Original Research Article

Evaluation of the performance of the production and marketing system of improved seedlings of fruit trees in Njombé-Penja

Abstract

The cultivation of fruit trees has a considerable socioeconomic impact in Cameroon which has led to a craze/keen interest around this value chain. The study analyzes the performance of the production and marketing system of improved seedlings of fruit trees in the locality of Njombé. Surveys were carried out among registered nurserymen (38) in the locality. The study shows that the production and marketing of fruit trees is an activity exclusively reserved for men. They are all married well educated with an average age of 35 and an average experience of 8 years. In the production units of avocado, lemon, mango, soursop, orange, and mandarin trees plants are the main species of the most produced fruit tree plants out of the 12 species demanded in the markets. The average annual supply of a nursery is around 27200 fruit tree seedlings for an overall supply estimated in 2020 at 638,450 seedlings to meet the increasingly growing demand in the locality. Due to competition between nurserymen, improved plants are sold between 1,000 and 2,000 CFA Francs depending on the age and size of the plant. The activity generates considerable income for the actors an average annual turnover of 39,252,961 CFA Francs and a net annual margin of 25,857,517 CFA Francs. Despite the profitability of the activity, the nurserymen face a certain number of constraints such as the scarcity of water, the lack of appropriate space, the insufficiency of financial means; the theft of seedlings, the lack of pre-established prices. Due to these constraints, the strong demand is not satisfied by the nurserymen established in this locality.

Keywords: Performance, production system, marketing, improved seedlings fruit trees, Njombé-Penja.

1. Introduction

The growing demand for fruits in the big cities of Cameroon (Temple 2001) as well as in certain neighboring countries such as Gabon Equatorial Guinea or Congo (Agristat 2004) has led to an increase in cultivated areas of fruit trees compared to cocoa and coffee of which prices have fallen considerably (Temple 2001). In developing countries, farmers are heavily dependent on trees which provide a wide variety of products such as tools, food, medicine,

firewood, and wood for construction. Generally, trees offer great socioeconomic and environmental potential for farmers (Laflèche 2017); this is particularly the case of fruit trees which play a very important role, especially in the economic, social, nutritional, and institutional sectors.

According to the C2D horticulture project (2013) the horticultural sectors in Cameroon face many difficulties; the country's horticultural production potential is appreciable but remains less flourishing than in some countries of West and East Africa. These constraints are agronomic, economic, infrastructural, and organizational. However, Wankeu et *al* (2019) revealed that one of the biggest problems linked to agroforestry techniques and in particular to the creation of orchards is the large-scale multiplication of trees. Plants naturally regenerate through seed propagation. However, for an intensive production of quality fruit trees, vegetative propagation offers many advantages. This is how in wild populations a wide range of important product properties can be expressed (fruit quality stiffness biomass etc.).

To overcome this problem, the State, within the framework of the `` Fruit " program of the Institute for Agricultural Research for Development (IRAD) has created some nurseries for the production of fruit plants in certain parts of the country (Yaoundé, Njombé, Foumbot, Kismatari). Due to financial difficulties, only the Njombé and Kismatari nurseries remained operational in 2011 (Dingues 2012*)*. In addition, the locality of Njombé-Penja (coastal region) has a strong potential for the cultivation of fruit trees due to its favorable climate and soils. This locality contributes a lot to the supply of improved seedlings of fruit trees and also represents a very large production basin for the latter. Due to the lack of statistical data on the supply of improved seedlings of fruit trees in rural areas, the objective of this study is to analyze the performance of the production and marketing system of improved seedlings of fruit trees in the locality of Njombé, Littoral region of Cameroon. The study will provide reliable and updated information on the potential offers of improved tree seedlings in this locality.

2. Methodology

The study took place in the Littoral region of Cameroon, more precisely in the Njombé-Penja subdivision. This choice is justified by the fact that this locality contributes a lot to the supply of improved seedlings of fruit trees and also represents a very large production basin of fruit trees (Nzouankeu 2015). It is an area with a favorable climate for fruit crops (IRAD 2017). Njombé's IRAD Polyvalent station through its fruit program has certainly greatly promoted the development of the activity in the area.

