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FACULTE D'AGRONOMIE ET DES SCIENCES AGRICOLES

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DEPARTMENT OF CROP SCIENCE

DEPARTEMENT D'AGRICULTURE

THE CAMEROON COCOA STORY

Contents

Responsible for the content: Christopher Mubeteneh TANKOU (University of Dschang, FASA, Cameroon)

GEFÖRDERT DURCH DIE
ÖSTERREICHISCHE
ENTWICKLUNGS
ZUSAMMENARBEIT

This report has been produced with the assistance of the European Union within the project "Supply Cha!nge – Make Supermarkets fair". The contents of this publication are the sole responsibility of Department of Crop Science, University of Dschang, Cameroon and can in no way be taken to reflect the views of the European Union

Acknowledgement
The following persons contributed in this research activity: Mvondo-Ze Antoine, Mvondo-Awono Jean Pierre, Fon Dorothy Engwali, Manu Ibrahim Nformi, Beyegue Djonko Honore, Essobo Nieboukaho Jean Daniel, Baleba Laurent, Dongmo Wilfried Narcisse, Mbami Esaie Ledoux, Patrick Sama-Lang and Joseph Oben Ako. Special thanks to the many farming families who provided us with valuable information. Thanks go the Administration of the University of Dschang for their permission to carry out this work. We appreciate very much the interactions that we had with Caroline Sommeregger (Südwind) and Martin Wildenberg (GLOBAL 2000) during their brief research visit in our country.

Executive summary

Cocoa (*Theobroma cacao* L.), the "food of the Gods." is a major cash crop in Cameroon in particular and many countries of the tropical world in general, where its production and export contributes significantly to the national economy and in poverty alleviation. Africa supplies nearly three quarters (73%) of the world's cocoa though consumption of cocoa beans in all of Africa put together is only 3%, mainly because of the high price of the (mostly imported) finished cocoa products such as chocolates. More than 20 million people depend directly on cocoa for their livelihood. However, cocoa prices fluctuate widely and economic hardship occurs when prices are low. The factors that influence the supply of cocoa are the areas planted with cocoa crop and the yields or production per unit area. Increasing the area planted with cocoa is the preferred option of many small-scale poor farmers due to low technical know-how and poverty. This option also contributes in the elimination of natural forests in the cocoa growing areas for the establishment of cocoa plantations with the negative effects on global warming. Increasing the yield requires high agronomic skills and funds for procuring quality inputs. The inadequate number of extension workers in the producing areas limits the possibility of transmitting modern findings to the few educated cocoa farmers. Cocoa production is not an especially labour-intensive activity, but at the same time it is ill-suited to mechanization.

Cameroon has been producing cocoa for over a hundred years. Cameroon cocoa which is believed to have come originally from a 'Trinitario' strain is different from other basic cocoa beans. It has a darker, more reddish break and a more pungent flavour. It tends to be preferred by the European processing industries for its higher cocoa-butter content. It can also be processed into a highly prized red powder which is used as a colouring and flavouring agent in the dairy and baking industry. Our results obtained through household and field surveys and other relevant stakeholders in the cocoa production system, show that the bottlenecks in cocoa production in Cameroon include crop age where most of the cocoa trees are more than half a century old with extremely low production potentials; age of farmers where most young people prefer white collar jobs in the cities as shown by the rural-urban exodus; gender disparity where female farmers are greatly discriminated in the cocoa production system with regards to land tenure, marketing and extension benefits; technical know-how due to the low level of education of most farmers that prevent them from easily adopting new technologies or investing appropriately in the cocoa

business; poverty which limits the ability of the farmers to obtain inputs such as fertilizers, pesticides and hired labour; poor infrastructure especially roads which inhibit farmers from transporting the produce from farm to market; availability of high quality planting materials due to the limited potentials of the research institutions assigned to the production of planting materials; less value added due to the limited knowledge possessed by the farmers to transform the cocoa beans to more profitable products; poor soil fertility due to the fact that farmers fail to replenish the soils after extracting nutrients through harvests; climate change which has resulted to unforeseen dry spells and floods that negatively affect the yield of the crop.

The government of Cameroon is making some efforts to improve the cocoa production system but the retailers and especially the supermarkets have a duty to share the huge profits with the poor farmers who are the most significant actors in the cocoa production chain. Improving the conditions of the small-scale cocoa farmers will go a long way to alleviate poverty in the developing world, assure high and sustainable yields of the crop and will greatly contribute to the reduction of global warming.

1. Introduction

The supermarkets and other retailers need to participate effectively in the cocoa supply chain in order not to provide false representations that cocoa products are of a particular kind, standard, quality, grade, quantity, composition, style or model, or have had a particular history or particular previous use. The cocoa value chain includes production, transportation, marketing, transformation and consumption. In each of these stages, the quantity and quality of cocoa, labour type and quality including the wellbeing of the producer have significant impacts that need to be understood and addressed. Cocoa growers currently receive around 6 percent of the price of chocolate paid by consumers in rich countries, compared to about 16 percent in the late 1980s. Many cocoa farmers and workers are among the 2.1 billion people living on $2 a day. Around 3.5 million tons of cocoa beans are produced each year. Cocoa demand has been increasing by an average of 3 per cent a year for the past 100 years. Production was projected to rise by 6 per cent between 2009 and 2013 to 3.98 million tons. It is estimate that the industry sector will need an annual production of at least 4.5 million tons of cocoa by 2020 to satisfy the growing demand. With demand forecast to exceed supply, the chocolate industry could be heading towards a dilemma (Anonymous 2011). The objective of this work is to highlight the cocoa production system in Cameroon; one of the top producers in the world in order to sensitize actors of the cocoa value chain especially retailers and supermarkets of the contributions they need to provide to sustain cocoa production in Cameroon in particular and other producing areas in general to satisfy the growing demand.

2. METHODOLOGY

Information contained in this report was obtained both through a library-based research/study and field trip/survey conducted to solicit primary information from relevant stakeholders

reflecting views on the cocoa production systems of Cameroon. The primary data were obtained through interviews of public and private stakeholders in the Cameroon cocoa chain; coca farmers in Santchou (West Region), Melon (Littoral Region), Mbanga (Littoral Region), Kumba (South-West Region) Bafia (Center Region) and sampling of cocoa fields. In cocoa field sampling, data was obtained on biodiversity and soils. Biodiversity was analysed to reveal the density/ha of any species or (Total number of plants of any species)/(Total number of plots studied)*(area of plot))*10000 which expresses the numerical strength of the presence of a species in a community; Relative density or ((Density of individual species)/(Total density of all species))*100; Frequency % or ((Number of quadrats in which species occur)/(Total number of plots))*100 and Relative frequency or the frequency of a species in relation to other species. Soil samples were air-dried, sieved, and analyzed in the laboratory using standard techniques. Soil pH was determined in water and 0.1 M KCl solution at 1:2.5 soil/solution ratio. Organic carbon content was found by the modified K digestion of Walkley-Black method (Nelson and Sommers, 1996). The cation exchange capacity (CEC) was determined by adding the 1 M KCl extractable acidity to cations (Ca^{2+}, Mg^{2+}, Na^{+}, K^{+}) exchanged by neutral 1 $MNH_4C_2H_3O_2$ (pH 7) as described in Thomas (1982). The K and Na were measured with flame photometer while the Mg and Ca were determined with atomic absorption spectrophotometer. The exchangeable acidity was determined by titration and the cation exchange capacity (CEC) was obtained by summation of exchangeable cations and exchange acidity.

3. Overview on Cocoa production

The cocoa plant whose botanical name is *Theobroma cacao*, the genus, *Theobroma*, comes from two Greek words: *theos*, meaning gods, and *broma*, meaning foods. Thus, literally, “food of the Gods.” . The plant produces seeds in pods which are transformed to powder, oil and

Figure 1 Cocoa tree and pods

Figure 2 Cocoa pod showing seeds

chocolate for human consumption. . Chocolate products contain some caffeine, but not nearly enough to explain the attractions, fascinations, addictions, and effects of chocolate. Chocolate addiction is thought to be theobromine addiction. Cocoa is a highly competitive and lucrative economic cash crop ranked highest in terms of income generation amongst other agricultural activities in the global markets (UNCTAD, 2004). Cocoa contains butter (54%), protein (11%), cellulose (9%), pentosan (7.5%), tannin (6%), water (5%), theobromine (1.2%), sugar (11%) and caffeine (0.2%). Chocolate obtained from cocoa is consumed either as a snack, drink or dessert (ICCO, 2001).

The plant is a native of the Amazon basin and other tropical areas of South and Central America, where wild varieties still grow in the forests. Today, the cocoa growing area has extended to the Caribbean , West and Central Africa.

