



## Important Issues in Snail Farming for Environmental Sustainability

A.U. Ndu<sup>1\*</sup>, B.C. Amadi<sup>2</sup>, Y.Y. Salisu<sup>1</sup>

\*[augustinandu15@gmail.com](mailto:augustinandu15@gmail.com)

<sup>1</sup>Dept of Agric Edu, Federal College of Education, (Tech), Bichi, Kano.

<sup>2</sup>C/O Amadi, U. Julian, Faculty of Agric Tech, Benson Idahosa University, Benin City.

### Abstract

*The study reviewed important issues in snail farming for ensuring sustainable environment. The review found that the major requirements in snail farming form part of the goals of green technology. The requirements and justification for sustainable snail farming were discussed. Snail grows and produce well in rich organic, leaf-covered soils devoid of chemicals and other synthetics, a condition which the commercial snail farmer tries to replicate through tree planting, controlled environment, and other activities. Moreover, the feeding of snails is mostly on recycling and reuse of 'wastes', thereby reducing environmental threats and emission of greenhouse gases. In addition, snail meat attracts high financial value both locally and internationally. Snail farming therefore, encourages environmental sustainability and conservation which are some of the key goals of Green Technology (GT). Hence, the conscious learning of the skills and application of good management in snail farms, is one of the ways of conserving the environment and its resources, ensuring healthy co-existence and production of healthy food for all. Hence, the study concluded that snail farmers should learn the skills in green technology that are applicable to snail farms for better production in a sustainable environment.*

**Keywords:** Hibernation, Sustainability, Congo Meat, Green Technology and Green Jobs.

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### Introduction

Snail is one of the micro-livestock animals domesticated by farmers especially for its healthy meat and other economic purposes. It is a nocturnal hermaphrodite with soft spiral body housed in a hard-calcareous shell and its farming is called Heliculture or snail farming. The meat, which is eaten as a delicacy among many people in different parts of the world (Umeh 2017), is called 'Escargot' and locally 'Congo Meat'. However, it is important that new or intending snail farmers should first study the wild snails in their environment or learn from local farmers and suppliers so as to have the first-hand idea about snail farming. Ekezie (2019) stated that snail farming is one of the vocational occupations, which implies that farmers should have knowledge and skill in its production in

order to make a success. This knowledge includes the requirements in space, housing, feed, protection from escape, environmental needs and maturation period of snails. Some species may take about six to eighteen months or more to mature. Hence the snail farmer needs some level of patience, as the snails grow in moist, humid, organic-matter-filled environments. Assan (2022) stated that snail is an invertebrate that is sourced locally and are reared at minimal costs. The feed resources are easily accessible and they have high reproductive rates. They are naturally found in tropical humid environments but can be grown in any clime as much as the environmental conditions are suitable and friendly. This means that when the conducive environment is altered, (dry soil, no shade and vegetative cover, poor feed

materials which may be synthetic, presence of predators and disease pathogens), snail productivity will be low. Moreover, the meat produced is healthy and rich in numerous nutrients: proteins, iron, vitamins, amino acids, yet low in cholesterol as identified by Umeh (2017) and Asuquo, Eka and Ekpo (2023). These natural environmental requirements of snail farming coupled with the healthy meat promotes environmental friendliness and safe health of humans, and are part of the goals and teachings of Green Technology.

Green Technology (GT) is an aspect of production process that emphasize environmental protection, conservation, sustainability and healthy co-existence of all. It is the greening of activities (healthier, friendlier, conserving and protecting) the environment from harm and damage. Kalaitzis, Bitá and Hilmi (2019) stated that the goals of GT are to prevent (destruction), reduce (resource use) and recapture (the wastes by recycling) on products, processes and systems that influence environmental and economic performance. This is to say that every production or process should be done with the aim of preserving and protecting natural resources and reducing negative impacts of man's activities on the environment. Okadi (2023) stated that the goal of GT is to ensure that production processes enhance healthy co-existence, environmental conservation that is sustainable and accessible to all. Proper awareness of the importance of reducing high gas emissions from production activities becomes imperative for sustainable environment as they are part of the major concern of Green Technology. Asuquo et al (2023) stated that new findings from science and technology are used to solve human and environmental problems (effects of climate change, desertification, flooding, volcanic eruptions and gas emissions). Some of these introductions that has improved production with minimal use of resources and carbon emission include vertical farming, composting, recycling, minimal or zero tillage,

automation of operations and practices, organic farming among others. Although snails grow naturally in environments devoid of synthetics, the additional efforts by the farmer to implements some of the green technology principles (tree planting, controlled environment, integrated farms, use of botanicals and proper feeding) has proved successful in both snail production and environmental conservation for sustainability.