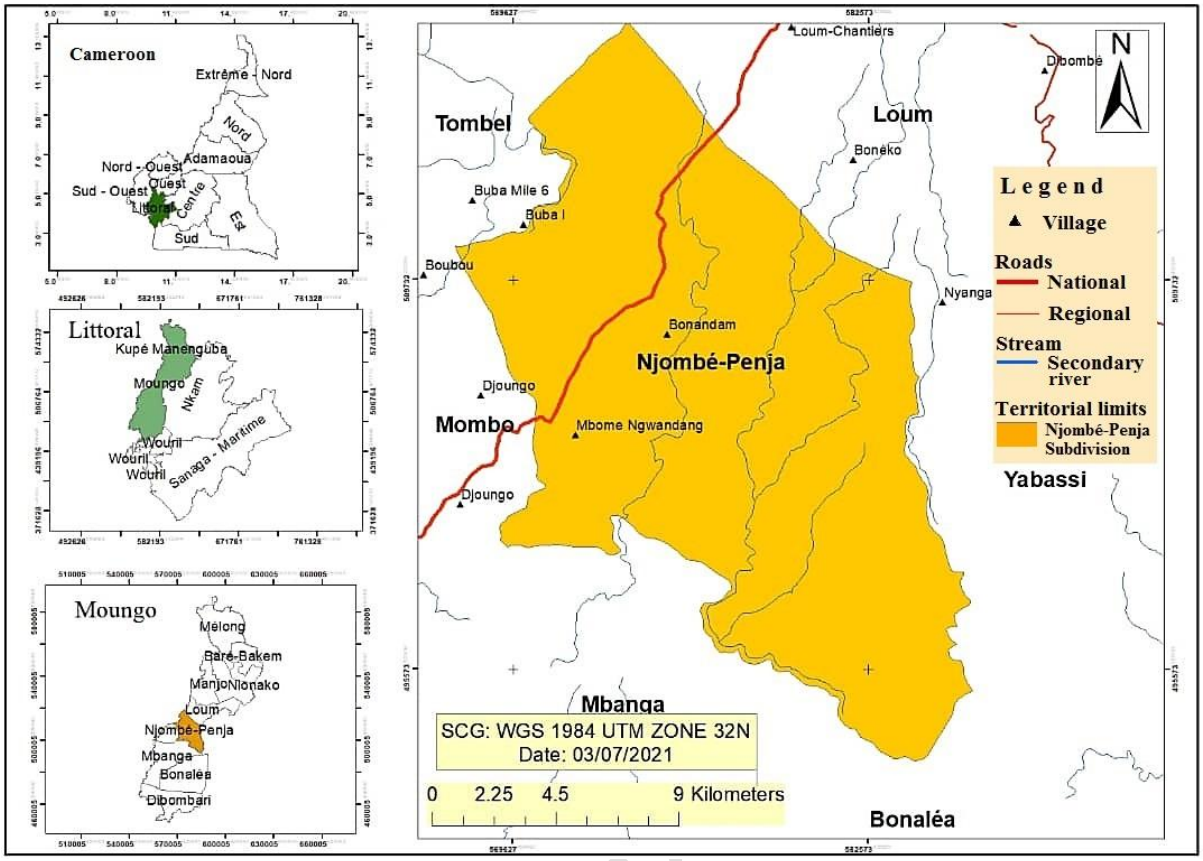

Figure 1. Location of the study area

Regarding sampling, this study looked at the link in the production and marketing of improved seedlings of fruit trees. The unit of analysis for this study is the individual nurseryman. An exhaustive investigation was carried out to complete this study. Indeed, a survey was carried out in the locality of Njombé - Penja to identify all the nurserymen of improved seedlings of fruit trees in the area. After what some individual interviews, through a structured questionnaire took place with 38 nurserymen. The nurserymen surveyed were mostly located along the national road N ° 5 between the Njombé crossroad and the Mboko Bridge on the way to Douala and a few in the quarters of Njombé and Penja. Subsequently, interviews were carried out with resource people: IRAD's researchers, Subdivision Delegate for Agriculture of Njombé - Penja. In addition, direct observations were made to complete the data collection.

The data collected mainly concerned the socioeconomic characteristics of nurserymen (age, sex, level of education, ethnicity, marital status, religion, main and secondary activity, years of experience); the types of species produced, production techniques, the charged prices, offers, plant production and marketing constraints and prospects.

Finally, the collected data was entered through the Microsoft EXCEL software and subsequently analyzed by the SPSS 20 software. As part of this study, descriptive analyzes

were carried out (frequencies, averages) which made it possible to obtain the results that we present below.

3. Results and discussion

1. Socio-economic characteristics of nurserymen

The socio-economic characteristics of the producers of improved seedlings of fruit trees which were retained in this study are sex, age, marital status, level of education, size of household and years of experience.

Table 1. Socio-economic characteristics of the nurserymen surveyed

Characteristics	Categories	Frequencies	Percentages (%)
Gender	Male	36	94.7
	Female	2	5.3
Age	[20-25]	1	2.7
	[26-30]	14	37.84
	[31-35]	6	16.22
	[36-40]	6	16.22
	[41-45]	6	16.22
	[46-50]	4	10.81
Marital status	Single	15	40.5
	Married	20	54.1
	Divorced	1	2.7
	Widower	1	2.7
Level of education	Primary	1	2.6
	Secondary	13	34.2
	Higher	24	63.2
Household size	[1-5]	10	35.71
	[6-10]	16	57.14
	[11-15]	2	7.14
Number of years of experience	[1-5]	18	47.37
	[6-10]	12	31.58
	[11-15]	1	2.63
	[16-20]	7	18.42

These results show that the majority (94.7%) of respondents are men against 5.3% who are women. The dominance of men in the production of seedlings of fruit trees can be explained by the fact that the activity requires a lot of physical effort and is therefore considered as a men's work. These results are contrary to those of Rutto *et al.* (2017) in their study in Kenya who concluded that men and women were equally represented as owners of nurseries.