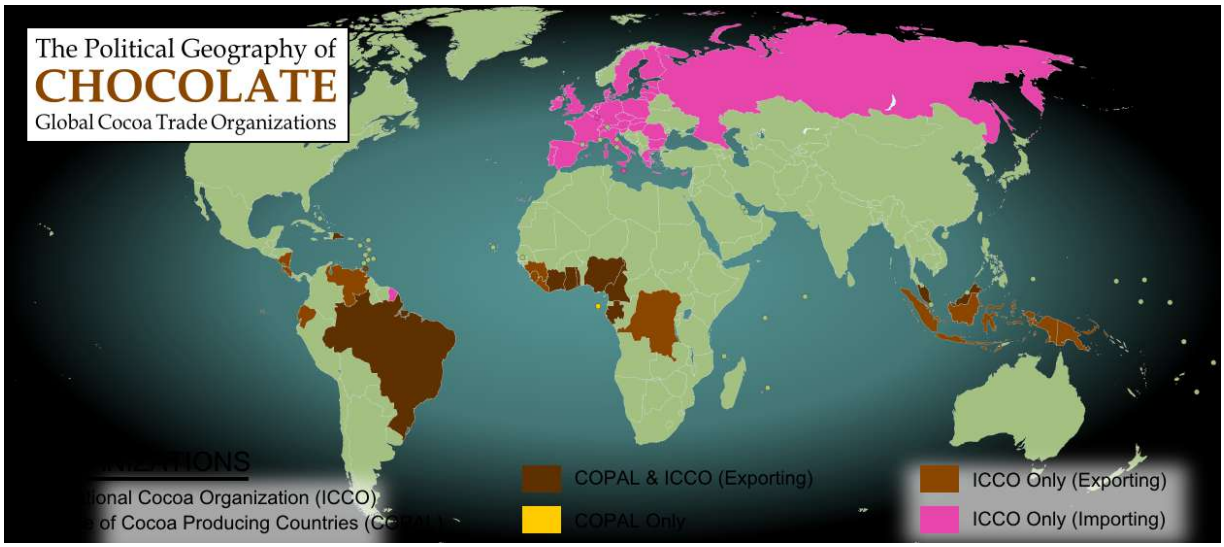

Figure 3 Global cocoa trade organizations

Different types of cocoa are selected for cultivation in the various growing areas. Most of the world's cocoa is grown in a narrow belt 10 degrees either side of the Equator because the trees grow well in humid tropical climates with regular rains and a short dry season. The plants thrive well under temperatures between 21and 23˚ C, and requires a fairly constant rainfall of 1,000 mm or more per year.

Cocoa plants need to be shaded from direct sun and wind particularly in the early stages of growth. Cocoa trees begin to bear fruit when they are 3-4 years old. The pink and white flowers and the pods grow straight out of the trunk (cauliflory) and main branches which is most unusual when compared to other plants. Like most tropical plants, flowers are present throughout the year but appear in abundance before the rain starts. Most of the flowers abort and only a small proportion develop into fruit over a period of about five months. The pods are hard and melon shaped, between 15-20cm long and each weighing about 450g each. When the pods are ripe they change from green to yellow, red or orange. Each pod contains about 20 or more seeds which when dried are the cocoa beans of commerce

Figure 4 Dried cocoa beans

There are three broad types of cocoa FORASTERO, CRILLO and TRINITARIO. Trinotario is a hybrid of Forastero and Crillo. Within these types are several varieties. FORASTERO forms the greater part of all cocoa grown. It is hardy and vigorous producing beans with the strongest flavour. AMELONADO is the Forastero variety most widely grown in Africa and Brazil. It has a smooth yellow pod with 30 or more pale to deep purple beans. CRILLO which has a mild or weak chocolate flavour is grown in Indonesia, Central and South America. Crillo trees are not as hardy and they produce softer pods which are red in colour, containing 20 or more white, ivory or very pale purple beans. TRINITARIO plants are not found in the wild as they are cultivated hybrids of the other two types. Trinitario cocoa trees are grown mainly in the Caribbean, Cameroon and Papua New Guinea. The pods are variable in colour and they contain about30 or more beans.

3.1. Social and Environmental conditions of Cameroon Cocoa

In Cameroon, 90% of the rural population is estimated to be engaged in small-scale agriculture (Robiglio *et al*., 2010) including cocoa production. Agriculture plays an important and strategic role in the revival of Cameroon national economy and cocoa (*Theobroma cacao* L.) remains a major export crop in Cameroon. Cocoa has long played a vital role in Cameroon's economic development (Armathé *et al*., 2013), and remains an important source of income for approximately 1.4 million people (KIT Royal Institute, AgroEco/Louis Bolk Institute, & Tradin, 2010). Its production is mainly by peasant farmers who do not earn sufficient income to meet their needs and maintain a moderate standard of living. They are left to suffer, which endangers the cocoa sector and their entire livelihood (Tcharbuahbokengo, 2005).

3.2. Genesis, Cocoa Production niches and Production in Cameroon

Figure 5 Localisation of Cameroon in the world

Cocoa production was introduced in the coastal zone of Cameroon since 1892 from South America. Cameroonian cocoa belt represents about 37% of total cultivated soil of the country. With about 180.000tons, Cameroon is among the leading cocoa producers in Africa. Cocoa is grown mainly in the coastal zone, the Centre, South and East regions in the country. The coastal zone which is the most important cocoa production area in Cameroon, extends from the area around mount Cameroon to kribi (Fig. 6)

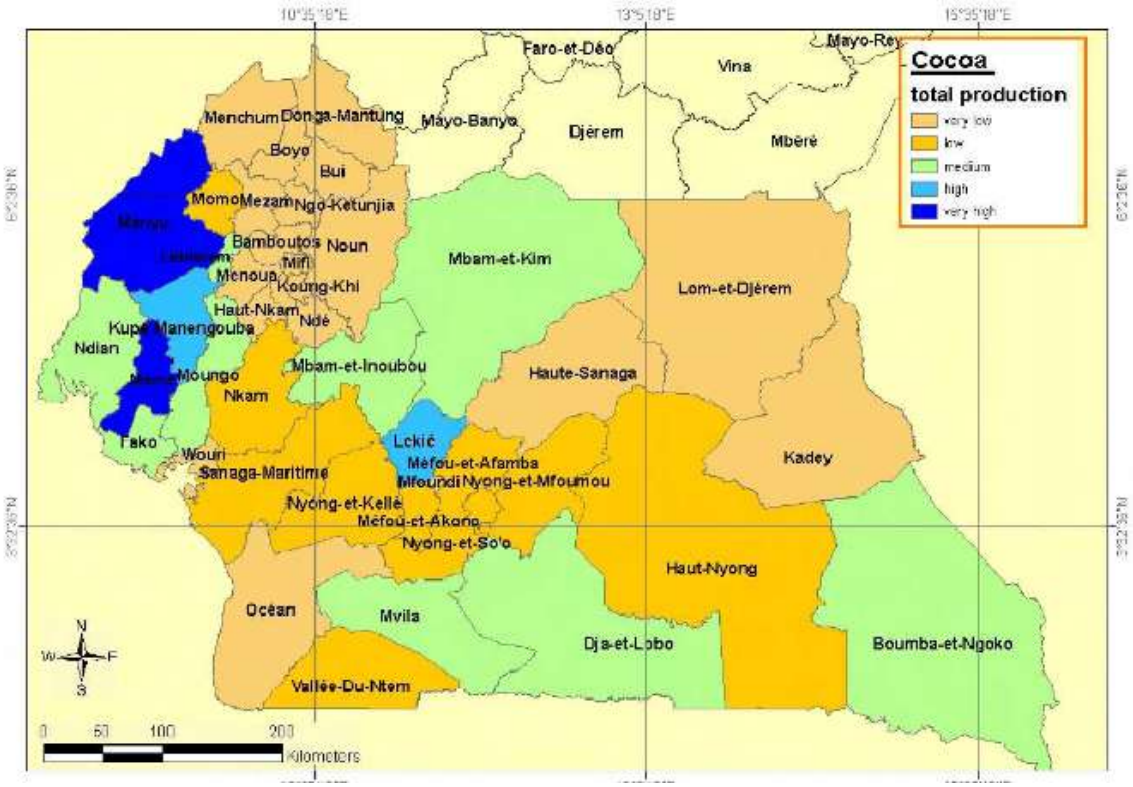

Figure 6 Main coca producing areas in Cameroon

About 50% of Cameroon's cocoa beans come from the South West, 35% from the Centre and 15% from the South East Regions (CAMACO, 2010). Out of the total cultivated area in the South West Region, about 40% comes from Meme Division, 11% from Fako Division, 14% from Kupe Muanenguba and 25% from Manyu Division (Delegation of Agriculture and Rural Development, 2007). Results from a survey carried out by Gockowski and Mva Mva (2001) showed that production systems in the Southwest were higher yielding and more intensively cropped relative to the other regions. The mean yield per ha of productive cocoa in the Southwest (446 kg/ha) was roughly twice as great as the other regions. Cocoa season runs from August to July with peak harvest from October to January/February, then, a light crop harvest from April/May to June/July. Cocoa is commonly intercropped with coffee, maize, plantain/banana, oil palm, cassava, pineapple, aroids and citrus fruitsThe attitude of cocoa producing areas is generally below 400m except in areas around mount Cameroon where altititudes are a bit higher. The second most important area covers the Centre, South and Eastern regions. The attitude ranges between 500m and 850m. The mean temperature is around 25°C and the mean annual rainfall between 1500mm and 2000mm. The two major climatic variables which are important in determining cocoa growth are temperature and rainfall (ICCO, 2011). Cocoa generally requires high temperatures with a maximum annual average of 30-32°C and a minimum average of 18-21°C. Average daily maximum temperature exceeding 33.5°C should not be more than 1 month. Variations in the yield of cocoa trees from year to year are affected more by rainfall than by any other climatic factor. An annual rainfall level of between 1500mm and 2000mm which is well distributed is good for cocoa production. Dry spells where rainfall is less than 100mm per month should not exceed three months (ICCO, 2011). Apart from these natural factors, other factors such as capital, labour, cocoa prices and the number of years of farming (experience) are very essential in determining cocoa production. All these determinants have, over the years, influenced the production of cocoa.

