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Agroforestry typology of some cocoa based agroforests in the Mbam and Inoubou division: The importance for local population livelihoods

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In order to estimate agroforestry typology of concerned cocoa based agroforests, a study was carry out in the Mbam and Inoubou division, Centre region of Cameroon. It focalized on farmer's agroforests diversity strategies and the relationship between these systems and associated fruit trees planted to raise the revenues. To achieve this goal, 26 sampling plots of 100 x 40 m has been establish in cocoa based agroforests in six rural villages. Inventories conducted in 10.4 ha reveal the presence of 1642 plants species, grouped into 59 species, 41 genera and 25 families. Moraceae, Sterculiaceae, Rutaceae, Mimosaceae, Bignoniaceae, Euphorbiaceae, Anacardiaceae and Arecaceae appears as dominant families and the common genera were *Albizia, Citrus* and *Ficus* representing four species each. The average tree density calculated was 172.166 stems per hectare. In terms of species richness and diversity, the Shannon index found was 4.63 and 0.042 was the Simpson index while the Pielou Equitability was 0.46, highlighting the diversity as well as the stability of these types of agro-vegetations. These cocoa plantations are also well diversified with the presence of many associated fruits trees species. A total number of 19 exotic fruits trees species were recorded and among them, only eight species were found indigenous or native. The most frequent exotic tree species was *Mangifera indica* found in all sampling plots. This study emphasizes the importance of agroforestry systems in the improvement of local livelihoods regarding the frequency of associated edible fruits species, integrated voluntary by farmer to increase their income and thus fighting against poverty and maintaining their wellbeing during the less or unproductive season of cocoa fruits.

Key words: Agroforest, Cameroon, cocoa tree, exotic species, farmer's livelihoods, Mbam and Inoubou, species richness and density.

INTRODUCTION

Cameroon is part of the Congo basin, which is a vast floristic region, that comprises 10% of the world's remaining tropical rain and moist forests and forms the second largest block of rainforest after Amazonia. Cameroon's forest with over 23 million hectares (11% of the Congo basin forests) (Letouzey, 1985; Satabié, 1997) is the second largest area in terms of forest cover in Africa after Democratic Republic of Congo (DRC).

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Among Cameroon's ecosystems, 17 million ha of dense rainforests and almost 6.5 million ha of degraded and fragmented forests are founded. Coastal lowland rainforest, evergreen rainforest and semi-deciduous ecosystems constituted the three main groups of ecosystems covered by the Cameroonian tropical forests. The biodiversity is still rich and diverse with more than 8, 000 plants species, among which 156 are endemic species (Satabié, 1997).

Agroforestry can be as a combination of forest trees with crops, or with domestic animals, or both. It can also lead to the increase or sustainability of agricultural yields, while at the same time protecting forests. The cacao production in southern Cameroon has been pointed out as an ideal example (Sonwa, 2001). Agroforestry help to rehabilitate degraded land and promote food security through the use of nitrogen-fixing trees to restore crop yields and then the diversification of the farming system with new crops; to create income generation opportunities from village tree nurseries and the domestication of indigenous fruits and nuts for local and regional trade; finally aimed to encourage the processing and marketing of food crops and tree products in order to create employment and entrepreneurial opportunities for community members.

