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Snail production system in Fako Division, South West Region-Cameroon

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Abstract

To explain the reasons for snail increasing production in Cameroon, their socioeconomic status, production system, management practices and production constraints were studied. Thus, 40 snail farmers were randomly selected from five subdivisions (16 from Buea, 12 from Limbe II, 8 from Muyuka, 2 from Limbe I and 2 from Tiko) in the study area. Snail rearing is predominated by females (57.69%). They are adults aged between 20 to above 61 years old, married (90.71%), all belonging to one religion, Christianity and had at least primary education. These farmers were either involved in livestock (51.83%) or crop farming (48.17) as main agricultural activity and are principally Bakweri (39.04%). Snails are mostly reared for the market and self-consumption (58.97%). Animals are mostly sold on the farm (83.33%) primarily during the dry season of the year for various reasons. The annual contribution of snail husbandry per household is 100000-150000 CFAF per year (200-300 USD). In the technical aspect, various housing type are applied with majority being trench pens (45.87%), the major species of snails reared was *Archachatina marginata*, reared by 92.69% under the semi intensive production system (98.00%). Few (35.63%) of the farmers are trained in snail farming. The most commonly used feeds is natural feed (leaves, fruits and tubers) and household waste. Concentrate supply (5.87%) is the main form of supplementation, and to a lesser extend calcium (1.14%) is use. A larger proportion (40.56%) of the farmers fed their animals on a daily basis and particularly in the morning (36.60%).Many (54.52%) did not serve water to their snails but those who did served, watered their animals on a daily basis (16.03%) as well. The major challenges faced by

the snail farmers were; pest attack, predators, lack of techniques, lack of funds, lack of feeds, lack of water, lack of animal supply, slow growth rate and climate change. However, farmers wish to continue with the activity. Thus more people are encouraged to engage in snail farming as it contributes much to the family welfare.

I. Introduction

International trade in snails is flourishing in Europe and North America(Cobbinah *et al* 2008). However, they investigated that in spite of the considerable foreign and local demand, commercial snail farms such as those in Europe, South-East Asia and the Americas hardly exist in Africa. Snail meat is an excellent source of animal protein in many parts of West and Central Africa (Blay *et al* 2004), with protein content (20.7 %) higher than that of conventional food animals (Malik *et al* 2011). Baba and Adeleke (2006) reported that snails have good quality protein and are rich in potassium, phosphorus, essential amino acid and vitamins B and C. The meat is also rich in iron (Okpeze2007) and low in fat (Cobbinah *et al* 2008). Apart from its excellent nutritional value, snail meat has also been reported to be of good medicinal value. The low content of fat (1.3%) and low cholesterol level make snail meat a good antidote for vascular diseases such as heart attack, cardiac arrest, Hypertension, stroke, high blood pressure and other fat related ailments (Akannusi 2002), which are common in the tropics. As the African population is increasingly interested in healthier living and low-cholesterol diets, snails will become a popular alternative to all the fatty and non-healthy meats that have taken in hostages our markets nowadays (AU 2016). In Ghana, the bluish liquid obtained when the flesh is removed from the shell is believed to be good for infant development and a recent study has also shown that the glandular substances in edible snail meat cause agglutination of certain bacteria, which could be of value in fighting a variety of ailments, including whooping cough (Cobbinah *etal* 2008). The curative substance extracted from the snail, ortho calcium phosphate is claimed to cure kidney disease; improve constipation and hemorrhoids; prevent influenza; restore vitality and virility; perpetuate beauty and clears the skin and have been recommended for those who sing and those in need of hormonal injections (Ogogo 2008).

In West Africa, snails dwell mainly in humid forest regions where they are traditionally gathered by rural folks, usually from damp places under leaves, trees, stumps and stones during the rainy season for sale and domestic consumption (Ngenwi *et al* 2010). However, there is a considerable decline in the population of snails in the wild as a result of human and other anthropogenic factors such as use of agrochemicals, deforestation for urban development, burning and clearing for agricultural purposes and collection of immature snails by the farmers/dwellers of the rainforest belt (Cobbinah *etal*2008). The bulk of snails sold in African markets (including Cameroon) are procured from the wild, which makes it difficult for the sellers to meet up with the demand. Consequently, the price of snail increases particularly during dry season (Ogogo *etal* 2011).