It is important to note that the age of the respondents varies between 22 and 49 years with an average equal to 35 years old. However, the 28-year-old age group is the most represented with a percentage of 37.84%. From this result we see that the nurserymen surveyed are mostly young. This is justified by the fact that the population is constantly growing and increasingly young, without forgetting that the production activity of the plants requires endurance work and these young people have these capacities. In addition, more and more young people are looking for work since the State cannot hire everyone. These young people trained in these trades regenerate income-generating activities to solve their daily problems. These results are in agreement with those of Babalola (2018) in his study carried out in Ibadan which showed that nursery companies have significant potential to provide reliable employment opportunities for young graduates and others in society.

Most (54.1%) of the nurserymen surveyed were married and 40.5% were single. These results are similar to those of Traoré (2016) in his study carried out in Burkina Faso which showed that nurserymen are mostly married men and who practice this activity to improve their sources of incomes. The level of education of the surveyed shows that most nurserymen have a good level of education with 63.2% for higher education 34.2% for secondary and 2.6% for primary. The literacy level of the respondents gives them the ability to make reasoned choices with regard to inputs and even multiplication techniques. These results corroborate with those of Ephraim *et al* (2018) who also showed that the more educated the owner of the nursery are, the higher the production and the quality of the plants are because their training allows them to adopt new and modern innovations and increase their risk management capacity.

Overall, 57.15% of respondents have a household size of between 6 and 10 people, 35.71% between 1 and 5 people and 7.14% between 11 and 15 people. Regarding the number of years of experience in seedling production, it varies from 1 year (minimum) to 20 years (maximum) with an average of 8 years and a standard deviation of ± 6 years. However, the most represented age group is that between 1 to 5 years. This result can be justified by the setting up of the C2D-PAR-HORTICULTURE project 6 years ago (2014). This project has again boosted the production of improved seedlings of fruit trees in this locality and consequently

several young people have been trained through this project and have gained experience over time.

3.2. Typology of improved seedlings of produced fruit trees

Several types of improved fruit tree seedlings are produced in the locality of Njombé-Penja so the distribution of the nurserymen surveyed according to the produced seedlings highlights the species most produced by the nurserymen of the locality (Table 2).

Table 2. Inventory of improved seedlings of produced fruit trees

Type of plants produced	Scientific name	Workforce	Percentage (%)
Avocado seedlings	*Persea americana*	38	100.0
Lemon seedlings	*Citrus lemon*	36	94.7
Mango seedlings	*Mangifera indica*	35	92.1
Soursop seedlings	*Annona muricata*	34	89.5
Orange seedlings	*Citrus sinensis*	31	81.6
Mandarin seedlings	*Citrus reticulata*	29	76.3
Plum tree seedlings	*Dacryodes edulis*	25	65.8
Grapefruit seedlings	*Citrus maxima*	22	57.9
Guava seedlings	*Psidium guajava*	11	28.9
Mangosteen seedlings	*Garcinia mangostana*	11	28.9
Rambutan seedlings	*Nephelium lappaceum*	10	26.3
Passion fruit seedlings	*Passiflora edulis*	4	10.5

It emerges from this table that the seedlings of avocado *(Persea americana)* (100.0%), lemon (Citrus *lemon)* (94.7%), mango (Mangifera *indica)* (92.1%), soursop (Annona *muricata)* (89.5%), orange trees (Citrus *sinensis)* (81.6%), mandarin trees (Citrus *reticulata)* (76.3%) plum trees (Dacryodes *edulis)* (65.8%) and grapefruit (Citrus *maxima)* (57.9%) are the main species of fruit tree seedlings produced in the locality of Njombé-Penja. This can be justified by the fact that demand for these species is high on the market especially for avocado seedlings because these seedlings are produced by all the nurserymen surveyed and lemon trees. Indeed, the world of cosmetics is growing in the country, that is how find on the market essential oils made from avocado and other agricultural products; concerning lemons, they now play a major role in traditional medicine for the fight against the pandemic which has been raging in the world for more than a year already. These results are contrary to those of

Djiam et al. (2009) in the North region of Cameroon where the most produced species are *Adansonia digitata* (Baobab) Annona *squamosa* (Cinnamon apple) Balanite *aegytiaca* (Date palm) Citrus *sp* (Citrus) Mangifera *indica* (Mango tree) Psidium *guajava* (Guava) and *Tamarindus indica* (Tamarind).

3.3. Production mode of improved seedlings of fruit trees

3.3.1. Source of water supply, plant material and agricultural inputs

The different sources of supply of the main inputs (grafts, fruits to extract the seeds, fertilizers) make it possible to identify the different actors involved in the production process of improved seedlings.

Table 3. Distribution of respondents according to input supply sources

Characteristics	Workforce	Percentage (%)
Source of supply of plant material		
Market purchase	38	100.0
Own orchard	14	36.8
Other nurserymen	12	31.6
IRAD	12	31.6
Source of water supply		
River	32	84.2
Drilling	5	13.2
Camwater	1	26
Total	**38**	**100.0**

Nurserymen have several sources of supply of plant material and water; these sources depend on the type of plant material. The purchase of certain plant materials and fruit for the extraction of seeds and to germinate (100%) is done at the market. These markets are mainly located in the western region of Cameroon such as Mbouda and Koutaba market for avocados and Douala markets (Sandaga market, fruit market) mainly for citrus fruits. Other orchards 36.6% have plant materials in their orchards and these orchards represent the supply point for both fruits and grafts and others within the Institute of Agricultural Research for the Development (IRAD).