Between 2003 and 2007, the cocoa sector contributed about 0.89% to 1.45% of Cameroon's gross domestic product and accounted for between 5 to 9.6% of annual total export revenues. Annual production in Cameroon grew from 120,619 tons in 2000 to 225,000 tons in 2013 (NCCB, 2014), making Cameroon the fourth largest producer of cocoa in the world after Côte d' Ivoire, Ghana, and Indonesia (ICCO, 2014). Cocoa farming is thus a major source of foreign currency, accounting for approximately 15% of total annual exports revenue in 2009 (KIT Royal Institute, AgroEco/Louis Bolk Institute, & Tradin, 2010), and 2.1% of Cameroon's Gross National Product (Armathé et al., 2013).

In the 2014/2015 year, Cameroon exported 188,129 tons (with 100,000 tons of certified cocoa) to eleven (11) countries with The Netherlands welcoming over 73 percent of Cameroon's beans, followed by Belgium and Germany. The official balance sheet showed that 85 percent of Cameroon's cocoa was shipped to Europe

3.3. Evolution of cocoa production in Cameroon

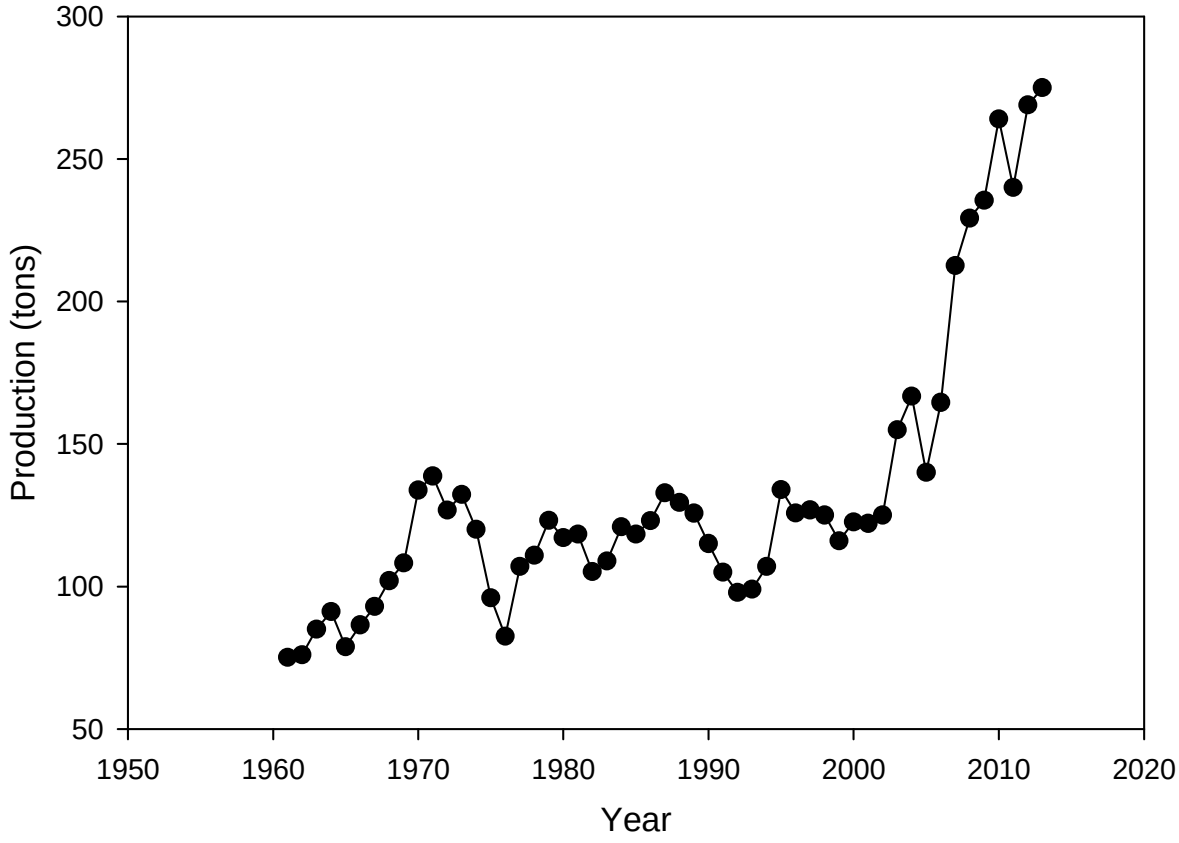

Figure 7 Annual production of cocoa in Cameroon

Cocoa production in Cameroon has been increasing since its introduction in the country (Fig.7) . Following the drop in the sale prices of cacao in the international market, cacao farmers experienced an unpleasant drastic drop in their incomes. The drop in the international market price in the early 90s resulted in a drop in production and land area (Fig 7 and 8) devoted to the crop. Local prices per kilogram fell from 450 frs CFA to 150 frs CFA in 1997 and from 1200 frs. CFA to 400 frs CFA in 2004 (Tcharbuahbokengo, 2005).

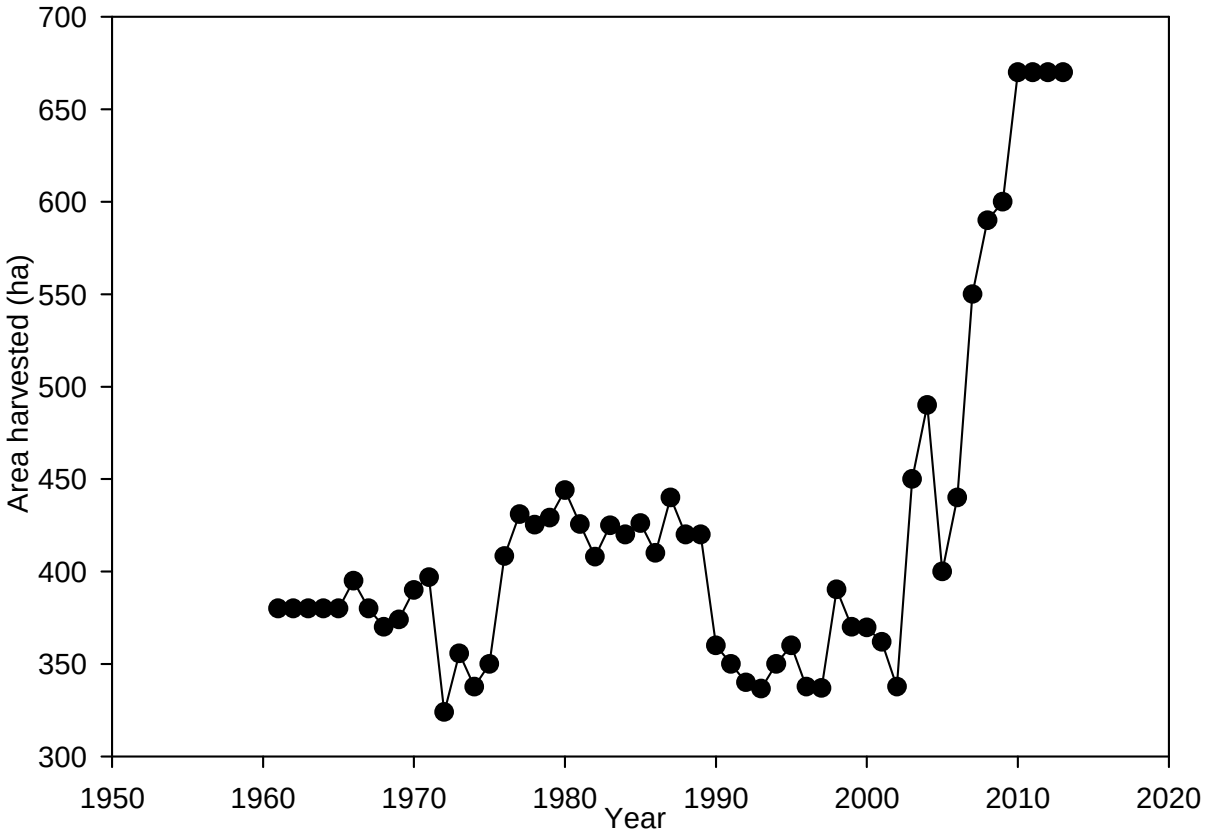

Figure 8 Evolution of area harvested for cocoa in Cameroon

The increased production over the past few years are due to increase in the area of land cultivated (Fig. 8) and due to improved production techniques. Our survey results (Fig. 9) show than many farmers cultivate less than 1 hectare of land.