Recent changes in climatic conditions have resulted in an increase in outdoor temperature in most countries of the world including West Africa and a reduction in the duration of the rainy season. This has consequently led to a reduction in the population of snail species in the wild (Ngenwi *etal* 2010). This steady decline has led rural folks to scout for longer periods in search of snails, leadingto indiscriminate collection of immature snails in an attempt not to come back empty (Chah and Inegbedion 2012). Given a fast diminishing population of wild snails and a fast growing demand for snail meat, the opportunity to create wealth from snail farming is increasing in both the developed and the less developed countries.

The aforementioned factors and practices are not favorable to snail growth and development (IPCC 2007). Domestication and intensive management of the edible land snail is therefore inevitable. It was on this basis that Achatiniculture which involves manipulation of the environment to make it suitable for a large scale and all season production of wholesome and desired species of snails was introduced.

It is in view of this that this study examined the snail production system in Fakosub-division of Cameroon. The study specifically examined the social, technical and economic characteristics of snail producers, estimated the cost and returns in snail production and examined the factors affecting snail improvement in the study area.

II. Methodology

Study Area

Study were carry out between February to March 2018 in Fako Division, located in the South West Region of Cameroon and is situated at the foot of mount Cameroon (Figure 1). It covers a surface area of 2093km^2 and an average altitude of 2833m. It is the most thickly populated division with a population of about 534854.Temperatures is about 26.4^{o}C around the coast area.

Sampling Technique

Fako sub-division(forest bimodal rainful agro-ecological area) was purposively selected from the 5 agro-ecological zones of the state for the study. This choice was made because of the dominance of snail production in the zone. A random sampling technique was applied to select 40 farmers in the following sub division; Buea (16), Limbe II (12), Muyuka (8), Limbe I (2) and Tiko (2). The main information was based on the age, sex, religion, level of education, marital status, mode of acquisition of animals, labour, income per year, objectives, constraints and perspectives. Technical data concerned animal size (herd), housing, feeding and farming system. Snow balling sampling technique which involves the establishment of personal contact with the respondents to build up the required sample was used to identify the snail farmers one after the other in these blocks. This was done with the assistance of extension agents.

