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Contribution of Penja Pepper Production on Economic Well-Being in Cameroon

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ABSTRACT

Improving household well-being by intensifying agricultural production is a major concern of most developing countries. Our main objective is to quantify the contribution of Cameroon Penja pepper production on economic well-being. With the used of multiple correspondence analyses we constructed a well-being indicator using primary data collected among pepper producers and the result is estimated using ordinary least square. The results show that Penja pepper production is significantly corroborating with household economic well-being. The result is explained by industrial pepper production, while climate change, financing difficulties and availability of cultivated land are the main constraints faced by Penja pepper farmers. Decision makers should create policies to regulate the pepper market in terms of exportation of the crop. This is a wise step towards increase household economic well-being.

Keywords: Contribution, Household, Economic well-being, Production, Penja Pepper, Cameroon

1. INTRODUCTION

Until date poverty issues are still at the centre of the world policy especially among the youths of Africa and other developing countries. According to the World Bank (2012) in order to significantly reduce poverty and hunger in the most direct way possible, priority must be given to economic growth in the sectors where the poor work, i.e. where the factors of production belong to the poor. The agricultural sector generally fulfills this criterion, and in Africa this sector of activity mainly includes farmers and the poor and evidence beyond Africa's borders, agriculture is able to take the lead in development initiatives.

According to the World Bank report No.13167-CM, poverty is synonymous with deprivation and vulnerability: deprivation of adequate nutrition, rudimentary health care, basic education and the possibility of escape poverty; vulnerability to hunger, disease, ignorance, destruction, and opportunities that cannot be grasped (Manga, 2008). If poverty persists, children born poor become adults and give birth to a new generation of poor children. The cost of persistent poverty is measured in terms of dreams always pushed back and lives spoiled. A society that is not able to offer opportunities to all who constitute it is a society of drift. From the foregoing, we can define poverty as the lack of material or financial resources needed to meet basic needs such as food, housing, health, education, access to water. According to the 2007 Cameroon Consumption

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Household Survey, the established income poverty profile reveals that with an estimated poverty line of 232547 CFA per year per adult equivalent, 52.1% of the rural population is made up of poor households (Manga, 2008).

The World Bank Development Report 2008 reports a major shift in the assessment of the important role of agriculture in economic growth and poverty reduction, and stimulates the debate on actions preferred. They noted that agricultural growth is accelerating in Africa, but that productivity is growing more slowly, and that the growth of agriculture is very effective in reducing poverty. Agriculture in Cameroon represents the most important economic activity, both in terms of volume of production, labor employed, contribution to GDP and contribution to exports. According to the National Investment Report in 2008 agriculture occupies an important place in the national economy because of its effects of training on other sectors of the economy. Over the period from 2011 to 2017, the Cameroonian economy experienced an average annual growth rate of 4.6%. The same has been true for the rural sector, whose share of GDP has remained around 20%, with 15% of GDP for crop production. The agricultural sector is a major contributor to production and plays a central role in food security, job creation and wealth, renewable resource management and biodiversity (MINADER, 2017).

The cultivation of Penja pepper was introduced in Cameroon since the 1950s due to the favourable climate, environment and volcanic soils located around the Penja zone. The white pepper cultivated in Cameroon is known as Piper nigrum in India. The cultivation of pepper was traditional and very little is dedicated to export in the past. However, today the culture is growing and offers many small planters the opportunity to cultivate this king of spices, a demanding, delicate and long-lasting culture. The year 2013 was the year of the new light of white pepper as it gains the recognition of the government, NGOs and many industries operating in the agricultural sector. Actually, this type of pepper belong to the species piper nigrum and of the family piperaceae which comes in green, black, white or gray peppers depending on the stage of maturity at harvest and processing (Balleti, 2016).