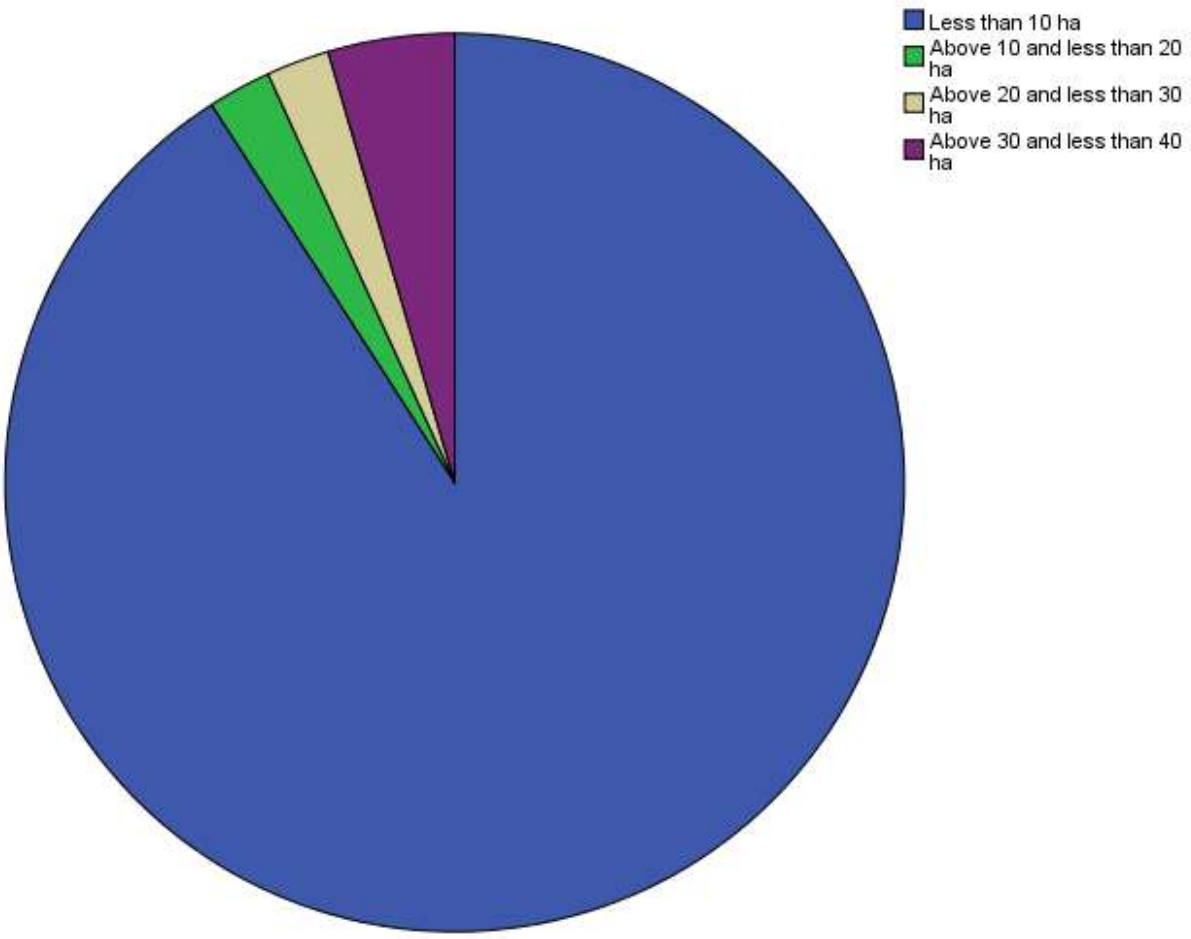

Figure 9 Average land area cultivated per household

Most of the farmers (18%) have farm size of 1 ha though some farmers have farms greater than 20 ha. However, very few farmers have sizable farms due to lack of means to manage the farms. The requirements needed to manage farms include labour force, inputs and drying facilities.

4. Social and Environmental bottlenecks in the Cameroon Cocoa sector

The socio-environmental drawbacks in cocoa production include gender inequality, access to credit, know-how, marketing conditions, crop age and chemical inputs.

4.1. Gender issues

It has been shown that gender disparity exists in the cocoa growing communities of Cameroon. Women produce about 80% of subsistence food on mainly small family and

rented holdings to meet family needs and to supply the local markets. These women-married, single or divorced - are victims of discriminatory cultural practices and inappropriate legislation which deprive them from either owning land or from inheriting land. Due to inadequate education and training, these women implore rudimentary farming techniques with resultant low production and productivity. Due to the poor road infrastructure, some of their food cannot get to the desired markets. Due to lack of skills in food conservation techniques, about 30% of their produce is lost. These women do not have access to credit to expand their lands, produce and make more money for themselves, families and communities. The men on their part dominate the cash crop production of coffee, cocoa and tea, palms etc and use above 5 hectares of land at any given time. These men are assisted in the cash crop production by most of these women. Land laws clearly favour men who either inherit or buy large parcels of land which they exploit or rent out at huge sums to big companies. Women are also strongly disadvantaged when it comes to extension services, marketing and control of proceeds. However, Bisseleua et al.(2008) found that widows and single mothers have more control over land for cocoa production, marketing and thus receive more revenue than married women. They proposed the following pro-active policies that could improve the livelihood of women cocoa producers:

1. Equal access to formal land ownership, including married women through promotion and use of co-ownership clauses
2. Equal or, initially, preferential access to extension services for women producers to grant them equal access to information, inputs, pest controls and fertilizers
3. Support in terms of credit access and the adoption of new technologies for women
4. Greater control over the marketing process through support for dedicated marketing channels for female producers (e.g. creation of female cooperatives)

4.2. Access to Credit

Agricultural credit schemes are indispensable to assist farmers to acquire basic agricultural tools, improved planting material, hire labour and transport facilities. This was realised by the early credit schemes developed in Cameroon. From the 1960s, through the 1980s, the government financed agriculture in Cameroon through the farmers' bank, FONADER. This institution supported small farmers by providing them with credit facilities for increasing agricultural production. The World Bank supported FIMAC (Investment Fund for Agricultural and Communal Micro Projects) scheme was also operational in the 1990s and gave out credit schemes to cocoa farmers operating in the country (Fonjong, 2004). Presently, most cocoa farmers rely on the rotatory loan and saving groups ('tontine') which are owned and operated by the communities themselves and cannot provide adequate funds to all farmers. Source of finance is therefore a major handicap in cocoa production in particular and agriculture in general in the country. Following the liberalization of the cocoa sector, many cooperatives have been unable to

compete against new traders/exporters that have access to cheaper internationally raised finances. Membership in the cooperatives has reduced tremendously. There has also been a proliferation of common Initiative groups with no basic structures, making the markets to be chaotic.

4.3. Level of education of Farmer

It has been demonstrated that differences in education levels is an important aspect of capacity building that influences labour productivity with regard to investment decision making. (Lockheed (1987), found that four years' of schooling increased farmers' output by 8.7% while Perrin and Winklelmann (1976), found that farmers invested on high pay-off inputs such as hybrids based on their levels of educational. The data collected in our research area is presented in table 1.The educational background of the farmers is appreciable and in addition,52.3% of them had undergone some training in cocoa production. However the picture is same for the other cocoa producing areas where farming has been relegated to the old and illiterates. The more farmers educated, the better the cocoa production system in the country.

Table 1 Level of Education of cocoa farmers in the study area

Educational level	Percent
Illiterate	2.3
Primary	43.2
Secondary	43.2
University	11.4

Training and capacity building for the local communities is a key incentive mechanism for enhancing sustainable intensification and diversification schemes in Cameroon. For instance, if farmers are to be engaged in modern cocoa production techniques such as propagation techniques, intercropping etc, it is crucial that farmers are educated because the local extension workers may not always be there to assist. Agriculture extension services of the Ministry of Agriculture and Rural Development (MINADER) provides extension workers who disseminate information to rural farmers about proper agricultural practices such as proper soil conservation and seed multiplication techniques, regeneration of old farms, and the importance of agricultural common initiative groups. However, the agriculture extension workers that provide extension services to farmers in Cameroon have not only decreased, but the few who are available, work under appalling conditions (Fonjong, 2004).

4.4. Marketing conditions

The lack of proper access to market for their produces cannot enable cocoa farmers reap the true potential of their efforts and as a result, they are exposed to selling their products at cheap prices to middle-men (brokers) who take advantage of their efforts. In general, the prevailing state of the roads in the cocoa producing areas is deplorable. In such poor road conditions it becomes

extremely difficult to transport cocoa from the remote locations where the farms are located to the market. 

Figure 10 Poor farm to market road infrastructure

In addition, 72.7 % of the sampled cocoa farmers were not members of cooperatives and had lower selling prices perhaps because their cocoa quality was lower and also because they had a lower bargaining power. However, they had a higher profit margin thanks to the fact that they did not rely on hired but rather family labour (this is in accordance to the African myth that children are a source of wealth for family heads) and equally because very few of them buy farmland since most of the farmland is inherited. “I do not know exactly when these trees were

planted because my father inherited the cocoa farm from his father" acknowledged one of the farmers. 