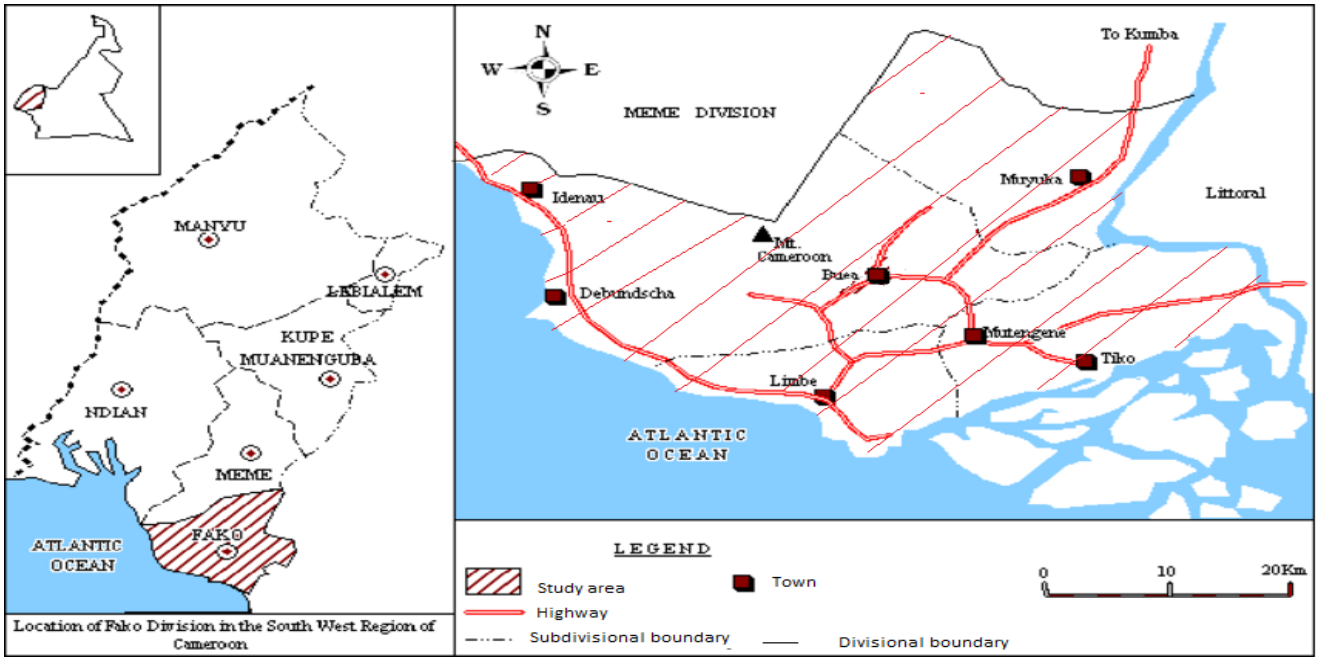

Figure 1: Map of Fako Division with Subdivisions indicated
Source: Enp and Fombe 2016

Validity and Reliability of Questionnaire

The validity of the questionnaire was tested using content validity, the questionnaire was adjudged 'satisfied' by professional in the field of Agricultural Economics. Reliability of the instrument was tested using the test-retest technique.

III. Data analysis

The analytical technique employed is descriptive statistics, such as frequency counts, percentage and mean was used to measure socio-economic characteristics of the respondents. These calculations were carried out thanks to Microsoft Excel 2013 and SPSS (*Statistical Package for Social Sciences*) software version 20.0.

IV. Results and discussion

Social characteristics of snail farming

As revealed by table 1, the majority of the farmers were between 41 and 60 years of age with an average of 66.90%.This finding is in tandem with those of Chah and Inegbedion (2012) who reported that in Edo State, Nigeria, the age group 41 to 60 years is the majority (91.1%). Snail farming requires little labour with no strenuous physical exertion (Goodman 2008), and this may explain why majority of the snail farmers were above 40 years of age(Mbolle and Inegbedion 2013).Contrary to this findings,Ahmadu and Ojogho (2012) study reveals that respondents were relatively young (39 years) in Edo State of Nigeria.

Except Muyuka and Limbé II with 25 and 22% respectively,snail farmers in study area were predominantly females (average 57.69%). This can be explained by the fact that, snail farming requires little labor with no strenuous physical exertion (Goodman 2008), and this may explain why majority of the snail farmers were females. This study agrees with the observation of Ngenwi *etal* (2010) who found that snail farming in Volta and Great Accra, Ghana, and Southwest Region, Cameroon, was predominantly in the hands of female farmers (60%). This work, however, contrast with the findings of Raheem (2001), Obinaju *etal* (2016) and Obisesan (2002) who revealed that 76%, 63.3% and 87.2% of the snail farmers are males in Oyo state, Akwa Ibom State and in South Western part of Nigeria accordingly.

No matter the locality, farmers were married with an average of 90.71%. This can be associated to the fact that income generation is more essential to married than single people. This study is in line with findings by Chah and Inegbedion (2012) and Ogunniyi (2009) who reported that 96.7% and 75.5% of the respondents were married in Edo State and Oyo state respectively. All those married were engaged in a monogamous marriage (100%).

It appears on Table 1 that of all five subdivisions, only Buea registered farmers (17%) with household size between 11-15. A greater proportion of the respondent had a household size of 1-5 with an average of 54.44%, 42.22% had household size 6-10 while remaining 3.33% had 11-15 respectively. This might be explained with the fact that all those married are monogamy. Also due to family planning agents in the hospitals and health centers and of the fact that they are well educated because of the University of Buea found in the study area.

Table 1: Distribution of snail farmers according to age group, sex, marital status and number of children or dependents

Social characteristics	Percentage of respondents per Subdivision					Average (%)
	Limbe II	Buea	Muyuka	Limbe I	Tiko	
Age group						
20 to 40	11	36	25	50	0	24.37
41 to 60	67	43	75	50	100	66.90
>61	22	21	0	0	0	8.73
Sex						
Male	22	64	25	50	50	42.30
Female	78	36	75	50	50	57.69
Marital status						
Married	100	79	75	100	100	90.71
Not married	0	21	25	0	0	9.28
Monogamy	100	100	100	100	100	100.00
Household size						
1 to 5	56	42	25	100	50	54.44
6 to 10	44	42	75	0	50	42.22
11 to 15	0	17	0	0	0	3.33
Educational level						
Primary	11	29	25	50	50	33
Secondary	33	14	50	0	50	30
Higher	56	57	25	50	0	38

Care for animals Male Female Male, Female	22	36	0	50	0	21.59
	11	29	25	50	0	22.94
	67	36	75	0	100	55.47
Type of labor Family Hired	89	100	100	100	100	97.78
	11	0	0	0	0	2.22

Two types of labor were registered; family and hired. Only Limbe II recorded respondent who hired labor (2.22%) of all the five subdivisions. Hence on average, a greater proportion of the respondent used family labor with a percentage of 97.78. This implies that majority of the snail farmers are still practicing on a small scale. This agrees with those of Ogunniyi (2009) who observed that all the farmers in Oyo State, Nigeria used family.