In West and Central Africa, many traditional agricultural and food products are tied to a specific territory and have a reputation at national and sometimes international levels. Penja pepper is recognized as one of the best peppers in the world. The current production of peppers from Penja-Cameroon is about 400 tons per year. However, it is likely to increase given that the pepper produced has obtained a geographical indication that allows it to be sold under the label "Pepper Penja" (Bridier, 2010). The production of this pepper helps to reduce poverty through the promotion of employment, the repatriation of foreign exchange and the increase of producers' incomes. In the middle ages, spices such as pepper were rare; however, the conquest of Alexandria

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in 642AD by the Arabs marked the beginning of this trade. That's why this rarest spice, were used as bargaining chips. There is also the expression "expensive as pepper", or "pay in cash (spices)". The wealth of a nobleman could be evaluated according to the quantity of pepper he possessed. Based on this, the rich Germans nicknamed this specie as 'pepper sacks'. Its exorbitant price in the middle ages and the monopoly on trade held by Italian trading with Arab merchants was one of the reasons that led the Portuguese to find a sea route to India.

In summary, the cultivation of Penja pepper has been attracting more and more farmers since 2013, the year in which the protected geographical indication of the African Intellectual Property Organization was attributed to this pepper. Since then, the price of this spice has exploded from 5USD/kg before September 2013; the price of certified Penja pepper reached 16USD/kg in 2014, and peaked at 28USD/kg during 2015, which is a source of information for producers. Despite all these, poverty is still a major issue in this region of the country (Balleti, 2016). It therefore, becomes compelling to quantify the actual effect of Penja pepper production in the improvement of household economic wellbeing in Cameroon, more so we are not aware of any study quantifying the production of this pepper in Cameroon. This study therefore targets the following research objectives: to examine the contribution of Cameroon Penja pepper production on economic well-being, check this effect by category of producers as well as identify constraints related to the production of Penja pepper in Cameroon.

Literature Review

In the context of the manifestation of poverty in Cameroon and agricultural production, Fouda (2003) thinks that it is the liberalization of the agricultural sector which is the main cause of poverty, because it has not been prepared and has been translated by a total withdrawal of the State in the context of lack of training of producers, high input costs, low producer prices, difficulty of access to credit. Other denounced causes include: poor road infrastructure, poor governance (corruption, misappropriation of public funds, uneven distribution of the fruits of growth). This analysis thus reflects a link between the failure of public policies and poor farmers in rural areas.

The origin of Penja pepper also known as white pepper is vague but assumed that it goes back several thousand years and was widely used in the Western world, mainly in India and China. Alexander the Great brought it to Europe following his expedition to Asia. Pepper has long been a bargaining chip, like many other spices. The expression pay "in cash" finds its origin in the payment "in spices". Pepper has quickly seduced Westerners and has become a basic spice in many traditions. Pepper includes three varieties of plants: cubebe pepper (piper cubeba), long pepper (piper longum) and black pepper (piper nigrum). The latter is the most used. The pepper tree is a

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liana that belongs to the family of piperaceae. Contrary to popular belief, the pepper does not produce only black pepper. Indeed, the stage of maturity at which we harvest its fruit will make us get black pepper, white or green. Black pepper is picked when ripe and dried in the sun. White pepper is also picked at maturity, but dried after being stripped of its envelope. As for green pepper, it corresponds to pepper picked before maturity, and preserved in vinegar. To preserve all the flavors of pepper, it is recommended to buy it as whole grains and to reduce them to powder at the last moment.

Used in all sauces, pepper enhances the flavor of a variety of prepared foods: from starter to full meal, including soup, salad dressings and marinades. It gives flavor to salads, meat, fish and seafood, omelet, stews, stir-fries… Pepper works in synergy with other spices by raising the flavors, without ever altering them. Whole grains of pink and green peppers are incorporated directly into certain soup to add a decorative touch, without resisting under the tooth. For a more pronounced peppery taste, pepper is added at mid-cooking or at the end of it, as its flavor and subtlety dissipate if cooked too long. When cooked for more than two hours, it loses its unique taste and becomes slightly bitter. In addition, the taste of pepper increases when a dish is placed in the freezer (see photo of Penja pepper in appendix A).