Cameroon is one of the countries, whose 50% of its area is quite occupied by forests and savannas. These areas provide non-timber forest products (NTFPs) especially those with high commercial value, which contribute by improving rural household income (Tabuna et al., 2004; Guedje et al., 2002). Accordingly, NTFPs trade has strongly grown since the early 90s at the national, subregional and international level (Ndoye and Ruiz-Perez, 1999; Tabuna, 2000; NGueko, 2005, Tchoundjeu et al., 2002). The country is classified among the highest cocoa producers of the African continent. This activity can occur both in forest areas and savannah. Farmers are aware of the vital and economic role that gives cocoa plantation. It allows them to better flourish and occur in many of their needs. There are several large basins production of this cash crop in Cameroon, including forest areas and savanna. This culture takes place in quite diversified plantations because of the need of shade that will be provided by trees associated. Generally, farmers combine many seedling trees to diversify their agroforest while enjoying the economic income that can provide all integrated fruit. By this end, these plantations must have a double meaning profitability. Cocoa in forestry area is quite strong and made by many farmers who are heavy producers. It benefited from the favorable climate that naturally brings their forest trees, unlike savanna areas where farmers must imperatively involve many tree plantations to make conducive culture. Cocoa based agroforests are classified among the most of types of land-use, frequently under transformation after logging. This type of land-use is found in the South Western, Littoral, Eastern, Central and Southern regions of Cameroon (FAO, 2002). The present study was conducted in the division of Mbam and Inoubou, Central Region of Cameroon. This transitional site is located between forest and savannah ecosystems, where cocoa-based agroforests establishment are still frequent or widespread (Ngaba Zogo, 2005). In fact, this area is classified among the most productive cocoa areas in the country (Sonwa, 2002; Jagoret et al., 2009).

Regardless the environmental plan, agroforests plantation implementation play major role and is considered to be an effective means of protection and stabilization of ecosystems (Tchoundjeu et al., 2002; Awono et al., 2009). Latest studies conducted in cocoa based agroforest in Cameroon where made in forest zones; some important works in this domain in Cameroon involve authors such as Losch (1995), Sonwa (2001, 2003) and Shikata (2007). The objective of this present work was to assess the impact of associated trees in the transition forest-savannah zone as compared to existing information in forest zone. This is possible after bringing out some appreciations according to the floristic composition and vegetation structure which diversify relevant cocoa based agroforests with emphasis on the presence of conophor nut, which is a local vine producing nutritive high value and commercialized seeds, commonly found in these rural cocoa based agroforest.

MATERIALS AND METHODS

Study area

Study has been conducted in the Mbam and Inoubou division of Cameroon (Figure 1) which is a transitional zone covered both by forest and savannah. This area is located between 4'39 and 4'49 North; then 11'4 and 11'19 East. Altitude varies from 600 to 900 m. Many types of soils can be found: lateritic soils with pH between 5 and 6, hydromorphic and raw mineral soils. The rainfall gradient is high in the northern part of the region (1500 mm) and goes to 1400 mm in the south and east. The average annual temperature is relatively high and constant (25.5°C) and minima are located between 19.7 and 19.8°C. The maximum relative humidity throughout the year varies between 95 and 98%, with the minimum between 51 and 74%. It is one of the most producing cash crops and cocoa basin area of the country due to its climatic variability. Our two sub-divisions site are surrounded in the northern part by Deuk and Ngoro; in the south by Bokito, Kon-Yambetta in the West and Ombessa in the east (Ngaba Zogo, 2005).

Data collection

Designation of villages was done randomly. In each village, the principle consist of inventoried all owner of conophor nut vine, that was the way orientating the study and the selection of the parcels. After identification of producers, a meeting was organized to visit and select these plantations where the plots of 40 x 100 m are materialized and all trees within the subsequent area inventoried. Then the selection of villages was based on the level of implication of farmers in the cultivation of this vine. At this level, it can be observed for higher productive villages, moderate and less productive one. Sometimes, many of them were not concern because of the lack of information concerning the vine. Using this methodology,