Figure 11 The lacale of a cocoa farmers union

4.5. Crop and Farmer age

The crop age in Cameroon is a contributing factor to the poor yields observed. Our results show that a significant number of cocoa farms are between 40 and 50 years (Fig.)

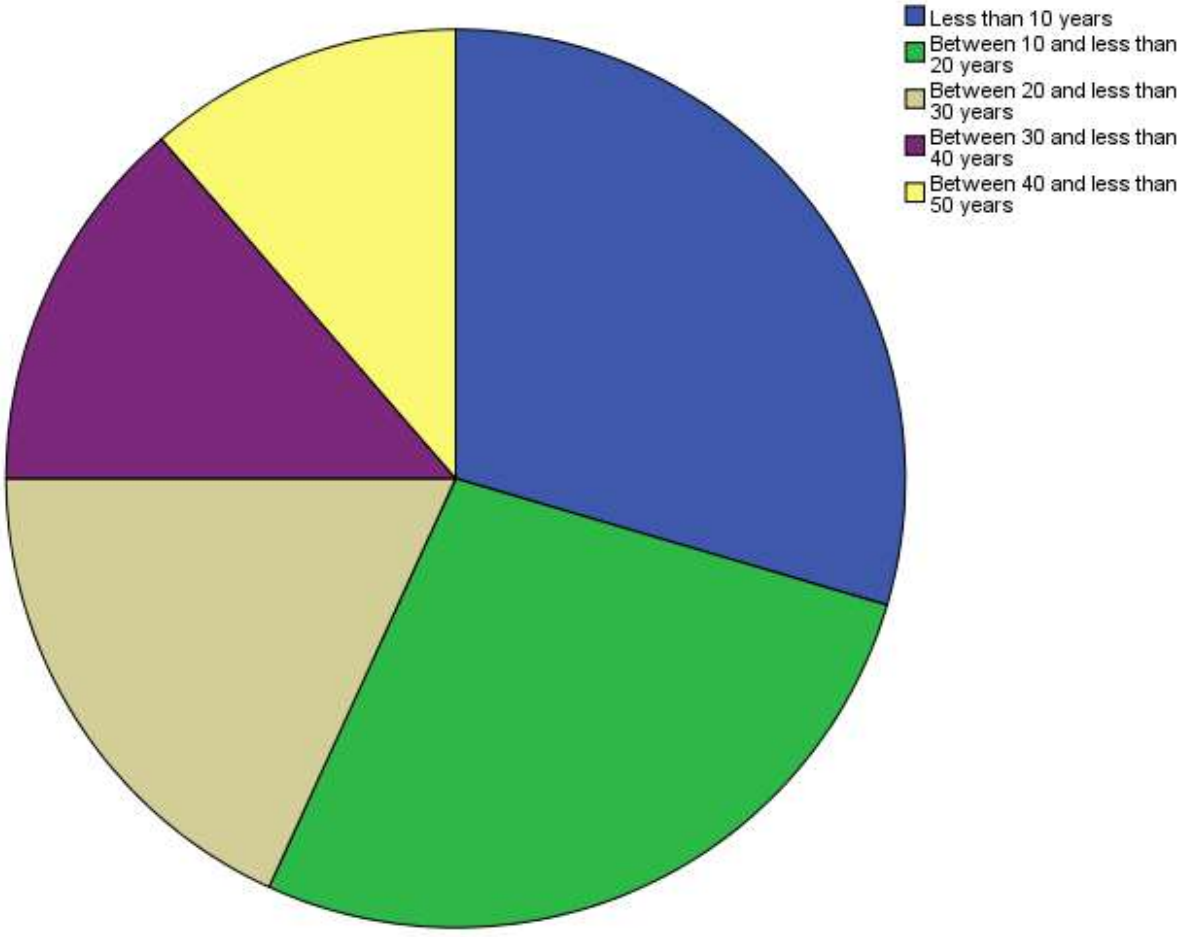

Figure 12 Age of cocoa farms in the study area.

The economic lifespan of cocoa trees varies from 25 to 40 years, depending on the variety. At the age of 40 the tree productivity is low compared to 10 years of age (cocoa productivity follows a bell shape distribution function). A transplanted tree requires 4 years to produce fruit. It however differs from variety to variety, but on average, the first harvest is almost negligible, although grows exponentially until about 10 years of age, then begins to decline at about 20 years of age.

Among the social factors that influence the under productivity is the physical old age of the cocoa farmers (Table 3). This is as a result of rural-urban exodus of youths to fetch for white collar jobs in the cities. "Young people today always think that they can achieve success in life in an office in town," said a 49-year-old farmer in the Centre Region, who quit university in 1987 to grow cocoa.

Table 2 Sample of age range of cocoa farmers.

Age range of farmers (years)	Percent
20-29	6.8
30-39	18.2
40-49	22.7
50-59	38.6
≥60	13.6

4.6. Chemical Inputs

Another production constraint is the application of nutrients. Most of the cocoa farmers are unable to apply substantial amounts of fertilizers in their farms because of lack of financial means. In our survey, we noted that 34% of the farmers applied no chemical fertilizer on their farms while only 2.3% could apply as much as 700 kg/ha/year of chemical fertilizer on their farms. Nutrients exported by harvested beans and pods need to be replaced in order to have high yields

The cocoa plant grows best on high nutrient content coarse soil with a depth of 1.5m allowing for good root development, water retention and drainage. A pH of 5.0 – 7.5 with 3.5% of organic matter in the top 15 centimetres and nitrogen/total phosphorus ratio of 1.5 are necessary for optimal growth (Coulibaly, 2012)

Table 3 Results of soil analysis of the study area

Variable	Santchou	Melong	Mbanga	Mbam et Kim
pH20	5.45b	4.94b	5.40b	6.38a
pH Kcl	4.81c	4.43c	5.00b	5.88a
OC (%)	0.87	1.27	1.01	0.87
Organic matter (%)	1.50	2.19	1.75	1.50
N total (g/kg)	2.02b	2.27a	2.21a	1.76c
C/N	4.36	5.20	4.50	4.94
Calcium (meq/100g)	4.08b	3.48b	7.80a	9.32a
Magnesium (meq/100g)	1.30	0.86	1.76	0.96
Potassium (meq/100g)	0.09	0.10	0.13	0.12
Sodium (meq/100g)	0.04b	0.04b	0.17a	0.05b

Phosphorus (mg/kg)	11.41b	13.14b	24.87a	9.56b

Crop production involves a complex interaction between the environment, soil parameters, and nutrient dynamics. Because of this fact, the soil must be studied in terms of the productive potentials. Soil fertility decline is considered as an important cause for low productivity of many soils (Sanchez, 2002). The ranges of the results of some soil chemical properties of the various sampling locations are presented in Table 2. The organic carbon, organic matter, Carbon/nitrogen ratio, calcium, magnesium and potassium contents were not significantly different amongst the locations. The organic matter of soils includes the remains of plants, animals and microorganisms in all stages of decomposition. The level of organic matters in soils influences a number of soil chemical and physical properties. Based on available data on soil guidelines, the data in Table 2, the organic carbon falls within medium (Karageorgis, 2005). Mbam et Kim showed a relatively higher pH value compared to other locations while Melong and Mbanga had higher total Nitrogen while Mbam et Kim had the least. While soils in Mbam et Kim are close to neutral, the soils of the other locations tend to be more acidic. The effect of soil pH is profound on the solubility of minerals and nutrients. It is regarded as a useful indicator of other soil parameters. The results provide useful information about the availabilities of exchangeable cations (e.g Ca^{2+}, Mg^{2+}, K^{+}, e.t.c) in soils. Most minerals and nutrients are more soluble or available in acid soils than in neutral or slightly alkaline soils. The highest sodium and phosphorus levels were recorded in Mbanga. The CEC is a measure of the soil's ability to adsorb (and release) cations. It is highly needed for the estimation of contaminant, transport potential and sorption capacity for any soil location i.e. the total number of cations it can retain on its adsorbent complex at a given pH. The exchangeable cations occur in low to very low concentrations, with calcium being the most abundant (Table 2). These values falls within low to very low CEC based on EPA's ESES guidelines (Russell and Dennis 2000). The presence of these low values of CEC indicates the presence of less clay and organic matter (Liber et al., 1996). Based on the data in Table 2, even when the exchangeable K is assumed as available K, the value was very low (0.09 – 0.12 mg/kg) for all the locations. Previous researcher suggested the application of potassium fertilizer to soils with exchangeable K of < 0.30 mg/kg fertilizer (Adiningsih and Sudjadi 1983; Yost et al. 2006). The application of fertilizer and manures may be necessary for all the sampling locations and the other cocoa producing areas of the country for improved cocoa productivity (Lal 2000; Wade and Sanchez 1983).

Figure 13 Disposal of cocoa shells on farm

Figure 14 Cocoa shells

Owing to fact that most farmers (34 %) are unable to purchase chemical fertilizers and also the fact that most of the farmers apply negligible quantities of this input, the cocoa produced in this area is not different from organic cocoa production systems. However the crop remains that are obtained after extracting the beans (Figures 13 and 14) could be transformed into organic manure

that the farmers can use in their farms. When these empty pods are disposed on the farms (Fig. 13), they could serve as hosts of some cocoa pests and diseases.