From the start, pepper has tonic, stimulating and antibacterial properties. Pepper also makes high-protein foods more digestible for the stomach because its essential oil stimulates gastric juice. Pepper stimulates pancreatic juice thus facilitating the digestion of carbohydrates and lipids. Although it shows the presence of some vitamins and minerals, their content is not high enough to make real satisfaction. Nevertheless, the antioxidants contained in black pepper have demonstrated in the laboratory a certain anticancer potential. Indeed, as part of a healthy diet, balanced and rich in fruits and vegetables, this spice would be part of the food to consume daily to help increase its capital of antioxidants and prevent certain cancers and 2ml (1/2 tsp) would be the reference amount to consume to have a significant effect (Nuhu, 2014). Studies also reveal that black pepper piperine seems to improve the assimilation of curcumin (present in turmeric) by the body, an effective compound acting in the prevention of certain cancers. This is why it is strongly recommended to season a dish of turmeric and black pepper mixture to fully enjoy the benefits of curcumin. Black pepper could also help reduce the amount of salt we use, both for cooking and during meals, as it brings flavor and taste to cooked dishes; a significant benefit for your health.

It is undeniably the "king of spices", as mentioned in the early fourth century BC, especially in Sanskrit under the name of "pippali". It is the most popular spice in the world that even intervened on the course of history since it played a key role in the search of the sea routes to the east by the Europeans. For centuries the pursuit of pepper has dominated the spice trade. It has

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been used as a bargaining chip (Belleti, 2016). The bulk of world production is concentrated in a few countries whose very high productivity comes from the technical improvements employed as well as large quantities of plants in cultivation. World production of pepper reached a peak of more than 355,000 tons in 2003. It was 271000 tons in 2008. Vietnam, which produced only 25000 tons in 1994, has been the leading producer and exporter since 2001. She has the highest yield per hectare: 1,200 to 1,300 kg (India has a yield of 314 kg). In 2008, Vietnam produces 34% of world production (98,500 tons). Followed by India (19%, 50000 tons), Brazil (13%, 35000 tons), Indonesia (9%, 25000 tons), Malaysia (8%, 20000 tons). China (7%), Sri Lanka (6%) and Thailand (4%), while in 2008 exports were 83000 tons for Vietnam, 36000 tons for Brazil, 30000 tons for India, 19000 tons for Malaysia, 16 300 tons for Indonesia, 8 500 tons for Sri Lanka, 3 000 tons for China and 1 500 tons for Thailand. and 1,200 tons for Madagascar. In 2009, world production is 285,000 tons, of which Vietnam's production is 105,600 tons. In 2010, world production is estimated at 320,000 to 350,000 tons. Much of the pepper goes to Cochin, the capital of the spice, where traders, buyers, experts and officials meet (FAO, 2012).

Empirical Specification

The locality of Penja-Cameroon is located in the department of Moungo from the Littoral region, Cameroon. It is bounded in the North by Loum, to the South by Mbanga, to the East by Yabassi and to the West by Melong. Temperatures are high throughout the year (24°C) and the annual average sunshine is 26.56°C. In addition, the minimum temperature is recorded in September (25.55°C) and the highest temperature in August (27.17°C). The average annual rainfall is 2434.69mm, the maximum rainfall is recorded in September (394.26mm) and the minimum in January with 22.13mm. During a year, the months of July, August and September are very wet, which is not the case for the months of December, January and February when rainfall drop. The locality of Penja is dominated by a monsoon wind blowing from east to west. It sometimes reaches high speeds in December (6.3m/s) and in March (8.3m/s).

The soils show that the Penja locality is characterized by two main soil types. The soils of the banana plain; which is a complex soil set comprising three types of soils, all of volcanic origin: poorly evolved soils, eutrophic brown soils and typical ferralitic soils. Etrophic brown soils; these are soils formed on recent flows of siliceous basalt. They are abundantly represented between Njombe-Penja and Manjo. They are deep (1.5-3m) and have very dark gray and very humi-ferous brown horizons, especially on the surface. The silty-sandy surface texture evolves towards the more colloidal fractions at depth; similarly, the lumpy surface grained structure has a cubic tendency when it develops in depth. The Penja hydrographic network is of dense dendritic type.

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The waters of the area are drained by two major watercourses. The Moungo west of the Wouri, which rises in the Bakossi Mountains at 1755m above sea level, joins the Wouri mangrove after a 200km course and the Dibombari in the East. Among the minor water courses are: Misele, Bwankoutou, Nyela and Ekowa.