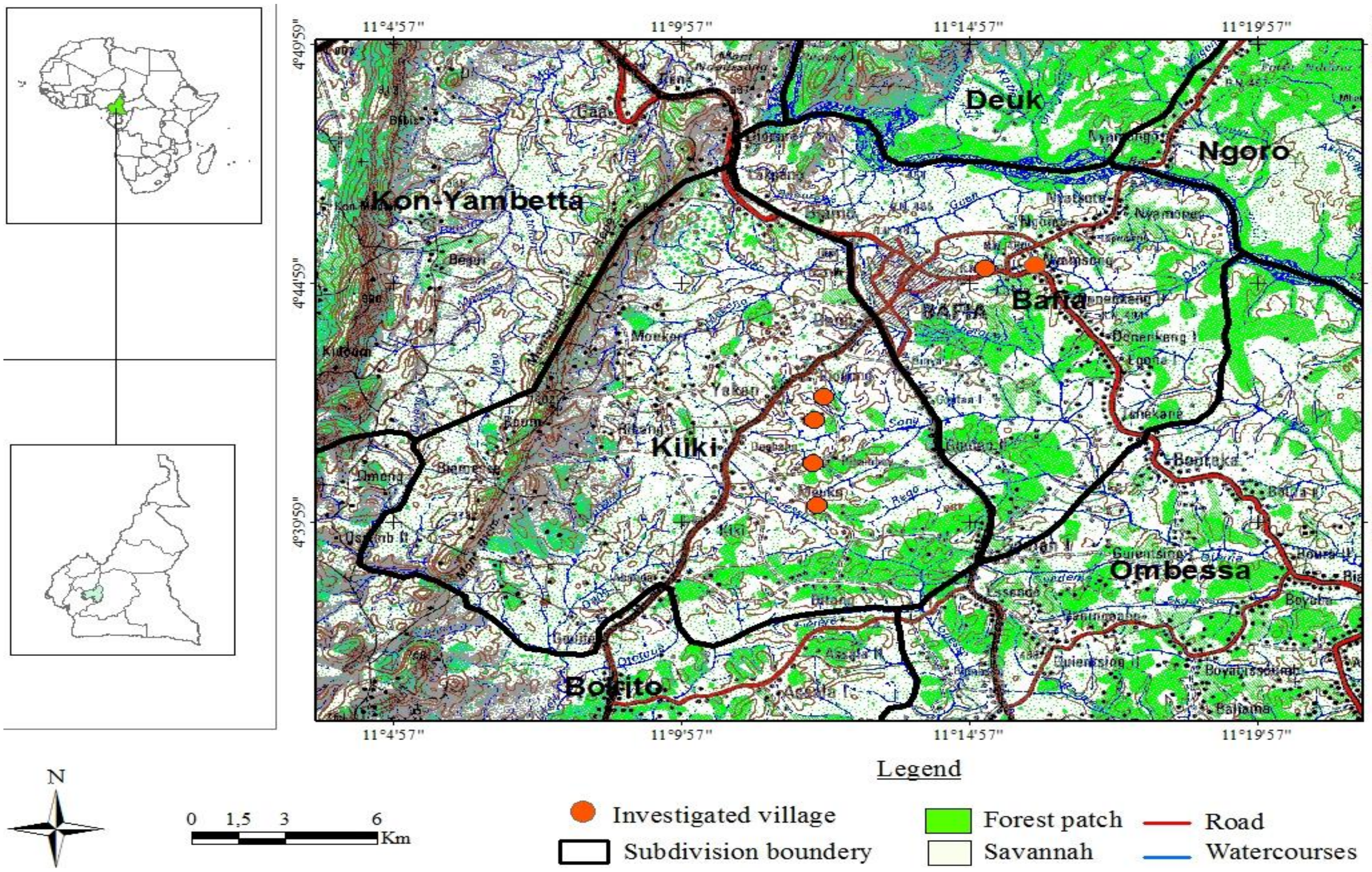

Figure 1. Location map of the study site.