The river is the main source of water supply (84.2%); followed by drilling (13.2%) and CamWater (2.6%). This high percentage of the use of rivers as a source of water supply is due to the strong potential of the locality which as a minor watercourse has several particularly in

Penja (Misésélé, Bwankoutou, Nyela, EKouma) and in Njombé (Mbanga, Boko, Moumbé, Tondè, Mbomè) (PCD 2012).

3.3.2. Type of labor used

Labor represents the human contribution remunerated first on the basis of all time spent and effort, then on the basis of qualifications or experience and finally on the basis of social standards in force (minimum wage, system promotion etc.). This human contribution can be salary (temporarily or permanently) and family.

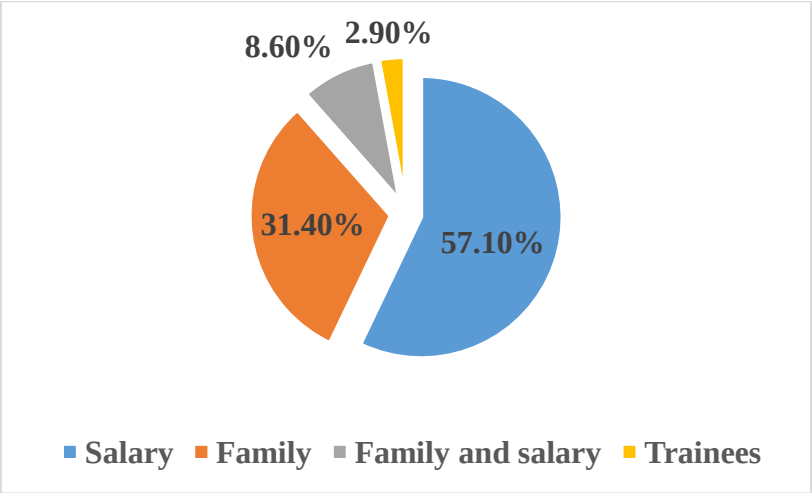

Figure 2. Distribution of respondents according to the type of workforce

According to figure 2, the labor used in the production units is mainly salaried (57.1%) then comes family labor (31.4%). In the field we also find an association between family and wage labor (8.6%) and also a portion of nurserymen who use trainees (2.9%) as labor. This higher percentage of the paid workforce can be explained by the nature of the activity. Indeed, it was shown above that the activity of nurseryman is the secondary activity of more than half of the respondents i.e. (73.9%). This workforce varies depending on activities such as bag filling, weeding, grafting, maintenance, nursery monitoring, and sometimes watering. The farm manager having other occupations is obliged to employ a workforce to follow the evolution of his nursery in his absence.

3.3.3. Plant production used techniques

Vegetative propagation is a set of techniques that allow massive production thanks to genetic information on plant cells (Boutherin and Bron 1989). As part of this study two techniques were identified with the nurserymen surveyed.

The grafting technique is practiced by all the nurserymen of the locality 100.0% while 50.0% practices layering. In another way, these results all simply mean that 50% of the respondents

practice both techniques compared to the other 50% who only practice grafting. It should be noted that these two techniques are not done on all species because the success rate depends on them; this could explain these percentages because the first five *(Persea Americana, Citrus lemon, Mangifera indica, Annona muricata, Citrus sinensis) most* produced species by nurserymen are grafted plants.

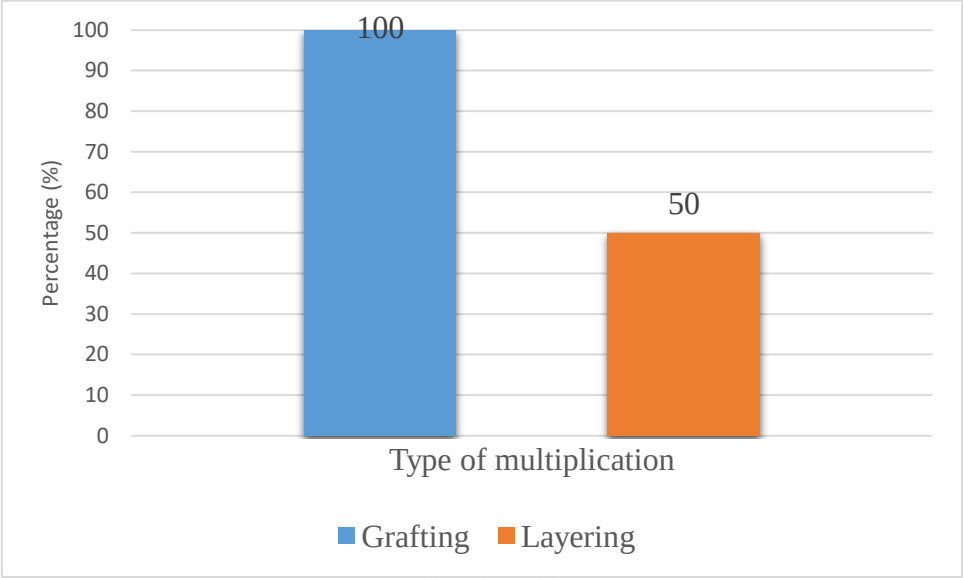

Figure 3. Distribution of respondents according to the type of multiplication carried out

Another reason could be the cost of each technique. These results are similar to those of Djiam *et al.* (2009) who showed in their study carried out in the North region of Cameroon that in general, producers more or less use the different vegetative propagation techniques namely grafting, layering, and cuttings. The results of their investigation revealed that the latter use more grafting and seed for the cultivation of fruit and forest seedlings respectively.