All farmers have had formal education in all sub-divisions as seen on table 1. A greater proportion had attended high school as illustrated. These high literacy levels make city dwellers ready to take risks, and are therefore early adopters of new technologies. This finding is similar to those of Ezeano (2016) and Ogogo *etal* (2010) who observed that a majority of snail farmers attended higher institutions, 52.8% and 71.2% in Enugu State and Cross River State in Nigeria respectively.

As shown on figure 2, Limbe I recorded the highest number of famers who were involved in livestock with 100%, second by Limbe II with 56% and the least from Muyuka (25%). On the contrary, Muyuka occupied the first position when it comes to crop production with 75%, followed by Buea with 71%. This may be due to the fact that Limbe I and II are located along the coast while Muyuka and Buea are the hinterlands with more land allocated to crop production. On average, a larger proportion of the respondent (52%) were involved in livestock business unlike 48% for crop farming. This might be because most of the farms were found in urban area with little land available for crop farming.

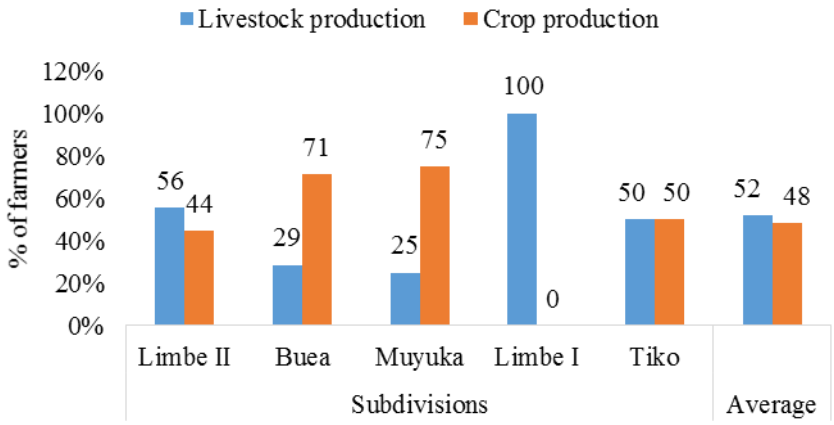

Figure 2: Distribution of snail famers according to main agricultural activities

Religion, experience and occupation of snail farmers in Fako division

All the respondents in the study area were (Table 2) Christians in line with Ogogo *etal* (2010) that observed 100% of the snail farmers in Cross River State, Nigeria were Christians. This might be because the area of studies is dominated by christians and also because of some cultural and religious restrictions to handling or eating snails (Cobbinah *et al* 2008).

Moreover, this farmers had at least one year of experience. Among the five subdivisions, Limbe II and Buea registered 33% and 7% of respondents had experience between 6 and 10 years correspondingly. This means

snail farming is still a new venture in the zone of study. This finding is similar to that of Ezeano (2016)who revealed that about 51.7% of the respondents had 1–5years of experience in snail farming in Enugu State.
Different economic activities practiced in the division which includes fishing, food processing, timber extraction, market gardening, oil refining, quarrying and tourism that attracts people to the area reason why occupations are dominated by these activities.