we sampled a total of 26 plots in six villages (Nyamsong 3;Lable, Rionong 3; Gnouka, Doguem and Mouko). Each plot measured cover 1/3 or 1/2 total area of the agroforest depending on the level of implication of the farmer in cocoa cultivation. The greatest number of plots were in Mouko village (15 sampling plots, representing 58% of the total size), and Nyamsong 3 recorded 5 plots (19% of the total area). Doguem and Rionong 3 villages received respectively 2 plots representing 7.5% of the total area and Lable and Gnouka, one plot each, representing 4% of the total area. A total sampled area covered was 10.4 ha. Within each plots, all forest or associated trees ≥ 10 cm dbh (diameter at breast height) were enumerated and identified. Data collected using this method allows to determine the structural typology of cocoa based agroforest habitat. While sampling in the plot, each stem of liana (*T. conopohorum*) were also inventoried without major diameter. Any preference is given to the vine diameter because of the fact that the study is also focalized on the regeneration or integration dynamic of the vine in these ecosystems. This can well explain while the natural regeneration of this vine is still weak. All plants specimens were identified to species using various books, such as Letouzey (1982), Vivien and Faure (1985), then Wilks and Issembe (2000) and various volumes of flora of Cameroon. Voucher specimens were collected and preserved using standard techniques for herbarium collections. Identification of sample specimens was confirmed at the National Herbarium of Cameroon and Millennium Ecologic Museum. All vernacular names of plants were also collected help by our guides and/or farmers.

Data analysis

For the floristic analysis, all the data of each plot were pooled and the total number of species and individuals were tallied. Using the pooled data, overall species richness, genera and family level richness, stem densities per ha of vine and species diversity were calculated. We also determined the leading dominant taxa by calculating the species importance value index (IVI). Structural parameters were calculated using the following formulas:

Relative frequency = (Number of plot containing X specie/Total number of plot) X 100

Relative abundance = (Number of individuals of the specie/Total number of individuals) X 100

Relative dominance = (Total basal area of the specie/Total basal area of all specie) X 100

IVI = Relative frequency + Relative abundance + Relative dominance. Curtis and McIntosh (1950) defined this formula.

To assess diversity parameters and to calculate floristic diversity, Shannon index H' (H = - pi.lnpi, where pi is the proportion of i^{th} species) were used. We also calculated Simpson Index D' (D' = Σpi^2); the 0 value of this index indicate the maximum diversity while the value 1 characterize the minimum diversity. With the aims to have intuitive value, this Simpson Index can be also calculated using 1-D' formula. In this particular case, the maximum diversity was close to 1 and the minimum close to 0. At the opposite, is the Pielou Equitability Index, which is the proportion between observed and maximum diversity (Eq = H'/lnN). It can allow determining the species distribution within a sample. This method of calculation has been used by Sonke (2005), Fongnzossie (2011) and Eyoho Ewane (2012) in Cameroon.

RESULTS

Structural and floristic characteristics of cocoa based agroforests

A total 1642 plants were inventoried, belonging in 59 species, 41 genera and 25 families. These taxa were dispatched as follow: Mouko (941 individuals representing 57.36% of the total number of individuals), Nyamsong 3 (319 individuals representing 19.43%); Doguem (138 individuals, 8.40%), Rionong (98 individuals, 5.9%), Gnouka (75 individuals, 4.57%) and Lable (71 individuals, 4.31% of the total number of individuals). Among the plant family inventoried, Moraceae, Sterculiaceae, Rutaceae, Mimosaceae, Bignoniaceae, Euphorbiaceae, Anacardiaceae and Arecaceae were the common. According to the plant genera, the genus *Albizia, Citrus* and *Ficus* were represented by four species each, the genus *Markhamia* and *Cola* had respectively 3 species. The genus *Sterculia, Terminalia, Zanthoxyllum* and *Annona* processed respectively two species each. The rest (*Anthocleista, Antrocaryon, Borassus, Ceiba, Celtis, Cocos, Dacryodes, Desplatia, Draceana, Elaeis, Erythrophleum, Hymenocardia, Mangifera, Milicia, Musanga, Myrianthus, Persea, Petersianthus, Picralima, Polycias, Psidium, Pterocarpus, Pycnanthus, Ricinodendron, Spathodea, Spondias, Staudtia, Tectona, Tetracarpidium, Theobroma, Triplochiton)* were represented by only one species. *Theobroma cacao* was the plant species more representative with 59 stems/ha, representing 37.09% of the total inventories, follow by *Mangifera indica* (19 stems/ha, 11.69%) and *Tetracarpidium conophorum* (14 stems/ha, 8.71% of the total). Summing all, the tree density calculated was 172.166 stems per hectare.