3.4. Annual production supply of improved seedlings of fruit trees

Within the framework of this study, the quantities of plants produced provide a general idea of the level of supply of seedlings in the locality. Thus, thanks to descriptive statistics, the averages of seedlings by species were obtained as well as the total of plants produced by species and over a year (Table 4).

Table 4. Inventory of plant produced by species

Type of plants	Average	Standard deviation	Minimum	Maximum	Sum*	N

Avocado tree	5 ,084	8 ,847	200	50 ,000	162 ,700	32
Lemon	3 ,597	3 ,419	500	15 ,000	107 ,900	30
Mango	2 ,566	3 ,045	200	15 ,000	74 ,400	29
Orange trees	2 ,476	2 ,787	200	11 ,000	61 ,900	25
Mandarin	2 ,396	3 ,434	100	15 ,000	55 ,100	23
Plum tree	2 ,355	2 ,700	100	10 ,000	51 ,800	22
Soursop	1 ,845	1 ,581	200	7 ,000	53 ,500	29
Rambutan	1 ,613	1 ,517	400	5 ,000	12 ,900	8
Guava	1 ,600	1 ,329	500	5 ,000	16 ,000	10
Grapefruit	1 ,380	1 ,340	50	6 ,000	27 ,600	20
Mangosteen	1 ,128	752	250	2 ,500	10, 150	9
Passion fruit	1, 160	250	1 ,000	1 ,500	4 ,500	4
Total	**27 ,200**				**638, 450**	

** Total quantities produced by all nurserymen*

Table 4 presents dual information: the first concerns the average quantities of each type of seedling that can be found in a nursery with an average production capacity of 27,200 seedlings. In fact, avocado (5,084 seedlings) lemon (3,597 seedlings) mango (2,566 seedlings) orange (2,476 seedlings) mandarin (2,396 seedlings) and plum tree (2,355 seedlings) represent the principal of such a nursery.

The second information concerns the total number by species that are produced during a campaign. It emerges from this table that in 2020 the locality of Njombé-Penja provided several different plants among which the avocado seedlings which are those having the largest number namely 162,700 plants followed by lemon plants which were 107,900 plants mango plants (74,400 seedlings) orange trees (61,900 seedlings) mandarin trees (55,100 seedlings) and soursop (53,500 seedlings) to name a few. These plants are the most produced in this locality due to the ever-increasing demand on the fruit market unlike passion fruits which are the least produced seedlings in the study area (4,500 seedlings) for this campaign of 2020.

3.5. Destination of improved seedlings of fruit trees sold

It was noticed during the investigation that the largest sales are made from Friday to Sunday in particular, several sales were made by the roadside and the main buyers were individuals with cars on the national road n^{o} 5 leading mainly to West Cameroon and Douala (Littoral).

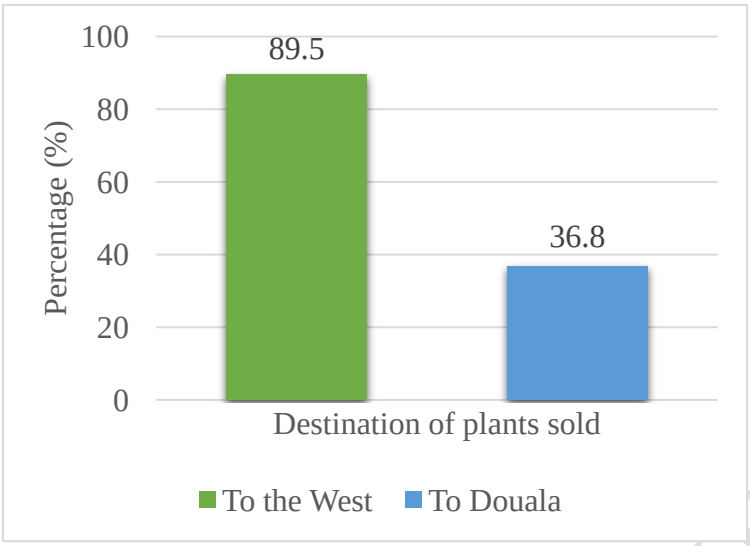

Figure 4. Distribution of respondents according to the destination of the plants sold

The figure shows that most of the seedlings sold by the roadside have as their main direction the West region of Cameroon (89.47%) while plants sold in the direction of the city of Douala (Littoral region) represent 36 84%. These results are justified by the fact that the majority of plants purchased by these individuals are avocado seedlings which are much more produced in the western highlands particularly in the Bamboutos and they have sufficient space to plant these trees. Those going to the city of Douala are very few, these are generally citrus seedlings (lemon, orange, mandarin, and grapefruit trees) because the Littoral region is part of the fruit production basin.