Sustainability of resources ensures that production and use of natural resources are managed in such ways as to remain and be used by upcoming generations. It requires that activities (farming, construction, mining etc) be done with high efficiency and minimal use of resources, and if possible, reuse or recycle wastes so that such materials are used to the optimum. Hilmi Martin (2019) calls this green food value chain, where wastes from one production is used in another production process. In like manner, snails, by their nature, feed on wastes from kitchen and vegetation, love environments that are shaded, cool and devoid of synthetics. Asuquo et al (2023) opined that snails are environmentally friendly, with no pollution (no offensive smell) and help reduce carbon emission through the consumption of leftovers and over-ripe fruits. This recycling of materials is healthy and help to sustain lives, hence encouraging co-existence of bio-diversity. Hence, the application of some of the principles of green technology into snail farming will enhance healthy co-existence of organisms, minimal use of resources, environmental sustainability and production of nutritious food for all

### **Concept of Snail and its farming**

Snail is a soft-bodied micro-livestock housed in a calcareous spiral shell, of the phylum Mollusca and about the second largest of the animal kingdom (Umeh, 2017). They are nocturnal (move more at night), hermaphrodites (have both male and female reproductive organs) and

invertebrates. There are different types of snails which include land snail, fresh water snail and slugs, however, it is the land snail that is mainly eaten. In many localities in Nigeria and other countries, snail is picked from the wild, which is endangering their continued existence. Begs, (2003) stated that the Italian government has banned the collection of snails from the wild. The commonly farmed snails in Africa include the Giant African Land Snail (GALS) of the *Archatina* species: *Archatina marginata*, *Archatina achatina* and *Achatina fulica* among other smaller species. They are generally large, and according to Ogba and Ndem (2016), GALS is the largest land snail. It grows naturally in the rain forest areas, under natural environments in many parts of Nigeria and other countries. They hate harsh environment that leads to their death. Snail farming involves identifying the right type of species, and managing them in the right environment for breeding to ensure good growth and productivity, with the products such as meat, slime and shell used for various purposes. Some of the uses include as a delicacy in menu, industrially in pharmaceutical, cosmetics firms, works of art and other uses. The business of snail farming can be financially rewarding and environmentally friendly, however, the farmer has to identify the breeds to grow, create adequate environment for them, create proper barrier from escape, provide the right feed and ensure cool and shaded niche.

### Requirements in Snail Production

There are several needs and requirements in snail farming and production. Some of these are land requirement and soil type, provision of shade, suitable feedstuff, selection of good breeding stock, proper screening of the snail farm against escape, housing and protection against harsh weather among others. These requirements may not be extensive; however, they need to be adequately provided to ensure maximum production.

### Land and Soil Requirement

Land requirement depends on the size of farm intended, and may not be a major issue if the farmer wants to practice for family use. For a small subsistence snail farm, a 50m x 50m<sup>2</sup> land may be bought or rented. Appropriate fencing, good water source and vegetation are important considerations. The soil conditions should not be clay or sand, low land, windy or flooded, but loam that has good vegetative cover in a shaded place (FAO, 1986). The area should not be prone to frequent fluctuations in weather factors as it could lead to loss of growing time as the snails tend to hibernate, thereby becoming unproductive. Tree planting is highly recommended (improved fast-growing species) as it provides the needed shade to regulate weather changes. Also, food crops with tender leaves (amaranthus, lettuce, cabbage, melon) can be integrated (planted) to provide shade, food and hiding places for snails. The pens should be well constructed and all forms of openings closed to avoid escape of snails. Ogba and Ndem (2016) stated that snails prefer environments that are dark and cool, with good shade trees and away from harsh weather. Tree planting is one of the key factors for environmental sustainability and conservation as it purifies the environment of CO<sub>2</sub>, generates O<sub>2</sub> and also provides different fruits and seeds for man and animals. In terms of soil conditions, loam soils with abundant vegetative cover that is rich in organic matter, minerals such as nitrogen, phosphorus and potassium and moist to enable them burrow and hide during the day. Begs (2003) stated that snails prefer soils with a pH of about 5.8 – 7.5, calcium content of three to four percent, light and friable. Well managed snail farms encourage the growth and proliferation of other beneficial soil organisms thereby enhancing conservation.

### Choice of Breeding Stock

The quality of foundation stock of snail is very important to the success of the enterprise. Hence, breeding stock should be bought from known farms (commercial and or neighboring snail farms). The snails should be healthy, unbroken strong shells and without any signs of weakness. They should be of same species and age-range for uniform growth that minimizes cannibalism. Also grow snails that are big, of economic value and commonly grown and eaten in the area. Commonly grown types, according to Umeh (2017), Ogbonna (2018) & Asuquo et al (2023) include *Archachatina marginata*, *Achatina achatina* and *Archatina fulica*, due to their large size and quality meat. Many people rear the *A. marginata* especially in the Eastern part of Nigeria due mainly to its large size and high level of acceptance by consumers.