Table 2: Distribution of snail farmers according to religion, experience, occupation and ethnic group

Social characteristics	Percentage of respondents per Subdivision					Average (%)
	Limbe II	Buea	Muyuka	Limbe I	Tiko	
Religion						
Christianity	100	100	100	100	100	100
Experience in snail farming						
0 to 5	67	93	100	100	100	91.90
6 to 10	33	7	0	0	0	8.09
Occupation						
Trading	33	14	25	0	50	24.52
Civil service	33	35	25	0	0	18.52
Student	0	21	0	0	0	4.00
Diverse	33	29	50	100	50	52.38

Economic characteristics of snail farming

The result presented in Table 3 shows that only farmers in Limbe II hired labor (11%) for 5000FCFA per month. Therefore a majority (97.78%) of the respondents spent no franc on labor. This confirm that snail farming is a low-cost operation. Still it appears that a larger proportion of the famers with an average 75.48% spent no franc in buying feed or food items only 2.22% spent 5000FCFA per month. This is explained by the fact that a majority (55.24%) of the respondents cultivate and beg food items (Table 3). It can also be because the famers are not aware of compounded feed and lack of formula. This work is in line with that of Ogunniyi (2009) and Ahmadu and Ojogho (2012) who observed that snail farming is less capital demanding, entails low cost of production.

Table 3: Repartition of farmers according to expenditure

Economic characteristics	Percentage of respondents per Subdivision					Average (%)
	LimbeII	Buea	Muyuka	Limbe I	Tiko	
Cost of work force per month (FCFA)						
5000	11	0	0	0	0	2.22
No cost	89	100	100	100	100	97.78
Cost of nutrition per month (FCFA)						
1500	0	0	25	0	0	5.00
2000	11	14	0	0	0	5.08
3000	11	0	0	50	0	12.22
5000	11	0	0	0	0	2.22
No cost	67	86	75	50	100	75.48
Acquisition of food items						
Cultivate	11	36	25	0	0	14.37
Cultivate and beg	33	43	50	50	100	55.24
Cultivate, beg and buy	44	0	0	0	0	8.89
Cultivate and buy	0	21	0	50	0	14.29
Beg and buy	11	0	25	0	0	7.22

Uses of snails, slime and shells

The entries of Table 4 shows that majority (58.97 %) of the respondents were involved in snail farming for sale and home consumption. Thus, snail farming is to generate income as well as to provide a source of animal protein for the family. This finding is in tandem with those of Chah and Inegbedion (2012) who reported that a majority (75.9%) of the snail farmers were involved in snail farming for sale and home consumption.

However, on average, a larger proportion (74.29%) of the fluid is discarded, 15.00% used it in cosmetics while 10.71% considered it to be medicinal (to stop bleeding from cuts). This finding is supported by that of Onuigbo (2015) who reported that the bluish fluid is used to stop bleeding from cuts, healing of amputated fingers, treatment of eye problem and suppression of small pox.

Majority (92.78%) of the famers discard the shells while only 7.22% of them make use of it as an ingredient in feed. This implies that snail farmers steel ignore other utilization form of snail shells.

Table 4: Distribution of snail farmers according to the fate of snail farming products

Economic characteristics	Percentage of respondents per Subdivision					Average (%)
	Limbe II	Buea	Muyuka	Limbe I	Tiko	
Fate of snails/meat						
Sale	11	7	0	0	0	3.65
Home consumption	22	14	0	0	0	7.30
Sale and home consumption	56	64	25	50	100	58.97
Home consumption and gift	11	0	0	0	0	2.22
All above	0	0	75	50	0	25.00
Home consumption and research	0	14	0	0	0	2.86
Fate of slime						
Use to stop bleeding from cuts	0	29	25	0	0	10.71
Use in cosmetics	0	0	25	50	0	15.00
Discarded	100	71	50	50	100	74.29
Fate of shells						
Used in poultry feed	11	0	25	0	0	7.22
Discarded	89	100	75	100	100	92.78

Annual quantity sold

Live snails are sold in buckets of 15l (photo 1) in the study area with the price ranging from about 4000 CFAF in the rainy season to about 15000CFAF in the dry season.

Photo 1: Selling snails on the farm in 15l bucket.

Globally, a majority (25.16%) of snail farmers sold 11-15 buckets annually while only 1.14% sold >20 buckets yearly. In other hand, the snail are sold mostly without any processing (85.48%). Reason for selling period it is the price.