3.6. Financial evaluation of the production of improved seedlings of fruit trees

To determine the financial performance of the nurserymen in the locality of Njombé-Penja the following financial indicators were considered: production costs (fixed costs and variable costs) total revenue (TR), gross margin (GM), net margin (NM) and rate of return (RR).

3.6.1. Investment for the production of improved seedlings

Production in an arboraceous nursery requires equipment.

Table 5. Investments required for the production of seedlings in a unit

Items	Units	Quantities	Unit Price (CFA Francs)	Total cost (CFA Francs)	Lifetime (year)	Annual depreciation charge (CFA

						Francs)
Field location	m²	2.000	525	1 ,050 ,000	3	350 ,000
Water can	Unit	5	7 ,500	37 ,500	4	9 ,375
Wheelbarrow	Unit	1	25 ,000	25 ,000	5	5 ,000
Shovels	Unit	1	5 ,500	5 ,500	4	1 ,375
Rake	Unit	1	2 ,500	2 ,500	2	1 ,250
File	Unit	2	1 ,500	3 ,000	1	3,000
Machetes	Unit	3	3 ,000	9 ,000	2	4 ,500
Pick-axe	Unit	2	6 ,500	13 ,000	4	3 ,250
Ladders	Unit	1	15 ,000	15 ,000	5	3 ,000
String	Roler	1	5 ,000	5 ,000	2	2 ,500
Stool	Unit	4	1 ,200	4 ,800	2	2 ,400
Scissors	Unit	2	1 ,500	3 ,000	2	1 ,500
Sprayer	Unit	2	25 ,000	50 ,000	5	10 ,000
Grafter	Unit	3	30 ,000	90 ,000	3	30 ,000
Motor-pump	Unit	1	200 ,000	200 ,000	7	28 ,571
Secateurs	Unit	3	7 ,000	21 ,000	3	7 ,000
Irrigation pipe	Unit	15	1 ,200	18 ,000	5	3 ,600
Watering pipe	Roller	1	8 ,000	8 ,000	2	4 ,000
Pipe coupling	Unit	15	500	7 ,500	5	1 ,500
Total				**1 ,567 ,800**		**471 ,821**

The table shows that to start the activity with an average production of 27,200 improved seedlings of fruit trees for one year an investment of 1.567,800 CFA Francs would be needed for the necessary equipment and the installation of the nursery. However, the annual depreciation charge of this equipment for a year of production is CFA Francs 471,821, this value represents the fixed charges per year for production. It is also important to note that the highest investment is found in the rental of the land (2,000 m²) for the 27,200 seedlings to be produced which goes up to 1,050,000 CFA Francs for a period of 3 years i.e., 350,000 FCFA per year.

3.6.2. Annual operating account for the production of improved seedlings of fruit trees

The average quantity of seedlings produced was recorded for a year of production and expressed in market value regardless of the purpose of the production obtained.

Table 6. Operating account of an average production unit of 27200 improved fruit tree seedlings

Section	Units	Quantities	Unit price (CFA Francs)	Total price (CFA Francs)
Expenses				
Seeds				
Plum	50 Kg bag	5	12 ,500	62 ,500
Oranges	Kg	26	250	6 ,500
Mandarins	Kg	25	350	8 ,750
Soursop	50 Kg bag	5	16 ,000	72 ,000
Grapefruit	50 Kg bag	2	18 ,750	37 ,500
Lemons	Kg	20	500	10 ,000
Guavas	Kg	15	700	10 ,500
Passion fruit	Kg	15	600	9 ,000
Mangosteen	Kg	20	1 ,500	30 ,000
Rambutan	Kg	25	2 ,000	50 ,000
Avocado pits	50 Kg bag	17	10 ,000	170 ,000
Mango pits	50 Kg bag	11	8 ,500	93 ,500
Grafts	Unit	24 ,000	150	3 ,600 ,000
Attachment sheaths	Unit	25	2 ,000	50 ,000
Sachets	Pack of 100	273	2 ,000	546 ,000
Protective sheaths	Pack of 1000	25	3 ,000	75 ,000
Black soil	20 ton tubs	3	50 ,000	150 ,000
Compost	50 Kg bag	100	1 ,500	150 ,000
NPK fertilizer (Yara)	50 Kg bag	5	22 ,000	110 ,000
Insecticides	Liter	3	9 ,500	28 ,500
Fungicide	Liter	3	9 ,000	27 ,000
Grafting of plants	Seedlings	25 ,000	200	5 ,000 ,000
Filling the sachets	Sachet	27 ,200	10	272 ,000
Salary workforce (2 employees)	Month	24	35 ,000	840 ,000
Temporary labor	H/D	45	2 ,000	90 ,000

Table 7. Annual operating account of a unit of 27200 improved fruit tree seedlings