### Housing, Equipment/Tools /Materials

Snail rearing can be carried out as intensive or semi-intensive systems. Ogbonna (2018) and Asuquo et al (2023) stated that snails can be reared intensively or semi-intensively in constructed pens, cages, cement-block enclosures, green house, and integrated with other crops. The intensive system requires that everything needed by snail is provided (feed, water, shade and all attention) and may be in integrated, green house or cages and cement-block enclosures. Some housing structures used in subsistent farms include hutches, plastic baskets, old vehicle tyres, boxes and even vertically cut plastic or iron drums and basins. Some equipment includes strong wire gauze and nettings, woven plant materials, iron/ wooden posts and ropes to protect the snails from escaping, woven baskets, containers of different sizes and shapes, feeders and drinkers, cutlasses and hoes. Equally, a small store may be built at one corner of the plot for safe-keeping of equipment, feed and other items of the farm. Adequate provision should be made for water:

containers such as rubber drums, watering pump or knapsack sprayer, hose and water basins among others. In the semi-intensive system, provision is made for snails will stay during the inclement weather, but allowed to move about within the enclosure. In such semi-intensive farms, they are mostly fed with wastes and vegetation. The soil should be moistened if there is no rain to avoid hibernation. In the case of integrated farms, snail may be grown along with other crops and animals. The crops may include plantain, banana, vegetables such as cabbage, fluted pumpkin, melon; while the animals may include poultry and fish pond depending on available funds, labor and skills. Where resources are available, recycling, reuse and resource reduction. Equally, there is minimal carbon emission, one of the goals of green technology.

### Feeding

Snails can be fed on compounded feeds, but majorly on wastes that are devoid of salt, waxy or hairy materials and non-toxic. Some of such materials include kitchen left-overs, remains of harvested farm produce, by-products from abattoirs, fruits, tubers and green vegetation. The abattoir wastes include bones, hooves and horns that contain beneficial minerals (calcium, phosphorus) are processed into bone meal and used as additives in formulated feeds. However, these wastes, which would have constituted pollutants in the environment, are recycled and reused in snail farming. This is advocated by the principles of green technology, as there is minimal carbon emission in snail farms. Recent research findings in snail feeding indicate that drying and powdering leaves of pawpaw, water leaf, cocoyam, okro and eggplant and combining with compounded snail feed improved growth performance (Ogbonna, 2018).

### Health Management

It is one thing to get the best breeds, house them well, adequately feed; however,

the health status is very important for good productivity. Good health can be achieved through starting with healthy foundation stock, ensuring proper sanitation of the environment and clearing neighboring bushes to rid the environment of pests and pathogens. Always check the snails and isolate weak or dead ones, those crawling out should be brought back and provided with good feed and water *ad libitum*. All sides of the pen/cage/greenhouse/integrated farm should be screened with nylon so that pests and parasites do not find way into the snailry. Proper management will prevent all forms of bacterial and fungal infections. Some medicinal plants like ginger, scent leaves and others can be included as vegetation in the farm.

### **Hatching the Eggs and Growing the Young**

For continuity and sustainability in snail farming, there is need for procreation of the young through hatching the eggs and growing them. Snails are highly prolific, laying many eggs several times in a year (Asuquo et al, 2023). Hence the farmer should learn the art of collecting the eggs, incubate, hatch and grow them to maturity. Juveniles can also be bought and grown to table size. Collect healthy eggs from the 'points of lay' and breeders, place the eggs in improvised hatchery (large-sized plastic take-away) plates. Fill the plastic plate with earth to about two thirds, arrange the eggs on the soil and cover it slightly with saw dust/leaf litter. Sprinkle water on it from time to time for optimal condition and place under good shade for the eggs to hatch. The young snails start crawling out of the shells from about the 30<sup>th</sup> day of incubating. With appropriate care and feeding, maturity for GALS can start from 6 months upwards. Hatching and growing the young snails is part of what green technology calls inter-generational equity, ensuring re-growing or renewing and not allowing for extinction of any resource. Harvesting the immature snails from the wild for consumption should be discouraged by all. As suggested

by the Nigerian Livestock Roadmap (2022), institutions and corporate bodies should encourage snail farmers by providing facilities, good breeding stock and other inputs for sustainable snail production to meet up with demand.

