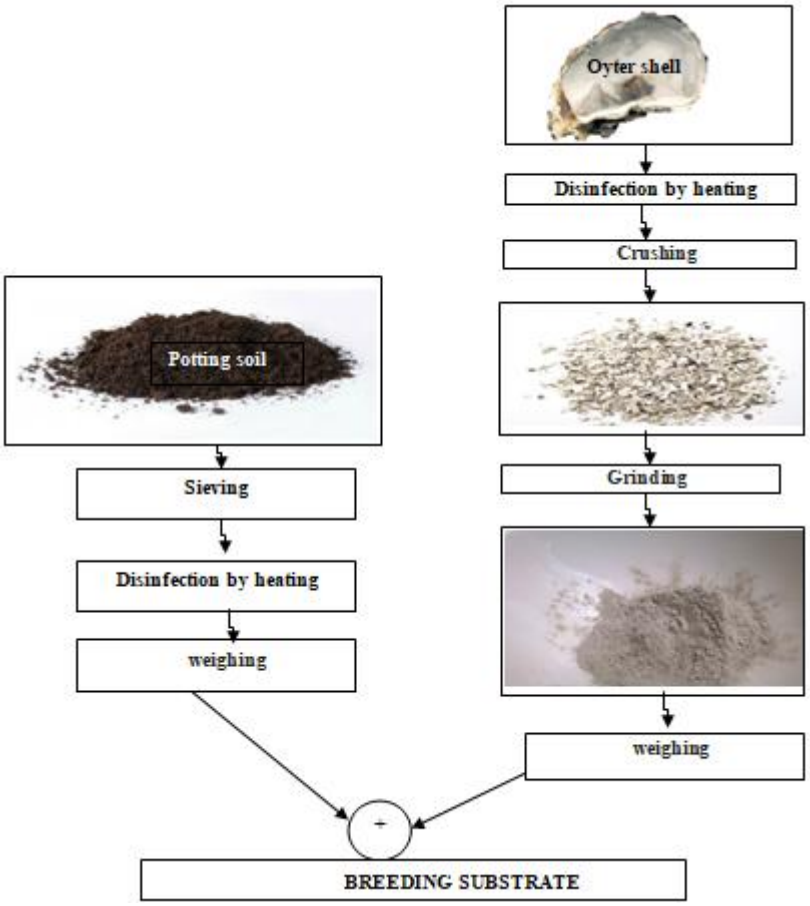
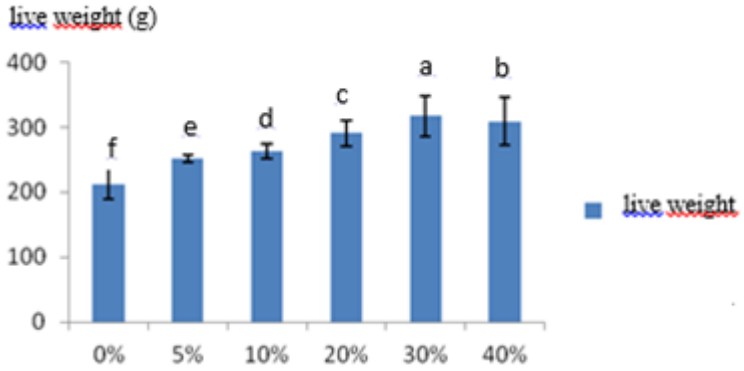


Figure 2: Manufacture of substrate for rearing snails

Figure 3: Breeding enclosure with a blanket



NB : The indexed bands of the same letters are not statistically different

.Figure 3: Variation of the final weight of snails (after 2 days of fasting) according to the rate amendment of the breeding substrate

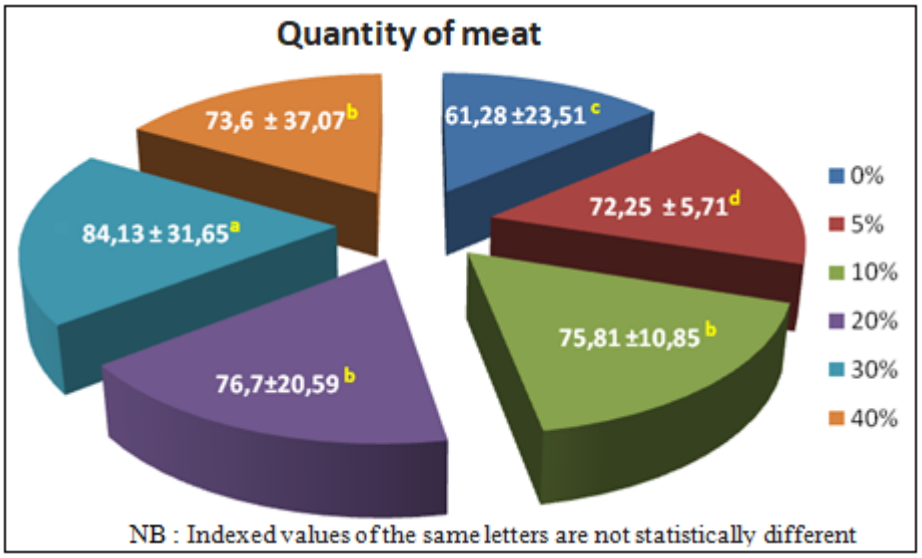


Figure 4: Quantity of meat according to the rate of amendment of the rearing substrate

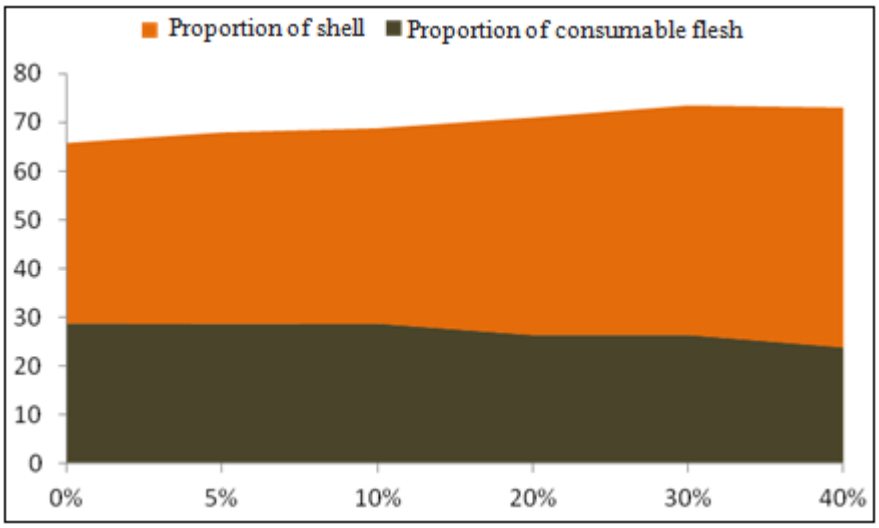


Figure 5 : Variation of shell and meat proportions according to the rearing substrate

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