Items	Units	Quantities	Unit price (FCFA)	Total price (FCFA)
Installation of the	Flat rate	1	50 ,000	50 ,000

irrigation system				
Total cost of transport	Flat rate	1	200 ,000	200 ,000
Contingency (10%)				1 ,174 ,875
Total expenses				12 ,923 ,625
Incomes				
Plum Seedling	Seedlings	2 ,355	1,388	3 ,268 ,109
Orange Seedling	Seedlings	2,476	1,117	2 ,764 ,867
Mandarin tree Seedlings	Seedlings	2,396	1,121	2 ,684 ,783
Avocado Seedling	Seedlings	5,084	1,905	9 ,687 ,072
Soursop Seedling	Seedlings	1,845	1,094	2 ,018 ,458
Grapefruit Seedling	Seedlings	1,380	1,082	1 ,492 ,909
Lemon tree Seedling	Seedlings	3,597	1,494	5 ,375 ,019
Guava Seedling	Seedlings	1,600	1,018	1 ,629 ,091
Mangosteen Seedling	Seedlings	1,128	1,860	2 ,097 ,667
Rambutan Seedling	Seedlings	1,613	1,844	2 ,974 ,167
Passion fruit plant	Plants	1 ,160	1,382	1 ,603 ,125
Total income				**39 ,252 ,961**
Gross margin				26 ,329 ,336
Annual depreciation charge				471 ,821
Net margin				**25 ,857 ,514**
Rate of return (%)				**193**

a) Production costs

Production costs are distinguished into variable costs and fixed costs. Variable costs dominate in the structure of production costs; they are illustrated in (Table 6) by the total expenses and represent 96.48% of the total costs for all the nurserymen surveyed against 3.52% which represents the fixed costs (depreciation allowance); they are on average estimated at 12,923,625 CFA Francs / year and 471,821 CFA Francs / year respectively for variable costs and fixed costs. The variable costs are distinguished by the cost of plant material (seeds and grafts), the cost of labor, the cost of inputs, other costs related to transport and contingencies. Indeed, labor costs are the most important variable costs for all nurserymen.

b) Total income, gross margin and rate of return

Table 7 shows the annual income for all nurseries which averages 39 ,252 ,961 CFA Francs / year. The gross annual margin obtained is positive for all the nurserymen surveyed, it is estimated on average at 26,329,336 CFA Francs / year.

The net margin is positive; it is equal to 25 ,857 ,514 CFA Francs / year for all the nurserymen surveyed for an average production capacity equal to 27,200 seedlings / year. According to the rate of return which is 193%, for every 100 CFA Francs invested in seedling production, an average profit of 193 CFA Francs emerges. Thus, the activity allowing to generate a positive and high profit, allows to conclude that the production of improved seedlings of fruit trees is very profitable.

These results corroborate with those of Séhouéto et *al.* (2015 and 2017) respectively on the production of teak seedlings and acacia seedlings in Benin. They concluded that the production of seedlings of forest species regardless of their nature is a profitable activity for both collective and individual nurseries. These results are also similar to those of Ephraim et *al.* (2018), in their study of rural nurseries in Nigeria.

3.7. Constraints of fruit tree nurserymen

Like all agricultural activities, the production and marketing of improved seedlings of fruit trees in the locality of Njombé-Penja also faces many difficulties, particularly in terms of production and marketing.

3.7.1. Production constraints of improved seedlings of fruit trees

Difficulties are encountered at each level of the sector which tend to hamper the proper functioning of the sector. Throughout their activities, seedling producers (nurserymen) face many difficulties, such as water scarcity which is one of the major problems (86.8%), lack of suitable space and insufficient financial means for the establishment and monitoring of the nursery are second in position and also represent major constraints for nurserymen (81.6%). Nurserymen do not have access to enough space, necessary for the establishment or expansion of their nursery in order to increase the quantities and sometimes the number of species produced.