The zone is constituted with the exception of cultivated areas, of a primary forest. Cash crops and food crops are sometimes grown in the forest, after eliminating a good number of trees and undergrowth (deforestation, nuisance effect, greenhouse effect). In industrial plantations, it is necessary to mention the introduction of mangoes as a cover crop. Almost all possible crops are grown (banana, oil palm, pepper, coffee, cocoa, papaw, pineapple, potato, cocoyam, etc ...). The municipality of Penja does not have protected areas in the true sense of the word. There are, however, some reforested hills (degree of development of the order of 58%) by the PHP (Plantation High Penja) and put in defense.

Construction of the synthetic poverty indicator

Index construction has been introduced by researchers and academics since 1998, and so far the most widely constructed index is the wealth or asset index. This method uses household asset data such as durable and semi-durable goods to describe household welfare rather than using household income or expenditure data. Its concept is based on evidence that the metric measure of money is too narrow to define the welfare of households and this index is likely to be compatible with the financial means. In addition, the index requires less data intensive collection, which may result in smaller measurement error and be adapted to the technical capabilities of government statistical offices. This would be a very useful tool for a primary household survey which is easy to collect. With respect to poverty reduction, we chose seven (7) bimodal variables (1 = yes and 2 = no). The variables selected for the synthetic variable are grouped in table 1.

Table 1: Variables used to construct the poverty index

Variables	**Modalities**
Does your engage in pepper production permit you to educate your children?	[1= yes, 2 = no]
Income derived from pepper production help you to satisfy your physical needs?	[1= yes, 2= no]
Income from pepper production permits you to save some money?	[1= yes, 2 = no]
Pepper production has increased your income significantly?	[1 = yes, 2 = no]
Income from pepper production permits you to invest in other domains/activities?	[1= yes, 2 = no]
Income from pepper has increased your standard of living?	[1= yes, 2 = no]

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Are you satisfied (socially, economically) with pepper production?	[1 = yes, 2 = no]

Source: author

The poverty index used in this study was constructed for this study. This index was constructed using Multiple Correspondence Analysis (MCA). The multiple correspondence analysis approach has been popularized in the area of multidimensional poverty analysis by Asselin (2005) and in the current literature. The MCA is applied in multidimensional welfare analysis as the case of Cameroon by Njong and Ningaye (2010) and Epo and Baye (2011). Technically, the MCA is obtained by using the standard correspondence analysis on a matrix of indicators by selecting the synthetic variable as well as the different modalities including the variable. As part of this work, the synthetic variable is "pepper production increases your income".

Econometric model

The Cobb-Douglas type functional form is generally accepted for the analysis of the production function in the agricultural sector. Our model is the conceptual basis of pepper production and poverty reduction. This model is shown below:

$$PR = \sim + \quad \text{¡}_i + £_i \qquad (1)$$

In equation (1), PR is reduction in poverty capture by the constructed synthetic indicator of poverty reduction. This poverty reduction index has been created using the seven variables in the table 1 and it is our outcome variable. The ¡_i represents the main independent variable i.e. the quantity of peppers produced per year, while the income level of producers and other exogenous variables are the main factors determining poverty reduction and the production of peppers in Penja. The ith at the base of ¡ simply represents the respective elements that can directly explain the quantity of pepper produced such as: training, gender, age, farm size, labour force, access to credit, access to fertilizer, level of education and age of operation. The estimation of the parameters $\hat{}$ shows to what magnitude the determinant factors will contribute to the reduction of poverty. The $£_i$ represents the unobserved random variables, which explains the difference between the actual responses observed and the expected result. In the same way; the $\sim$ stands for the constant term. The parameter estimate of the weighted ordinary least square estimation can be estimated using a simple mathematical formula as indicated in equation (2).

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$$\hat{} = \frac{\sum i_i \sum PR - \frac{1}{n}\sum i_i \sum PR}{\sum i^2_i - \frac{1}{n}\left(\sum i_i\right)^2} = \frac{COV\ [i, RP]}{VAR\ [X]} \quad (2)$$

Still focusing on the weighted OLS, the constant term may be estimated by the following formula.