Figure 15 Disposal of pesticide packagings

Negligible amounts of fungicide are applied by farmers due to lack of financial means. About 6.8% apply no mineral fungicide and 2.3% apply 18.5 kg/ha/year, which is the highest dose that we recorded. . In the same light 29.5 % applied barely 1kg/ha/year of insecticide while only 2.3% apply as much as 60 kg/ha/year. Among the most damaging diseases that attack cocoa are witches' broom (*Crinipellis perniciosa*), black pod (*Phytophtora palmivora, Phytophtora megakarya*), monilia (*Moniliophthora roreri*) and vascular streak dieback which can all be

treated by fungicides. The major pest is mirids (capsid) which causes crop losses.

Figure 16 Image showing diseased cocoa pod

Figure 17 A farmer explaining cocoa pest problems

5. Postharvest treatments of Cocoa beans

Figure 18 Modern cocoa drying facility (greenhouse)

The pulp is the substance that is seen immediately after the pod is opened. It is white, juicy and rich in fer mentable sugars such as glucose, fructose and sucrose. The pulp has a high concentration of acids, especially citric acid, and also has smaller amounts of other organic acids present such as lactic acid, and acetic acid (Schwan and Wheals 2004). During on-farm processing, this mucilaginous pulp is degraded by microbial fermentation, producing a running liquid. Fermentation, was considered as simply an easy way to remove the pulp to facilitate drying, but its importance to cocoa quality has been well established (Ardhana and Fleet 2003). Raw cocoa beans have an astringent, unpleasant taste and flavour. The final chocolate flavour is influenced by the origin and cultivar of the cocoa beans, on-the-farm fermentation, drying, roasting and further processing performed by the cocoa and chocolate manufacturer. (Leal *et al* 2008.)

The quality of the cocoa beans depends on the humidity and smoke residues which are influenced by the drying methods. Sun drying (Fig. 19) is the most common practice in the cocoa growing areas. However due to the high air humidity content, the cocoa beans require a very long time period to dry to the required moisture content before baging and comercialization. Efforts are being made by some cocoa farmer groups to use more modern and efficiant drying methods such greenhouses (Fig. 18)

Figure 19 Sun drying of cocoa beans

Figure 20 Oven for ddrying cocoa beans

Most cooperatives use oven driers (Fig. 20) most of which have worn out and contaminate cocoa beans with smoke thus reducing their quality.

Figure 21 Humidity tester used by some cocoa cooperatives

Figure 22 Weighing the dried cocoa beans

Figure 23 Dried cocoa beans in a bag

6. Environmental impact of the cocoa production system

Rural landscapes possess a strong potential for Reducing Emissions from Deforestation and forest Degradation (REDD+; van Noordwijk & Minang, 2009). Cocoa systems represent one of the agro forestry systems with a potential to reduce global warming (FAO, 2010). It has been suggested that with proper implementation of regulations to control illegal encroachment into the forest, the promotion of increased productivity in cocoa agro forestry landscapes, through proper intensification pathways, is a strategy for limiting cocoa expansion and agriculture in general (Minang *et al*., 2014). Within developing countries, agricultural expansion is a leading cause of deforestation (Achard et al., 2002; Robiglio et al., 2010) making such strategies all the more pertinent. In Cameroon, cocoa plantations are often created by cutting down large areas of forest to plant food crops for subsistence purposes and cocoa for cash on the same piece of land (Kimengsi & Tosam, 2013). Cocoa is cultivated on an estimated total surface area of 450,000 hectares by smallholders who usually farm on 1 to 3 hectares of land (ICCO, 2014)

With regards to tree species richness, Bisseleua *et al*. (2009) found that there are about 9 tree species in old cocoa forest homegardens while mature intensively managed cocoa forest gardens contain five tree species on average. With regards to richness in herbaceous species, there are about 33 species in old cocoa forest homegardens and 26 species in mature intensively managed cocoa forest gardens. Gockowski and Sonwa (2011) estimated the carbon sequestration potentials of these systems as 104 tons/hectare).

In many cocoa producing areas, the crop has been a driver of deforestation replacing the original forest ecosystems (Ruf and Schroth 2004). In comparison to other land uses that replace intact forest, traditional cocoa production systems with diverse and structurally complex canopies are among the agricultural land uses that are most likely to conserve a significant portion of the original forest biodiversity (Rice and Greenberg 2000, Schroth et al. 2004). In our sampling area, many species were found in the different cocoa agro forests (Table 4). There were 9 species common in all the 3 zones sampled.

Figure 24 Some under-storey food crops in cocoa production system

Figure 25 Illustration of different strata in cocoa biodversity systems

Fruit trees, shrubs and other plants in cocoa agro forests occupy three levels of canopy, one below the cocoa plants level and, more importantly, one or two above (Ruf, 2011). As the level of biodiversity hosted generally depends on the quality and quantity of shade provided, cocoa agroforests where higher proportions of different shade trees are maintained is increasingly being viewed as a sustainable land-use practice able to complement biodiversity conservation (Asare, 2006), while satisfying ecological, social and economic requirements (Asare and Prah, 2011)

Table 4 Species and families recorded in cocoa farms of the sampled area

Zone	Number of Species	Number of Families
Santchou	15	13
Mbanga	17	14
Melong	16	13

Table 5 Common species found cocoa farms in Santchou

Common name	**Scientific name**	**FAMILY**	**Category**	**Relative density**	**Frequency**
Avocado	*Percea Americana*	Lauraceae	Fruit tree	0.50	4.17
Banana / plantain	*Musa spp*	Musaceae	Fruit tree	6.06	83.33
Cassava	*Manihot esculenta*	Euphorbiaceae	Food crop	6.90	62.50
Citrus	*Citrus sp*	Rutaceae	Fruit tree	3.03	4.17
Cocoa	*Theobroma cacao*	Malvaceae	Fruit tree	13.50	100.00
Coconut	*Cocos nucifera*	Arecaceae	Fruit tree	0.50	4.17
Cocoyams / taro	*Colocasia sp and Xanthosoma sp*	Araceae	Food crop	11.11	41.67
Coffee	*Coffea canephora*	Rubiaceae	Fruit tree	43.33	79.17
Guava	*Psidium guajava*	Myrtaceae	Fruit tree	0.50	4.17
Mango	*Mangifera indica*	Anacardiaceae	Fruit tree	0.50	4.17
Palm	*Elaies guineensis*	Arecaceae	Fruit tree	2.14	87.50
Pepper	*Capcicum sp*	Solanaceae	Fruit tree	0.76	8.33
Pineapple	*Ananas comosus*	Bromeliaceae	Fruit tree	2.19	25.00
Plum	*Dacryodes edulis*	Burceraceae	Fruit tree	0.72	29.17
Sugar cane	*Saccharum officinarum*	Poaceae	Fruit tree	8.25	25.00

Table 6 Common species found cocoa farms in Melong

Common name	**Scientific name**	**FAMILY**	**Category**	**Relative density**	**Frequency**
Avocado	*Percea Americana*	Lauraceae	Fruit tree	0.32	5.88

Banana / plantain	*Musa spp*	Musaceae	Fruit tree	3.75	94.12
bitter cola	*Garcinia kola*	Clusiaceae	Fruit tree	0.32	5.88
Cassava	*Manihot esculenta*	Euphorbiaceae	Food crop	4.77	70.59
Cocoa	*Theobroma cacao*	Malvaceae	Fruit tree	7.29	100.00
Coconut	*Cocos nucifera*	Arecaceae	Fruit tree	0.32	5.88
Cocoyams / taro	*Colocasia sp and Xanthosoma sp*	Araceae	Food crop	2.88	11.76
Coffee	*Coffea canephora*	Rubiaceae	Fruit tree	24.84	94.12
Cola	*Cola acuminate*	Malvaceae	Fruit tree	0.96	5.88
Maize	*Zea mays*	Poaceae	Food crop	31.95	5.88
Palm	*Elaies guineensis*	Arecaceae	Fruit tree	1.28	100.00
Pawpaw	*Carica papaya*	Caricaceae	Fruit tree	0.32	5.88
Pineapple	*Ananas comosus*	Bromeliaceae	Fruit tree	19.17	17.65
Plum	*Dacryodes edulis*	Burceraceae	Fruit tree	0.68	47.06
Quinqueliba	*Vepris heterophylla*	Rutaceae	Fruit tree	0.32	5.88
Sugar cane	*Saccharum officinarum*	Poaceae	Fruit tree	0.85	17.65