The representation of abundance, dominance, relative frequency and Importance Value Index of inventoried species characterizing this farmer's cocoa based agroforests of the Mbam and Inoubou is well mentioned, as well as the relative abundance of some species found in major agroforest, following the inventories (Table 1).

Diversity of plants species

The Shannon index observed was 4.63. This index is higher when the species number was higher and their proportion neighbored. The heterogeneity index of Simpson was 0.042. Their transformation 1-D' = 0.95 indicates diversity of species. The value indicated that there exists 95% of probability to have 2 trees taken randomly which do not belong to the same species. The value of Pielou Equitability was 0.46 characterizing disturbed ecosystems.

Cocoa based agroforest plants diversification

The number of fruit trees was high; 790 stems or taxa representing 48.11% of the total individuals, follow by Cocoa trees (609 taxa representing 37.09% of the total individuals) and other trees species represented by 14.8% of the total individuals (Table 2). Mouko village recorded the higher fruits trees density (47.21%) while Gnouka recorded only 3.79%.

Diversification of Cocoa based agroforest by farmers

Major associated fruits plants found in the Mbam and Inoubou cocoa based agroforests were exotic fruits types. Indigenous fruits types were less represented with *Picralima nitida, Ricinodendron heudelotii, Dacryodes edulis, Tetracarpidium conophorum* and different species and varieties of *Cola* spp (Table 3).

DISCUSSION

The Mbam and Inoubou division were selected among many other regions such as Mintom; Mbangante, Eseka, Makak, Makenene, Ndikinimeki, Santchou and Kekem due to its proximity and its characteristic to be one of the best productive area of conophor nuts. Here, the number of species found compared to those inventoried by Eyoho Ewane (2012) in the south-west region of Cameroon was similar. This author inventoried 58 species associated in cocoa agroforest in this locality. Our results were less superior to those of Laird et al. (2007) with 50 species of trees and shrubs found in agroforests surrounding the Mount Cameroon. Bobo et al. (2006) found 204 species associated in cocoa based agroforests around the Korup national park of Cameroon. Sonwa (2004) has inventoried 206 species associated in agroforestry systems of south Cameroon and Zapfack et al. (2002) has recorded 116 species in some villages of the south Cameroon. All these data presents the variability of cocoa based agroforest in terms of integrated number of plant species or in term of farmer's trees preferences. The specific density of the present sampling area was 172.16/ha. This is greater than 14 found by Eyoho Ewane (2012) and 17.02 found by Bobo et al. (2006). Regarding all this, it was concluded that specific richness of some cocoa based agroforests depends on many criteria such as: forest proximity around or surrounding agroforests systems, proximity of a park or protected area, species richness (number of species found in a site) and diversity regularity (the manner by which the number observed N

Table 1. values of abundance, dominance, relative frequency and IVI of plants species characterizing cacao based agroforest of the 6 prospected area.