$$\tilde{\hat{}} = \overline{RP} - \hat{}\overline{X} \quad (3)$$

From equation 1, we can explain the variables used in the regression. Principally, the quantity of peppers produced (X_1) known as the yield is measured by the quantity of Penja pepper produced per year. The greater the quantity the more the income increases, which leads to an increase in the standard of living. Farmers initial Income (X_2) which is a variable that determines the household production level. Actors had formal/informal training jn the production of pepper (X_3): Having to attend training on the practice of farming techniques is an asset to farmers in the management of agricultural techniques to increase their production. Other variables considered in our regression table include: gender (X_4), age (X_5), mechanized agriculture (X_6), farm size (X_7), the larger the area under cultivation, the greater the chance of having a large production and in return a higher income. The type of labor used (X_8), on a farm is an important explanatory factor for the increase in production. It is expected that hired labor will be more efficient. Access to credits (X_9) has an effect on farmers' output especially for start-up or expansion of activities. Credit allows for the acquisition of inputs needed in the production process, which allows farmers to improve their performance. Access to fertilizers (X_{10}) everything being equal, a large consumption of fertilizer, necessarily induces high production. The level of education (X_{11}) is expected to have an effect on pepper production. Education is a form of human capital development that increases labor productivity. Experience in production (X_{12}) is another input factor in the production of pepper.

4. RESULTS AND DISCUSSIONS

Socioeconomic characteristics of Penja Pepper Producers

The result in table 2 shows that 96.70% of pepper producers are men and 3.30% are women. These results are similar to those of Shah et al (2015) who found that 90% of farmers are men and 10% are women. The predominance of men in pepper cultivation is due to the fact that women are heavily involved in food crops cultivation. This can also be explained by the intensive physical work that production requires. With regards to age, the majority of producers are between the ages of 30 and 55 (54.2%), the work of Shah et al (2015) have relatively the same results. Young people under 30 years old represent 32.5%, this can be explained by the fact that they are

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motivated by the PAMPIG. They consider pepper as a high-value crop. The proportion of over 55 years is low (13.3%) because at this age the physical strength is considerably reduced.

Table 2: Socioeconomic characteristics of Penja Pepper Producers

Description	**Relative Frequency**	**Percentage**
Age group		
< 30 years	39	32.5
Between 30-55 years	65	54.2
> 55 years	16	13.3
Total	120	100
Gender		
Women	4	3.30
Men	116	96.70
Total	120	100
Level of Education		
No education	15	12.5
Primary	39	32.5
Secondary	57	47.5
Higher	9	7.5
Total	120	100
Marital Status		
Single	41	34.20
Married	79	65.80
Total	120	100
Distribution of Producers according to Household Size		
Small household size (< 5 persons)	17	14.20
Average (Between 5-8 persons)	72	60
Large (> 8 persons)	31	25.80
Total	120	100
Distribution of producers by crop area		
Small land size (< 2 hactares)	69	57.5
Average (between 2 – 4 hactares)	30	25
Large (> 4 hactares)	21	17.5
Total	120	100

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Distribution of Producers by Annual Income (CFA)		
Small (< 1000,000)	77	64.20
Average (Between 1000,000-5000,000)	28	23.30
Highe (> 5000,000)	15	12.50
Total	120	100

Source: author

The result in Table 2 shows that 47.5% of producers have a high school education; Ololade and Olagunju (2013 also report similar proportions (62.5%). Very few producers pursue higher education (7.5%). We note in summary that the level of studies here is on average high, contrary to the result of the work of Folefack (2012) which states that 92% of producers are illiterate. Level of education is a form of human capital development that increases labor productivity, usually resulting in higher output. According to this analysis, 65.80% of producers are married compared to 34.20% who are not married. These results are similar to those of other authors (Nuhu, 2014) who reported respective rates of married producers of 70%, 80% and 61%. This is explained by the fact that in rural areas, getting married at a very young age and even the mere fact of living in a cohabiting relationship is generally considered an official union. We note in this study that, 60% of producers have between 5 and 8 people under their roof, the work of Ololade and Olagunju (2013) illustrate similar results; they found that 76.70% of producers have on average more than 5 people under their roof. The large size of the household is usually a cause of poverty in large families with insufficient financial resources. The statistic show that many producers use less than 2ha (57.5%) while a small number uses more than 4ha (17.5%). This can be explained by the fact that most producers do not have enough financial means to acquire large plots, so they are content to exploit small plots on which they can bear the costs of production.