Table 5: Distribution of snail farmers according to annual quantity sold and period of sales

Economic characteristics	Percentage of respondents per Subdivision					Average (%)
	Limbe II	Buea	Muyuka	Limbe I	Tiko	
Quantity sold(buckets) annually						
1 to 5						
6 to 10	22	14	25	50	0	22.30
11 to 15	0	0	50	0	50	20.00
16 to 20	22	29	25	0	50	25.16
>20	22	21	0	50	0	18.73
None	0	7	0	0	0	1.14
	33	29	0	0	0	12.38
Processed						
Yes	33	14	25	0	0	14.52
No	67	86	75	100	100	85.48
Reason for period of sales						
Increase in price	56	36	75	50	50	53.25
When requested	11	7	25	0	50	18.65
To avoid massive loss during the dry season	0	0	0	50	0	10.00
When in need of money	0	14	0	0	0	3.00
When they reach the market size	0	14	0	0	0	3.00
No reason						
	33	29	0	0	0	12.00

Majority of the respondents (60%) sold their animals during the dry season, 24% in both seasons and 16% had no idea of what time of the year they do the most sales (figure 3). Many explained that they sell during the dry season because of high prices (53.25%) and also to avoid massive loss (10.00%) as conditions become unfavorable especially temperature and humidity (Table 6). This result is in line with those of Ogogo *etal.* (2011) observed in Akwa Ibom State, Nigeria that the price of snail increases particularly during dry season.

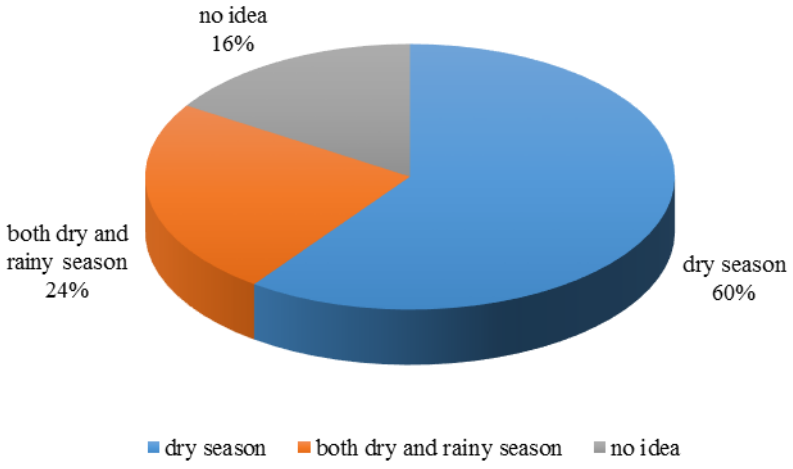

Figure 3: Distribution of farmers according to period of sale of snails

Form of sale of products

Snail farmers sold their produce either alive (fresh), frozen or smoked. Tiko (100%) and Limbe I (50%) famers sold their animals alive contrary to Buea (86%) and Muyuka (75%) farmers who sold it frozen and Muyuka (25%) and Limbe II (22%) farmers sold snail meat smoked. Majority (55.48%) of the respondents sold snail meat frozen, 32.22% fresh and 12.30% smoked (figure 4). This implies that most of the farmers do shelling,

washing and conserve the meat to be delivered to their customers. They might also smoke or conserve the snails for sale when prices are high. ENEDEP (2009) reported that snails can be smoked or stored for sale when prices are very high. They can equally be processed and canned.