Scientific name	RA	RD	RF	IVI
Albizia adianthifolia	0.43	2.22	15.38	18.03
Albizia ferruginea	0.12	1.57	7.69	9.38
Albizia sp.	0.37	1.58	23.08	25.03
Albizia zygia	0.61	2.78	26.92	30.31
Annona muricata	0.06	0.28	3.85	4.19
Annona senegalensis	0.18	0.16	3.85	4.19
Anthocleista vogeliana	0.24	1.63	15.38	17.25
Antrocaryon sp.	0.24	0.2	15.38	15.82
Arthocarpus heterophyllus	0.06	0.43	3.85	4.34
Borassus aethiopicum	1.04	1.6	15.38	18.02
Ceiba pentandra	2.86	11.67	69.23	83.76
Celtis sp.	0.06	0.14	3.85	4.05
Citrus aurantium	2.07	2.4	73.08	77.55
Citrus limon	0.24	0.75	15.38	16.37
Citrus reticulata	0.30	0.47	19.23	20.00
Citrus sinensis	0.79	1.3	34.62	36.71
Cocos nucifera	0.79	2.13	34.62	37.54
Cola nitida	1.34	1.84	26.92	30.10
Cola rostrata	0.18	0.4	7.69	8.27
Cola sp.	0.30	0.49	19.23	20.02
Dacryodes edulis	7.37	5.18	92.31	104.86
Desplatia mildbraedii	0.12	1.08	7.69	8.89
Dracaena arborea	0.73	0.37	7.69	8.79
Elaeis guineensis	7.55	6.78	84.62	98.95
Erythrophleum suaveolens	0.18	0.54	3.85	4.57
Ficus etrangulator	0.24	1.1	15.38	16.72
Ficus exasperata	0.43	2.25	23.08	25.76
Ficus mucuso	0.49	4.17	30.77	35.43
Ficus sp.	0.12	0.85	7.69	8.66
Ficus vogeliana	0.06	0.21	3.85	4.12
Hymenocardia acida	0.12	0.21	3.85	4.18
Mangifera indica	11.69	10.45	100	122.14
Markhamia lutea	0.06	0.14	3.85	4.05
Markhamia sp.	0.18	0.75	11.54	12.47
Markhamia tomentosa	0.37	1.21	19.23	20.81
Milicia excelsa	0.43	1.82	19.23	21.48
Musanga cecropoides	0.12	0.53	3.85	4.50
Myrianthus arboreus	0.06	0.1	3.85	4.01
Persea americana	5.05	4.56	84.62	94.23
Petersianthus macrocarpum	0.18	0.75	11.54	12.47
Picralima nitida	0.06	0.3	3.85	4.21
Polycias fulva	0.06	0.15	3.85	4.06
Psidium guajava	0.49	0.89	19.23	20.61
Pterocarpus macrocarpus	0.06	0.73	3.85	4.64
Pycnanthus angolensis	0.18	1.77	11.54	13.49
Ricinodendron heudelotii	0.06	0.53	3.85	4.44
Spathodea campanulata	0.37	2.78	23.08	26.23
Spondias mombin	0.85	1.95	26.92	29.72
Staudtia kamerunensis	0.06	0.42	3.85	4.33

Table 1. Contd.

Sterculia sp.	0.37	0.49	19.23	20.09
Sterculia tragacantha	0.73	2.33	34.62	37.68
Tectona grandis	1.64	1.3	23.08	26.02
Terminalia schimperiana	0.73	1.42	23.08	25.23
Terminalia superba	0.12	0.49	3.85	4.46
Tetracarpidium conophorum	8.71	2.26	100	110.97
Theobroma cacao	37.09	2.97	100	140.06
Triplochiton scleroxylon	0.43	1.49	19.23	21.15
Zanthoxyllum macrocarpum	0.06	1.97	3.85	5.88
Zanthoxyllum zanthoxyloides	0.06	0.21	3.85	4.12

RA = relative abundance; RD = relative dominance; RF = relative frequency; IVI = Importance Value Index.

Table 2. Typology of plants species distribution according to the villages.

Villages	Nyamsong 3	Lable	Gnouka	Rionong 3	Doguem	Mouko	Total
Fruits trees	212 26.83%	34 4.3%	30 3.79%	57 7.21%	84 10.63%	373 47.21%	790
Cocoa trees	72 11.82%	20 3.28%	27 4.43%	30 4.92%	42 6.89%	418 68.63%	609
Other trees species	35 14.4%	17 6.99%	10 4.11%	19 7.81%	12 4.93%	150 61.72%	243
Total	319	71	67	106	138	941	1642

individuals is dispatched within the species). To easily understand the variability, mathematics models have been used to determine richness, regularity and some-times both parameters.

Shannon index found here was 4.63 and is a proof that cocoa based agroforests of Bafia and Kiiki sub-division were much diversified. Eyoho Ewane (2012) and Zapfack et al. (2002) found respectively 3.0 and 4.39. The value index reveals that all individuals are equally dispatched.