### **Marketing/Sales of Produce**

Although it is always said that there is ready market for snails and their by-products, the farmer, however, should locate the most appropriate market for products within and outside his locality. Some of these places may include hotels, private homes and government agencies and crop farmers (offal) and industries (shell). Also, as the enterprise grows, a small farm-fresh shop can be strategically located in the town for freshly processed and frozen snail as well as at farm-gate prizes. The snail not only recycles wastes from other sources, its own wastes and by-products are re-cycled and reused by humans into very many beneficial works of art and beauty. The shell is a good source of calcium and phosphorus; hence broken ones are used as components of commercial feed additives while the big strong shells are designed by artists into article articles for beautifying environments. These artistically designed shells are of high market value in many parts of the world (Ogba and Ndem, 2016). The slime from snail is an industrial raw material used in the production of different cosmetics and products that reduce wrinkles, scars, dry skin and acne. The farmer, therefore needs to learn the art and practice of harnessing them for increased income and profit.

### **Challenges in Snail Farming**

Just as it applies in every enterprise, snail farming has its share of challenges in production and processing. Some of these include inadequate finance, poor research and inadequate dissemination of innovations in snail farming, inadequate improved breeding stock, poor soil conditions. Others include traditional beliefs and stigma in some quarters that

snail are sluggish, hence people who consume them may likewise act in that way. In addition, Ogogo and Mmaduabuchi (2014), identified some other challenges to include poor environments such as waterlogged soils, frequent fluctuation of weather factors, inadequate skills and poor infrastructural development in snail farming. The farmer should ensure that these things are properly managed for better production. With sustainability and conservation of species in mind, the farmer can attend trainings and workshops and ensure proper linkages and collaborations with other stakeholders. Snail farming is lucrative and has good rewards to diligent farmers. In addition, it ensures conservation and sustainability of resources and environmental friendliness which are some of the goals of green technology.

### **Justification for snail farming**

Snail farming in Nigeria should be encouraged due to a number of reasons that include relatively low start-up capital, good nutritious product, environmental health and species conservation, reduction of carbon gas emission and recycling of waste into useful products. These are briefly discussed.

Snail farming is an enterprise that has minimal start-off capital, hence can be engaged by many persons who have interest and can learn the required skills. Hence, with minimal capital investment, good income and profit can be attained under proper management. Profit of as much as 80% to 100% has been made from one production cycle as reported by Afolabi (2013) among Ondo State snail farmers. This can be earned twice a year since production cycle is about six months' interval; in foreign currency and naira since the meat is of international value. Moreover, the local demand for snail meat, according to the Nigerian Livestock Roadmap 2022), is projected about 7.5 million tons annually, which the present rate of production cannot met, thereby creating room for expansion and an

encouragement for more people to take up snail farming as an additional source of income.

Health is wealth. The healthy white meat of snail has no side effects on consumers, thereby improving human health. Snail meat, according to Ogbonna (2018) has higher protein content (35-51%) when compared with that of pig (20.3%), poultry (18.3%), fish (18%), cattle (17.5%) and sheep (14.5%) and equally rich in minerals such as calcium, phosphorus and iron which are helpful to human health. Snail meat is good for all, irrespective of age or gender of consumers. Due to the increased awareness of the therapeutic benefits of snail meat to human health, Wyness (2016), reported that the consumption rate has increased, hence the higher price offered for it. In addition, snail farming can be done either indoors or outside depending on available space and scale of production. This gives room for both rural and urban dwellers to participate in the enterprise.

Snails convert production wastes and kitchen leftovers into other useful material through recycling and reuse. This activity by snails reduces natural resource use and emission of carbon gas that would have would have polluted the environment. Plant extracts, rather than synthetics (pesticides and herbicides) should be used as pest control. Furthermore, their burrowing activities coupled with the rich organic matter of their feces helps in creating conducive environment for healthy bio-diversity.

Another justification for snail farming is that the skills needed for production and processing is minimal, hence can be easily learnt and used by all irrespective of educational qualification, age or gender. Snail farming, therefore can be taken-up by the young and old, males or female, retirees, and especially the youth as a form of employment. With skilled manpower and desire to take it up as an income-generating enterprise, employment will be created, collection from the wild of

immature snails will be minimized and natural resource use will be reduced. The Nigerian Livestock Roadmap (2022) has called for urgent measures to protect the wild snail in order to avoid their extinction.

### Conclusion

This paper discussed some of the basic requirements of snails in their natural environment which are, co-incidentally, integral parts of the principles of Green Technology. Some of these include their love for natural environment (moist, cool and shaded), efficient converters of kitchen and vegetative wastes into healthy and nutritious meat, their droppings/feces which is rich in soil nutrients encourage the growth of bio-diversity and does not emit carbon gases. When snails are reared in well-built integrated farms or in greenhouses, the diversity of plants and animals makes the environment friendly and sustainably. Snails' sensitivity to acidic, flooded, dry lands and other harsh environment helps the farmer to create friendly niche that is sustainable in nature. All these encourage conservation of the soil and sustainability of natural resources. Both the requirements of snail farming and some of the principles of green technology (GT) ensures environmental friendliness and sustainability, proper waste recycling, good health concerns and minimal or non-emission of green-house gases.

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