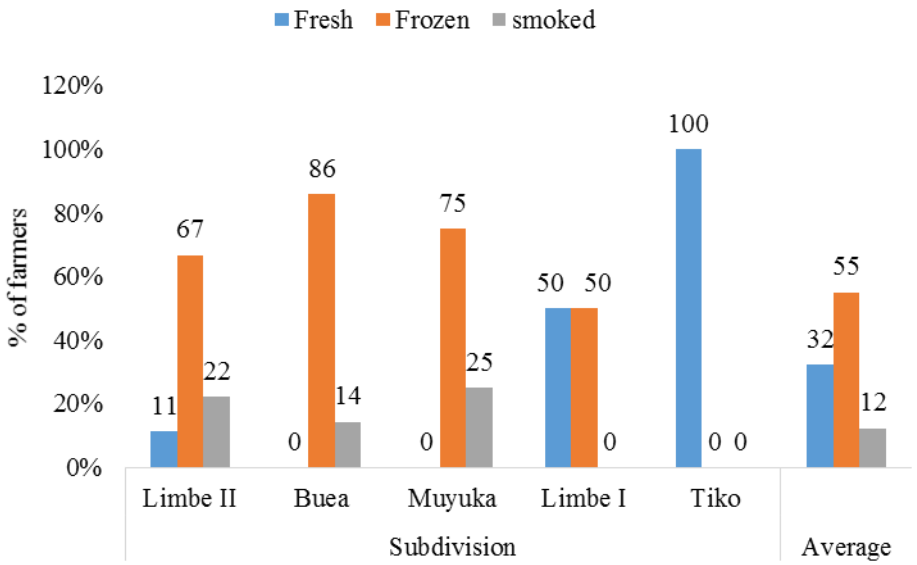

Figure 4: Distribution of snail farmers according to form of sales

Annual income, satisfaction and reasons

Entries of the above table 6 reveals that snail farming is an income generating business. A larger proportion (27.20%) of the farmers had an annual income of 100001-150000FCFA, 17.22% had an annual income of 50001-100000FCFA, 15.95% had an annual income of 150001-200000FCFA, 14.29% had an annual income of >200000FCFA, 12.20% had an annual income of <50000FCFA while 12.38% earn nothing. This is because these ones rear snails for home consumption and at times offer them as gifts to relatives. This result is in contrast to that of Ezeano (2016) who reported that a majority (43.1%) of snail farmers in Enugu State, Nigeria had an annual income of 48387.10-64516.13FCFA.

An average of 58.97% of the respondents said they are satisfied with this activity whereas 41.03% said they are not (Table 6). They are satisfied because of the following reasons; money making business (40.79%), low cost of production (7.94%), source of protein for the household (6.67%) and won many prizes at agro-pastoral shows (1.14) (Table 6). Not being satisfied is as a result of; mortality (15.08%), lack of managerial techniques (18.65%) and knows little about the activity (2.22%).

Table 7: Repartition of snail farmers according to place of sale and annual contribution

Economic characteristics	**Percentage of respondents per Subdivision**					**Average (%)**
	Limbe II	**Buea**	**Muyuka**	**Limbe I**	**Tiko**	
Annual income (FCFA)						
<50000	11	0	50	0	0	12.20
50001 to 100000	11	29	0	0	50	17.93
100001 to 150000	11	0	25	50	50	27.20
150001 to 200000	33	21	25	0	0	15.95
>200000	0	21	0	50	0	14.29
Nothing	33	29	0	0	0	12.38
Satisfied with activity						
Yes	56	64	25	100	50	58.97
No	44	36	75	0	50	41.03

Reason						
Source of protein and income	33	0	0	0	0	6.67
low cost of production	11	29	0	0	0	7.94
Money making business	11	43	0	100	50	40.79
Won many prizes at agro-pastoral shows	0	7	0	0	0	1.14
Know little about the activity	11	0	0	0	0	2.22
So many dead	11	14	50	0	0	15.08
Lack techniques	11	7	25	0	50	18.65
No reason	11	0	25	0	0	7.22

V. Constraints

The farmers identified so many challenges to snail production. Following table 8, pest was identified as the most important (34.60%),followed by lack of techniques (20.20%) and predator (13.40). Ndah *et al.* (2017) also reported pest attack and predator as one of the constraints to snail production in the South West Region of Cameroon respectively.

Table 8: Repartition of snail farmers according to constraints effecting snail production

	Percentage of respondents per Subdivision					**Average**
Constraints	**Limbe II**	**Buea**	**Muyuka**	**Limbe I**	**Tiko**	**(%)**
Predator	16	26	25	0	0	13.40
Pest attack	22	26	25	50	50	34.60
Lack of finance	11	14	0	0	0	5.00
Climate change	0	14	0	0	0	2.80
Lack of animal supply	0	10	25	0	0	7.00
Lack of techniques	26	0	25	50	0	20.20
No formulated feed to buy	10	0	0	0	50	12.00
Slow growth rate	15	10	0	0	0	5.00

VI. Conclusion

Based on the findings of the study on the socio-economic and zoo-technical characteristics of snail husbandry carried out in Fako Division, South West Region of Cameroon, it can be concluded that farmers were educated with at least primary education and were all Christians. Most of the sales are done on the farm with the period of sales being the dry season when prices are especially high (about 15000FCFA per 15l bocket). Snail farming is a profitable venture. The major challenges faced by the snail farmers were; pest attack, predators, lack of techniques, lack of funds, lack of feeds, lack of water, lack of animal supply, slow growth rate and climate change. The States Ministry of Agriculture and Rural Development, through its extension agents, should endeavor to enlighten snail farmers on appropriate ways to handle snail production.

VII. Acknowledgment

The extensions services of the Ministry of Agriculture and Rural Development of the Fako division and all the snails farmers for their availability.

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