Table 7 Common species found in cocoa farms in Mbanga

Common name	**Scientific name**	**FAMILY**	**Category**	**Relative density**	**Frequency**
Apple	*Diospyros blancoi*	Ebenaceae	Fruit tree	0.76	4.35
Avocado	*Percea Americana*	Lauraceae	Fruit tree	1.01	26.09
Banana / plantain	*Musa spp*	Musaceae	Fruit tree	2.44	82.61
bitter cola	*Garcinia kola*	Clusiaceae	Fruit tree	0.76	4.35
Cassava	*Manihot esculenta*	Euphorbiaceae	Food crop	3.42	8.70
Citrus	*Citrus sp*	Rutaceae	Fruit tree	1.41	60.87
Cocoa	*Theobroma cacao*	Malvaceae	Fruit tree	53.90	95.65
Coconut	*Cocos nucifera*	Arecaceae	Fruit tree	0.87	30.43
Cocoyams / taro	*Colocasia sp and Xanthosoma sp*	Araceae	Food crop	23.19	47.83
Cola	*Cola acuminate*	Malvaceae	Fruit tree	1.06	43.48
Filbert or Hazlenut	*Corylus maxima*	Betulaceae	Fruit tree	1.52	4.35
Mango	*Mangifera indica*	Anacardiaceae	Fruit tree	0.76	4.35
Palm	*Elaies guineensis*	Arecaceae	Fruit tree	0.91	21.74
Pawpaw	*Carica papaya*	Caricaceae	Fruit tree	0.76	4.35
Pineapple	*Ananas comosus*	Bromeliaceae	Fruit tree	0.91	21.74
Plum	*Dacryodes edulis*	Burceraceae	Fruit tree	5.20	56.52
Quinqueliba	*Vepris heterophylla*	Rutaceae	Fruit tree	1.14	8.70

The inclusion of fruit trees into the cocoa agroforestry systems helps farmers obtain additional income from the system as portrayed in our sampling areas. Some of the crops included in the cocoa agroforest are used for other traditional activities because of their cultural values. Overall, these results suggest that cocoa farmers depend to a greater degree on biodiversity and, by extension, that biological diversity is related to cultural diversity.
Research institutes and university researchers have made significant contributions in the cocoa value chain. 

Figure 26 Illustration of the set-up in a cocoa research unit

Mounjouenpou et al. (2014) carried out a study focused on building the capacities of women cocoa farmers of Mbalmayo and Mbangassina regions for sustainable improvement of their livelihoods. Through field trips, meeting with village groupings and inquiries from individuals and groups, 185 women were interviewed and trained on the manufacture of cocoa butter, cocoa powder and soy-chocolate drink. Cocoa butter was among others, the most adopted innovative product, followed by cocoa powder and soy-chocolate drink. The training contributed to women becoming more efficient in their household management and enabled them to start generating more income due to the commercialization of the surplus of process product, and also contribute to the household charges.
In Cameroon there are specialized cocoa research Institutes. These Institutes handle everything concerning cocoa research. However, there is a shortage of cocoa nurseries while seedpods and seedlings production as well as distribution are in very limited capacities.

National Institutions involved in the cocoa production system
The local bodies put in place to guarantee the efficient production of cocoa in Cameroon include:

I. The national office of cocoa and coffee with the French acronym ONCC. Created by the decree n° 91/271 of the 12th of June 1991, and latter modified by the

decree n° 97/141 of 25th August 1997. It is an administrative public establishment with a financial autonomy, placed under the supervision of the Ministry of Commerce. Its responsibilities are as follows:

- Provide the statistics of local cocoa and coffee markets
- Carry out export products inspection.
- Technical inspection of quality control organizations, factories and storage facilities before official approval
- Protection and promotion of the image and trademark of Cameroonian origin products
- Follow-up of international accords of cocoa and coffee and representation of Cameroon in international cocoa and coffee organizations
- Carry out all studies in the cocoa and coffee domains assigned by the government of Cameroon
- Management of the information system INFOSHARE in the domain of cocoa and coffee in Cameroon.

II. Inter-professional Council of Cocoa and Coffee with the French acronym CICC.

It is a consultative organ that brings together different actors in the cocoa and coffee sector with representatives from the farmers, buyers, factory workers, local transformers, quality control enterprises and exporters.

Following the current legislation in force, the Inter-professional council has the following tasks:

- To provide propositions on all questions related to reform of the production and marketing systems of cocoa and coffee
- To determine the criteria in the cocoa and coffee marketing profession and provide moral standards for the smooth running of the operations
- To see to the application of laws that assure a healthy and loyal competition amongst the different members of the different professional organizations affiliated to CICC and respects the status
- To manage the mutual support and professional guarantee funds and to conceive a system of assurance and re-assurance using these funds.
- To provide all necessary support and/or services to all the professional organizations in the General Assembly in order to improve on the efficiency of the professional organizations.

III. Development funds of the Cocoa and Coffee sector with the French acronym FODECC

FODECC was created on March 2006 by the decree No 2006/085 of 9th March 2006 to increase the efficiency of the cocoa and coffee sector. Her principal mission is to support this sector through funding of projects aimed at protecting, increasing, and guarantying the production of high quality cocoa and coffee

- To represent the Cameroonian professionals in international cocoa and coffee organizations
-

IV. COMPANIES UNDER THE MINISTRY OF AGRICULTURE

1- The cocoa development company (SODECAO) for the Centre, South and East Regions
2- The South West Development Authority (SOWEDA) for the South-West Region,

The state carries out a series of actions in these principal production areas with the aim of

Improving the social and economic wellbeing of small-scale farmers and to contribute to the sustainable production of the ecosystem

V. Technical cell for the follow-up and coordination of the cocoa and coffee sector

At the level of the Prime Minister, a technical service was created for the follow-up and coordination of the cocoa and coffee sectors to assure coordination and transparency of the different operations in these sectors

VI. OTHER LOCAL ACTORS

Officially approved buyers

Associations of producers

Association of Exporters of cocoa and coffee **(AECC)**

Syndicate of Factory workers and buyers of cocoa and coffee of Cameroon (**SUACC**)

7. Labour source in the cocoa production system

Child labour, defined as activity which, by its nature and/or by the way it is carried out, harms, abuses, and exploits the child or deprives him/her of an education. Anyone below the age of 18 years is considered a child (IPEC, 2007). Gockowski and Mva Mva (2001) found that the more children present in the household and the larger the cocoa farm, the more likely the child is to work. They identified the following types of labour in cocoa production:

1. Own labour—defined as the producer's own labour input.
2. Extended family labour—Work provided by members of the producer's extended family.
3. Paid casual labour—Workers hired on a piece rate or daily basis to achieve a particular task.
4. Reciprocal labour—A nonmonetary labour exchange between the producer and a group of other individuals (usually other producers) where tasks are undertaken jointly by the group. Normally this involves adult workers although in certain instances the producer may enlist the participation of family children in the labour exchange as well.
5. Spouses' labour—The work contribution by the household head's spouse(s).
6. Family child labour—The work contribution by the children residing in the household.
7. Sharecropping—The supply of labour by a third party in exchange for a share of the harvest proceeds (typically one-half in Cameroon).
8. Hired extended family labour—Defined as workers hired on a piece rate or daily basis who belong to the producers' extended family.
9. Hired salaried labour—Defined as workers hired on a semi permanent basis that undertake the full range of tasks associated with the production of cocoa and most typically contracted and paid on an annual basis following harvest.

Owner labour supply has been identified as the most popular and involved more than 95% of the cocoa producing household while the smallest number of cocoa household (less than 10%) depend on paid casual labour of children less than 18 years (Gockowski and Mva Mva,2001).

Figure 27 Removing cocoa beans from the pods

Figure 28 Cocoa beans transferred to the stores at the end of the day

Their results on the number of cocoa producing household for different tasks assigned to children (ibid) showed that the most common task assigned to children is pod breaking while the least is to carry out cocoa fermentation. Other tasks include field transport, drying, pod harvesting, clearing/weeding, and pesticide application. With respect to the proportion of total child labour by age, they found 17% of children less than 10 years, 23% between 10 and 14 years and 60% between15 and 17 years. With respect to gender, they found that 68% of the number of children employed were boys while 32% were girls.
Our random survey of 44 households on the number of children below 18 working on cocoa farms is shown on Fig. 29:

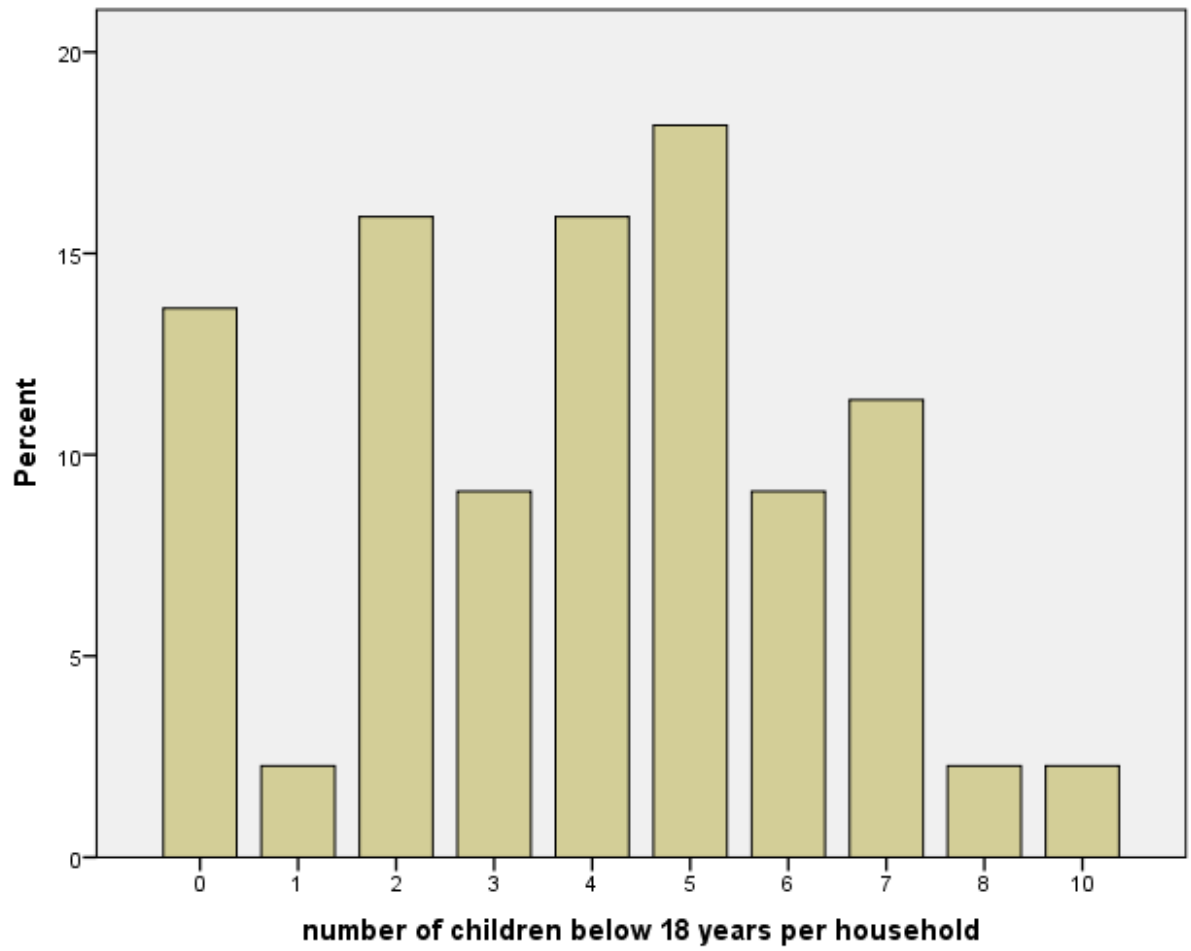

Figure 29 Number of children per household providing labour on cocoa farms

In general, child labour is very limited on cocoa farms. Most parents believe in a sound education for their children such that children are invited to work on farms either during the holiday periods or with the primary aim of educating them on farm activities.
Most cocoa cooperatives such as KOAFCOOP in the South West Region of Cameroon have developed labour policies which prohibit child labour in cocoa production systems.

Figure 30 Labour policy of KONAFCOOP

Measure taken by the International Labour Organization in Cameroon together with the local Non Governmental organization to sensitize the population on child labour issues in cocoa farms include:.

- The yearly exhibition by the American Embassy to sensitize the Cameroon population on the fight against child labour
- The tree crop Production, marketing and livelihoods project sponsored by the United States department of Agriculture and executed in the Centre and South West Regions of Cameroon by the International Institute of Tropical Agriculture (IITA)

This project is being implemented under four major components

- Production Activities
- Income generating activities
- Capacity building activities
- Micro credit activities

8. Quality Assurance

Alongside Konye in Meme Division of the South-West Region, the community of Ayos, in the Nyong and Mfoumou Division, is a key beneficiary of the COCOA ECO-PROJECT**,** thanks to a convention signed between SNV Cameroun and IITA (International Institute of Tropical Agriculture) to implement environmentally-suitable modern cocoa farming techniques aimed at; reducing cultivable lands to avoid wastage, introducing new hybrid plants and limit the use of pesticide to assure quality. This project through CACAO+, an 800 member cooperative lodged in the Division, will oversee the construction of a "*Cocoa Business Service Centre*" comprising a solar drying system, a storage facility and processing facility to grind cocoa into powder and butter. This venture is already near completion in Konye.

The Public Private Partnership Platform (PPPP) is at a decisive phase after two successful sessions so far. Cocoa processing would double to around 70,000 tons in the years ahead, thanks to a 3.2 Billion FCFA loan by government to boost the capacities of Sic-Cacaos, Chococam, the Company *Chérifienne Chocolaterie* as well as the establishment of new cocoa processing plants. Cameroon is making efforts to compete at all levels in the world cocoa market. The government is responding swiftly and favourably to these international cocoa market exigencies, through NCCB and international certification bodies to encourage and guide actors through this suitable path.

Since Telcar Cocoa Limited, a representative of Cargill, launched its certification programme in August, 2014 the quantity of certified cocoa has more than doubled.

According to official certification data, Cameroon certified over 10.000 tons of cocoa throughout the 2014/2015, up from 5446 tons in the 2013/2014 season and 2000 tons registered in the 2012/2013 season. It equally shows that certification is manned by three actors; Telcar Cocoa Ltd, AMS and SICCACAOS.

Certification is a key component to guaranteeing a sustainable cocoa sector in Cameroon and the cocoa farmers in all seven producing regions are happier by receiving one of the highest farm-gate prices in the world, from 1500 FCFA/Kg to 1530FCFA/Kg.

At the heart of Cameroon's ambitious plan is a drive to rejuvenate its trees, many of which are a half-century old.

The government sees a solution in the Biofabrica growing technique developed by Brazil’s cocoa research institute CEPLAC, which selects and nurtures millions of disease-resistant high-yield cocoa seedlings for planting.

The launching of the cocoa fund by the Government of Cameroon shall have a great impact on the sustainability of the cocoa economy

- The Cocoa Coffee inter-professional Board of Cameroon with its mission to guarantee a healthy and fair competition between operation within the sector, To facilitate transactions in internal markets and at exportation to defend the origin of our cocoa.
- The National Cocoa and Coffee Board of Cameroon with its policy to check on quality of our cocoa, collect statistic, facilitate export, and represent our cocoa industry abroad.
- The penetration of alternative markets such as the organic single origin, fair trade markets which offer a better return because of the price premium they earn. Some farmer’s organizations are already benefiting from this.

9. Conclusion

In order for cocoa farmers in Cameroon to contribute their part to meet the rising cocoa demand in the world, certain critical factors need to be addressed. These include:

- Knowhow of the farmers - Lack of education in all forms has had significant negative contributions in cocoa producing communities, rendering almost every family helpless. These communities generally depend on their traditional lifestyles and they remain voiceless in decision making about their own resources. Issues of poor knowledge cover all activities from production through to marketing. These local farmers are thus confused with adjustments due to privatization, marketing channels, modern production and postharvest techniques
- Poverty – Which limits capital availability to farmers that can enable them obtain adequate inputs, transportation, processing and storage facilities

- The contribution of the government – The government needs to protect the farmers by sanctioning middle men who use fake scales when buying cocoa from local farmers, educate the local farmers on what privatization is all about.
- Additionally, potential for the organic cocoa production can also be realized through cocoa certification (fair-trade) so that the farmers can benefit from a premium as well as through the possibility of transforming cocoa beans at least into grindings and cocoa butter before exporting it out of the region. Since all these entail huge financial costs that would yield profit only in the long run, the government can facilitate farmers with access to credits and technical support. It is worthy to note that, faced with the challenges of climate change, it is important to maintain cocoa farms at a small scale of say 5 hectares maximum that would enable the famers to monitor their farms effectively without running the risk of incurring extra costs accruing from moral hazard.

Based on the soil analysis results, it is obvious that the dominant limiting factors of soil fertility include low organic matter content, low exchangeable minerals nutrients such as K and low soil CEC. Consequently, cocoa farmers are advised to increase organic matter for better soil CEC, and water holding capacity. This may include addition of farmyard manure, green manures, and/or crop residues and inorganic fertilizers. As regards the contribution in biodiversity services, the type of trees and plants that farmers maintain or introduce in the cocoa agro forests varies between regions, according to local availability and soil characteristics, to smallholders' needs in terms of family own use and depending on the capacity of the planted trees to provide additional income.

One strategy to increase income for cocoa growers is to exploit other cocoa-based products in addition to the cocoa seed crop. Generally, most of the cocoa beans are used in the production of cocoa products such as cocoa butter, cocoa powder, chocolate and chocolate-related products. However, cocoa beans constitute only 10% of the fresh weight of the cocoa fruit. This means that only about 10% by weight of the cocoa fruit is commercialized while 90% by weight (mainly cocoa pulp and cocoa pod husk) is discarded as cocoa waste. Moreover, cocoa pod husk poses a serious waste disposal problem in most cocoa producing countries. Several promising commercial products can be obtained from these cocoa by-products (Figueira *et al.* 1993). Cocoa pod husk can be transformed into animal feed, potash (used for soft soap making) and pod gum (used as binder in the pharmaceutical industry) while cocoa pulp can be used for making juice, soft drink, alcohol and pectin (for jam, jelly and marmalade).

The future of cocoa production in Cameroon will also depend on the contributions of the supermarkets in contributing to the wellbeing of cocoa farmers that will ensure sustainable cocoa production.

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