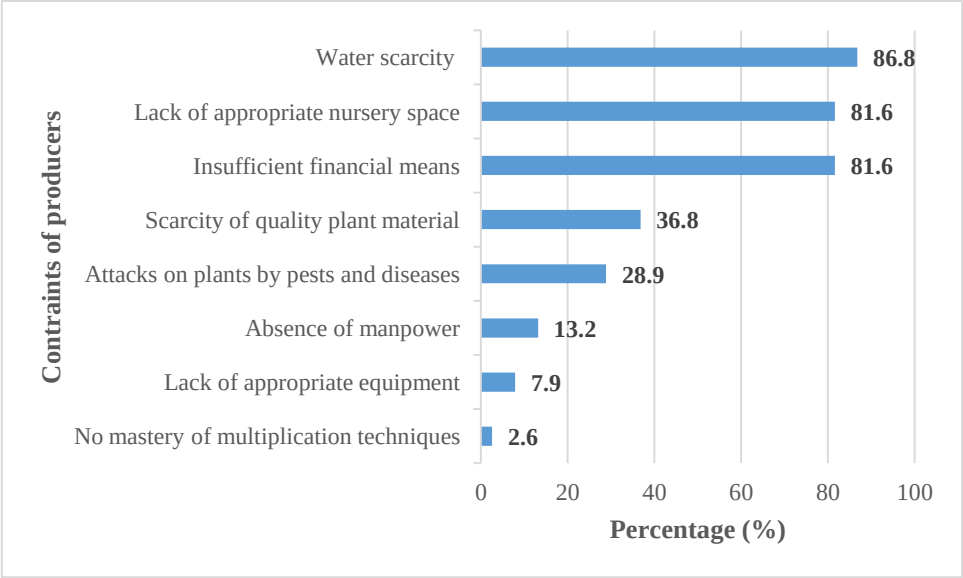

Figure 5. Constraints of nurserymen during plant production

These results are in agreement with those of Ephraim et *al.* (2018) and those of Fakayode et *al.* (2008) who also showed that insufficient financial means and water for irrigation were the main obstacles in a nursery. During the dry season, the lack of water leads to water stress of the seedlings and this invariably results in a low survival rate and therefore losses. Thus, nurserymen reduce their selling prices to eliminate the seedlings which result in a higher production cost of watering. On the other hand, there is an increase in the production of seedlings during the rainy season, as more people are engaged in planting, which leads to an increase in demand for the seedlings and subsequently an increase in the prices of. general unit sales. In the same vein, the study of Kassim et *al.* (2017) in Ethiopia showed that the challenges faced by nurserymen in the study area were mainly on the supply side (i.e., lack of material and low quality of seeds), which was partly in agreement with what was reported for nurseries in Africa and Asia by Nyoka et *al.* (2015).

3.7.2. Marketing constraints for improved seedlings of fruit trees

Figure 7 shows that for 75.7% of nurserymen, the theft of seedlings is the major constraint in terms of marketing. Indeed, the production units are neither protected by guards nor by enclosures. Subsequently, for 67.6% of nurserymen, the absence of pre-established prices also represents a major difficulty, since everyone is free to set their price at the level of sales.

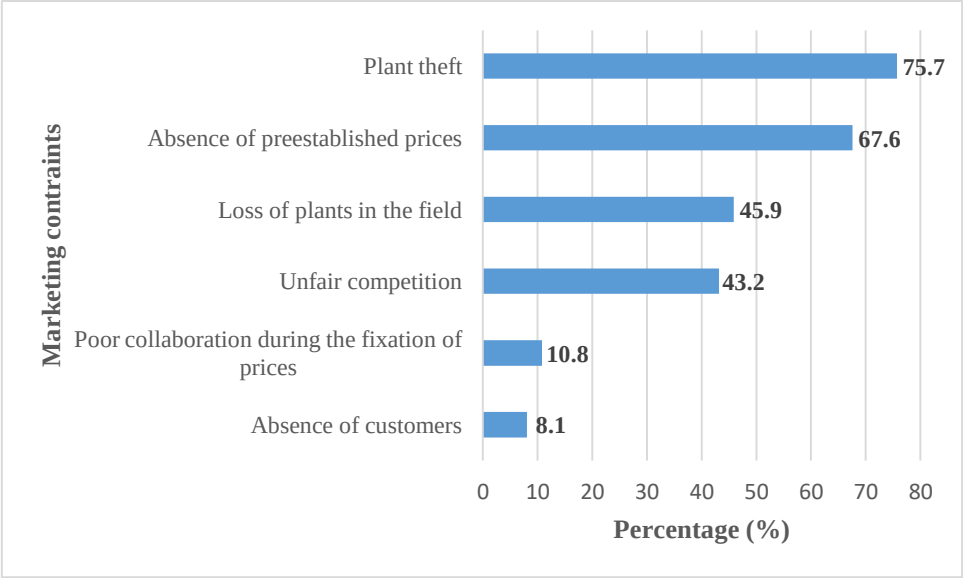

Figure 6. Constraints of nurserymen during the marketing of plants

These results are contradictory to those of Djiam et *al.* (2009) who showed in their study that the marketing constraints are essentially linked to the scarcity of customers, to transport difficulties, particularly for the delivery of seedlings and the non-respect of purchase contracts by customers; the latter also shows that communication problems (because of the isolation), the presence of competitors and the poor organization of nurserymen are other obstacles to the marketing of products. Nyoka et *al.* (2015), however, identified a problem on the demand side, the lack of market, also as a very important challenge. This was not really the case in our study area, as most of the nurserymen were doing quite well in sales and were not complaining of any absence from the market for the most of them.

4. Conclusion

The study analyzes the performance of the production and marketing system of improved seedlings of fruit trees in the locality of Njombé, Littoral region of Cameroon. The production and marketing of improved seedlings of fruit trees is an activity practiced mostly by married men. To carry out the production of seedlings, nurserymen must in particular provide themselves with an appropriate space (near a water source to facilitate irrigation) for the establishment of the nursery. The acquisition of this space is generally done by rental; however, the choice of species to produce is very important. The labor used for production is mainly salaried and the most common propagation technique is grafting. Marketing prices vary according to the client and the seedlings are sold along the roadside, most of the part towards the directions of West Cameroon and the Littoral region.

The activity of producing and marketing of fruit tree seedlings is profitable and provides substantial income to the men who practice it. Despite this high rate of return, nurserymen face a number of factors that are unfavorable to seedling production. Thus, production and marketing constraints are among others the scarcity of water, the lack of appropriate space and insufficient financial means for the establishment and monitoring of the nursery and the scarcity of plant material quality, theft of seedlings, the absence of pre-established prices and unfair competition.

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