Verifying the income status of the producers and households, we observed that at-least 64.20% of the producers have an average income of less that 1000,000 per year, meaning that despite the engage of the pepper producers, they are relatively poor as compare to their counterpart engage in other cash crop production. This can easily be understood given that only 12.5 percent of the exploiters can produce and make an income of 5 million per year. It also means that, apart from pepper production, the people do not actually have another secondary activity that they can derived money from.

Production of Penja Pepper and Household Economic Well-being

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The results of the multiple linear regression show that the variables that have a significant effect on poverty reduction are: training, age, farm size, access to fertilizer, age of exploitation and the main independent variable which is the amount of peppers produced. Regarding the variable quantity of peppers produced, its coefficient is positive (0.5687) and significant at 1%. This means that increasing the unit amount of peppers produce, increases income, which leads to a reduction of poverty by 56.87%. This result is similar to that of Ololade and Olagunju (2013) who finds that increasing agricultural production in the face of a good marketing system reduces poverty among farm households at the 70% scale. Similarly, the training variable coefficient is positive (0.0204) and significant at 1%. This implies that additional participation in training workshops increases the amount produced which contributes to a 2.04% reduction in poverty.

In addition, the producer experience variable coefficient is positive (0.0206) and significant at 1%. This result states that age and poverty reduction move in the same direction. The increase of one unit of age induces a poverty reduction at the scale of 2.06%. These results are justified by a concentration of large plots to people between 30 and 65 years old with multidimensional abilities to practice in the production of peppers. This result is contrary to that of Folefack (2012) who found that the experience of the farm household head and the reduction of poverty move in the opposite direction. The size of the farm coefficient is positive (0.02) and significant at 1%, which implies that the increase of one unit of the size of the farm leads to a reduction in poverty. 2% scale. This result corroborates that of Nuhu (2014) who notes that a variation in the exploited land leads to a variation in the standard of living of the head of the household in the direction of an improvement in it.

Tableau 3: Production of white pepper and Household Economic Well-being

Variables	**OLS**
	Household Economic Well-being
Quantity of pepper produce per year in kg	0.5687*** (50.66)
Producer received formal training	0.0204*** (5.18)
Male household head	-0.0500 (-0.603)
Producer is experience in production	0.0206*** (16.95)
Large cultivated land	0.02***(18.02)
Have labourers	-0.0068 (-0.80)
Access to credit	-0.0084 (-0.15)
Used fertilizer	0.1731***(19.68)
Secondary level of education	0.0096 (0.83)
Producers falls between 30-55 years	-0.0617***(-6.36)

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Constant term	0.4299***(7.03)
R-squared	0.7042
F (dl: Prob> F)	24.1314 ; 0.0000]
Nombred'observation	**120**

Source: computed by authors. Note ***, **, * indicate 1%, 5%, and 10% significance respectively, while values in parentheses represent robust t statistics.

The variable access to fertilizers coefficient is positive (0.1731) and significant at 1%, which implies that an additional use of fertilizers leads to a reduction of poverty of 17.31%. This result is similar to that of Nuhu (2014) who founds that the use of fertilizers on the farm reduces poverty by increasing production, thus having a positive effect on it. The age of pepper producers is negative, its coefficient is negative (0.0617) and significant at 1%. This indicates that an increase of one age unit of the farm leads to a decrease in standard of living of 6.17%. The life cycle of plants is that of men (youth, maturity, and old age) and the majority of large farms were older than 18 years which may reflect the opposite variation. The constant has a positive sign and its coefficient is significant at 1%. This implies that, if all the coefficients of the model take the value zero, the constant contributes to the reduction of poverty by 42.99%.

We can conclude from the results obtained that the production of peppers has a positive and significant effect on the reduction of poverty. The assumption that pepper production has a positive effect on poverty reduction is valid. The R-square of this model is equal to 0.7042, which means that 70.42% of the changes observed on the dependent variable are explained by the independent variables. The F cal is equal to 24.13 and is significant at 1%. It appears that this model is globally significant and seems good for forecasting purposes. All the variables in this model are not significant, they are: gender, the nature of the workforce, access to credit, and level of education. These different variables have no significant influence on the quantity produced that contributes to the reduction of poverty. This can be explained by the fact that the production of peppers has requirements other than those provided by these variables.