Simpson index found was 0.042 indicating these agro-forests are quite a little bit diversified or such a minimum of diversity can be exist in these agroforests. The index reveal the manner by which species are dispatched with-in different communities and sampling sizes. This value is quite lower when compared to those found in forest zones. Fongnzossie (2011) in the Mengame Gorillas sanctuary in Cameroon, Millet (2003) in exploited forest in Tai Phu in Vietnam and Gimaret-Carpentier et al. (1998) in Malaysian forests found respectively values comprising between 0.83-0.90, 0.90-0.98 and 0.99. These values are greater than 0.69-0.83 found by Sonké (2005) in the Dja biosphere reserve of Cameroon characterizing the higher diversity and the less disturbance level of the reserve. The latest Simpson values are normally higher because of the forest ecosystem where the study has been carrying out. Typically, forest ecosystem presents a higher density and richness as compared to agroforest where some species have been destroyed or logged to allow cocoa cultivation or agroforestry cash crops imple-mentation but both still diversify and only the degree of perturbation can differentiate.

Equitability index was 0.46 indicating disturbed middle, in fact saturated ecosystems without any disturbed con-straints presents optimal value shared between 0.6 and 0.8 (Guedje et al., 2002). This indicates that only few species is dominant in what sense (height in canopy or dominant by the number of individuals in some sampling plots. Eyoho Ewane (2012) found 0.2 in the cocoa based agroforests of the south-west Cameroon.

According to the frequency of associated species, *Mangifera indica* was the most frequent species found in all sampling plots. Eyoho Ewane (2012), Bobo et al. (2006) and Sonwa et al. (2002) found in their cocoa based agroforests that the most frequent species was *Dacryodes edulis*. In the south and south-west Came-roon, populations preferred planting or growth of *D. edulis* while in the Mbam and Inoubou division, they preferred *M. indica*, which is the most preferable host tree used to produce *T. conophorum*, a tick vine. *D. edulis* found in this part of country is ranked fourth after *M. indica, T.*

Table 3. Associated fruits trees integrated in cocoa based agroforests by farmers and their origin.

Scientific name	Family plant	Origin	
		Indigenous	Exotic
Annona muricata	Annonaceae		Caraïb, Central and south America (Bolivia, Colombia, Venezuela, Equator)
Annona senegalensis	Annonaceae		Afrique de l'ouest
Picralima nitida	Apocynaceae	x	
Ricinodendron heudelotii	Euphorbiaceae	x	
Cola rostrata	Sterculiaceae	x	
Citrus limon	Rutaceae		Italia
Citrus reticulata	Rutaceae		Brazil
Cola sp.	Sterculiaceae	x	
Psidium guajava	Myrtaceae		Tropical America
Citrus sinensis	Rutaceae		Mediterranea, Brazil
Cocos nucifera	Arecaceae		Indo-Malaysia regions
Spondias mombin	Anacardiaceae		Amazonia
Cola nitida	Sterculiaceae	x	
Citrus aurantium	Rutaceae		Mediterranea, Brazil
Persea americana	Lauraceae		South America (Mexico)
Dacryodes edulis	Burseraceae	x	
Elaeis guineensis	Arecaceae		Occidental Africa
Tetracarpidium conophorum	Euphorbiaceae	x	
Mangifera indica	Anacardiaceae		India and Birmania