Pepper Production effects on Economic Well-being by Producer Category

The result of the weighted OLS by producer category has similar points in terms of the significance of the variables with the result in Table 3. Regarding the independent variable principal amount of peppers produced, for small producers, the coefficient is positive (0.0649) and significant at 5%. This means that an increase in the amount of one-ton of peppers leads to an increase in income that contributes to a reduction of poverty of 6.49%. Professional producers and large production companies have respective coefficients 0.1254 and 0.6037 and significant at 5%.

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This implies that an increase in the amount of peppers by one ton in these categories reduces poverty by 12.49% and 60.37% respectively. Some explanatory variables are significant in this reduced form model. This is the case for training variables, access to credits and level of study.

Table 4: Pepper Production and Economic Well-being by Producer Category

Variable	OLS		
	Small Producers	**Professional Producers**	**Enterprise Production**
Quantity of pepper produce per year in kg	0.0649** (2.47)	0.1254** (2.61)	0.6037** (2.78)
Producer received formal training	-2.297*** (-33.35)	-2.2624*** (-14.91)	-2.2112*** (-29.25)
Male household head	0.0077 (0.17)	0.0903 (0.78)	0.0728 (0.57)
Producer is experience in production	0.0064 (0.19)	0.1483* (1.86)	0.0693 (1.55)
Large cultivated land	-0.0234 (-1.25)	0.0295 (0.94)	-0.0081 (-0.64)
Have labourers	-0.0008 (-1.10)	-0.0028 (-1.13)	-0.0004 (-0.52)
Access to credit	0.06703*** (11.34)	0.0832*** (9.37)	0.0721*** (10.63)
Used fertilizer	-0.0008*** (-12.58)	-0.0010*** (-10.12)	-0.0008*** (-11.51)
Secondary level of education	0.5984*** (14.80)	0.7243*** (9.77)	0.4824*** (10.29)
Producers falls between 30-55 years	-0.2557*** (-5.11)	-0.0682 (-0.76)	-0.2190*** (-3.71)
Constant term	0.5909 (0.0046)	0.5965 (0.0076)	0.6070 (0.0054)
R-squared	0.7422	0.6249	0.7104
F-Stats	21.18 [14;0.0000]	18.54 [14;0.0000]	20.61 [14;0.0000]
Number of observations	**69**	**30**	**21**

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Source: Computed by authors. Note ***, **, * indicate 1%, 5%, and 10% significance respectively, while values in parentheses represent robust t statistics.

Training variable is negative with all coefficients and significant at 1%. This implies that it moves in the opposite direction with increase in the quantity produced which contributes to the reduction of poverty in each category of producers. Subsequently we have the variable credit access which is quite significant in the 1% producer categories. Its coefficients are positive and all have a respective contribution of 6.703%, 8.32% and 7.21% to the reduction of poverty in the categories of producers. The level of education is significant at 1% in all producer categories. This is because the increase in one unit of human capital leads to a reduction in poverty of an average of 60.17%. This result is not consistent with the work of Nuhu (2014) who showed that agricultural activity is practiced mainly by illiterates who thus begin at young ages. The educated take the initiative only after all chances of gaining access to a qualified job have been exhausted, they are hardly motivated in agricultural activity as they consider their education to be wasted. We can conclude from the results obtained that the reduction of poverty through the production of peppers affects all categories of producers but at different proportions and magnitude.

Constraints of Penja Pepper Production

Table 5 shows the constraints faced by pepper producers in the Cameroo - Penja area. In this table, variables that have negative differences are dominant constraints and positive ones are non-dominant. For the age of producers, 86.7% of respondents do not find this variable a constraint because they are aged between 25 and 55 years 13.3% (above 55 years old) who consider it a constraint. The difference between these two percentages is positive, which means that age is certainly a constraint but little considered in the production of peppers because most of the farmers are between 25 and 55 years old. The age of producers has a percentage of 76.7% which consider it a constraint (have holdings of less than 10 years) against 23.3% who do not consider it a constraint. The difference between these percentages is negative, which implies that this variable is a constraint to production. This is explained by the fact that the production of peppers increases with the age of exploitation and in the zone the majority of the farms date from 2013 (year when the product is labeled).

Table 5: Constraints related to the production of peppers

Variables	**Observations**	**Contraintes**	**Non contraintes**	**Différence**	**%**
Age	120	0,133 (16)	0,867 (104)	0,734	73,4%

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Age of exploited land	120	0,767 (92)	0,233 (28)	-0,534	(53, 40%)
Location of land	120	0,483 (58)	0,5167 (62)	0,0337	3,37%
Secondary occupation	120	0,3167 (38)	0,6833 (82)	0,3666	36,66%
Size of exploited land	120	0,575 (69)	0,425 (51)	-0,15	(15%)
Climate change	120	1 (120)	0,00 (0)	-1	(100%)
Access to chemical inputs	120	0,208 (25)	0,791 (95)	0,5837	58,37%
Access to credit	120	0,625 (75)	0,375 (45)	-0,25	(25%)

Source: Computed by authors from field survey

The dwelling place variable has a proportion of 48.3% of producers who consider it a constraint against 51.67% who do not consider it. The difference is positive, which means that this variable is not a constraint for pepper production in the area because many of the farmers live in the village. 31.67% find that the secondary occupation variable is a production constraint against 68.33%. The difference is positive so secondary occupation is not really a constraint to production because it is a source of funding for small pepper growers.82.5% of respondents find that the lack of acreage is a constraint against 17.5%. The difference is negative. This implies that the lack of area is a constraint to the production of peppers. Climate change has a proportion of 100% of those surveyed affected by climate change because of its naturalness. For access to credit, 62.5% of respondents found that access to credit is a constraint against 37.5%. The difference is negative, which means that very few producers have access to credits and therefore it is a drag on pepper production. Similarly 20.8% find that access to fertilizer is a constraint against 79.2%. The difference is positive, which implies that a good number of producers do not face the difficulties of access to fertilizers. We can conclude from the results obtained that the size of the farm, climate change and access to credit are the dominant constraints faced by pepper producers in Penja. Most

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of the discussion in relation to the behavior of our variables is consistent with the result of Nuhu (2014).

5. CONCLUSION

The main objective of this study has been to analyze the effect of pepper production on the reduction of poverty in Penja – Cameroon. Other important issues related to the study are: to highlight the socioeconomic characteristics of pepper producers, to quantify the effect of pepper production on the reduction of poverty, to verify this effect in the categories of producers and to identify the constraints related to the production of peppers. In order to achieve this goal, data collected from 120 farmers were analyzed in STATA 13.0. In relation to socioeconomic characteristics, the study shows that the producers consists largely of men, i.e. 96.70% against a minority of women (3.30%). About 54.20% of farmers are between 30 and 55 years old; the youngest, under 30 years of age represent 32.50% of the sample and farmers aged above 55 represent 13.30% of the sample. The level of education of the respondents is relatively high, 12.5% of the pepper producers are illiterate, 47.5% of the farmers have a secondary education and only 7.5% have a higher education. The proportion of married farmers is relatively large (65.80% of the sample) compared to a moderately high number of unmarried farmers (34.20%).

We have constructed a synthetic indicator to measure and capture the poverty reduction variable. It is clear from this indicator that the contribution of the first axis to the reduction of poverty is 70.20% against 21.10% which is that of the second axis with inertia total of 91.3%. This model has also proven globally significant at 1% and seems good for prediction purposes. The OLS results show that the gender, the nature of the labor force, access to credit and the level of education do not have significant effects on poverty reduction. On the other hand, the variables that contribute significantly to the reduction of poverty are: the quantity produced, the formation, the age, the size of the exploitation, the access to the fertilizers, the age of the exploitation. The assumption of this objective states that pepper production has a positive and significant effect on poverty reduction. In view of the above results, this hypothesis is valid.

To verify the effect of pepper production on the reduction of poverty by producer category, the results show that the production of pepper reduces poverty among small producers, professional producers and large production companies in different proportions of 6.49%, 12.54% and 60.37% respectively. The survey of pepper growers identified the major constraints related to pepper production as climate change, lack of acreage and difficulties in accessing credit. We note from this study that an increase in the quantity produced generates high incomes; these induce a

strong investment which in turn contributes to a reduction of poverty. This appears as a solution to the vicious circles of poverty.

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Appendix A:

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Figure 1: Plantation of white pepper Penja