conophorum, and *Elaeis guineensis* in term of frequency. Globally, the maximum of associated plants was identified as exotic plants (Jiofack et al., 2011). Among these species, are found many species of *Citrus* spp., *Persea Americana, Spondias mombin, Cocos nucifera* and some non-timber species such as *Musa* spp. and *Carica papaya*, which are not taken into account in the present work. Beside this, introduction of exotic plants species does not only insure food, incomes nutritive, and trade value for farmers, but also create or maintain shade in cocoa farms that limit risks and allow regular cocoa production even if this is sometime less in comparison to those from sun shine area (Mossu, 1990). The higher frequency of associated edible fruits species integrated voluntary by farmer is to increase their income and thus fighting against poverty and maintaining their wellbeing during the less or unproductive season of cocoa fruits. As agroforestry is recognized as a strategy for biodiversity conservation, in tropical areas, cocoa production tends to be used for biodiversity conservation (Asare, 2006). However, in countries such as Ghana and Côte d'Ivoire, two main countries of cocoa production, for example, they have lost their forests because of deforestation, conditioning their cocoa plant to direct sunlight. On the other hand, cocoa production in southern Cameroon is highly-evaluated for its biodiversity conservation. As an "ideal model", international aid agencies and chocolate companies assist many countries in tropical areas to promote cocoa–based agroforestry, such as in southern Cameroon. This is to demonstrate that as cocoa based agroforest are so diversified, they participate to biodiversity conservation in terms of variability of integrated plant species that are used for diversification, and produce shade need for better cocoa growth.

Cocoa yield in Cameroon is stable, compared with Ghana and Côte d'Ivoire, and it is produced by small holders under heavy shade (Ruf and Zadi, 1998). This is one reason why cocoa-based agroforestry is ideal in southern Cameroon. Sometime, cocoa is often planted near plantains with shade and the farmer cannot only harvest cocoa and plantain but also avocado (*Persea americana*), citoron (*Citrus* sp.), and oil palm (*Elaeis guineensis*); that are linked with agricultural field combine agriculture (the production of cash crops and foods) with forest conservation (Shikata, 2007).

Regarding the table based on associated species and their origin, many exotic plants species were found integrated in agroforest system. Nineteen (19) fruits trees species were recorded among them, seven are indigenous. Exotic species are those introduced voluntarily by farmers for many reasons. Authors signaled that these plants were introduced since many years and are becoming spontaneous and cultivated or planted (Letouzey, 1972; Lebrun, 1947; Schnell, 1970; Pijl van der, 1969). These exotic species nowadays are characterized by their rapid regeneration and perfect adaptation (Jiofack et al., 2011). Species' diversity can also play a fundamental role in maintaining and enhancing the productivity and resilience of agroforestry ecosystems in the face of environmental change. Diversification with agroforestry] species can increase the expected income and hedge, for example, against catastrophic disease attacks on particular species. The extent to which diversification is beneficial depends on how different production activities complement each other. Interventions should be more concerned with maximising the functional diversity present in farming landscapes rather than simply increasing the number of tree species found in them. Since a range of local and exotic trees and crops can improve resilience to change, promoting diverse smallholder agroforestry systems is seen as a key means of 'climate-smart' development (World Bank, 2009). According to general remarks, local population is usually planting exotic fruit trees for their edible and commercialized fruits. It has also been observed that while moving from local to the urban area, exotic edible plants diversity decrease; that is why Eyoho Ewane (2012) concluded that farmers during difficult moment to access the cocoa market easily integrated in their agroforests some edible fruits trees species providing useful products supplying families' nutrition.

Conclusion

The Mbam and Inoubou division of Cameroon is one of the very rich divisions providing cocoa in the country. Cocoa trees were planted in agroforestry systems in association with many other trees, which can be indigenous and exotic. The percentage of integrated edible fruits trees was very high compare to other agricultural systems. This can be explain by the fact that cocoa based agroforests sometimes required associated trees to provide shade necessary for the cocoa plant development; and can explain more the role play by agroforest in biodiversity conservation. However, the potential of logging timber is very low compare to south and southwest regions of Cameroon bearing cocoa based agroforests. The presence of forest allows great diversity of these cocoa based agroforests while the savannah around the Mbam division conditioned the presence of some pyrophyte species found in certain plots. The association of plants in agroforests secures food and help population to fight against poverty. The number of species found here is more or less close to the number of species reported by other researchers in the different part of country using similar methodologies or working in the same system. Study also allow the characterization of cocoa agroforest and it become important to evaluate which of the local or indigenous species providing income can be well adapted as well as exotic species to this kind of habitat.

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