



Status of Honey Bee (*Apis mellifera* L.) Industry in Cameroon: A Review Article

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Abstract

Beekeeping is one of the oldest environmentally friendly activities practiced in Cameroon. In Cameroon, beekeeping is an important livelihood activity especially to those not involved in agriculture and forest exploitation. It has contributed much in poverty alleviation and environmental protection through hive products and pollination respectively. Cameroon has five main agro-ecological zones with a diversity of melliferous plants species suitable for beekeeping. Despite the abundant resources, honey and other hives products extraction is still low. Amongst hive products, honey and bee wax are harvested by 100% and 94% of beekeepers respectively. Honey and bee wax production vary from region to region with Adamawa, North-west, West and Southwest being the most production regions respectively. The price of honey varies from 1,200~2,500 FCFA and 2,000~4,500 FCFA for brown honey and Oku white honey respectively. The country is facing many constraints of beekeeping such as climate change and deforestation, poor hive management practices, pests, poor market system as well as many others. To overcome these challenges, beekeepers, together with the government are putting forward measures such as sustainable forest management through the Ministry of Forestry and Wildlife, and the practice of modern beekeeping techniques.

Keywords

Agro-ecological zones, Beekeeping, Honey and hive products, Pollination, Pest

INTRODUCTION

Beekeeping is an environmental friendly activity which is practiced by a number of persons around the world. In Cameroon, beekeeping is an ancient activity practiced in most forest and savannah areas. Apiculture which refers to beekeeping, is the management of honey bee colonies for pollination of crops, production of honey and other products (Bradbear, 2009). Regarding the fact that Cameroon was categorized in 2018 as a medium-level developing country, with a multidimensional poverty index of 0.244 (United Nations Development Programme, 2018), beekeeping is an important livelihood activity especially in developing countries since it alleviates poverty and maintains natural biodiversity (MASHAV, 2016; Lowore *et al.*, 2018). Beekeeping

plays a great role directly by providing valuable output such as honey, bee wax, queen and bee colonies, and other products such as pollen, royal jelly, bee venom and propolis, and indirectly by providing nutritional, economic and ecological security (ARSD, 2000). Honey is also valued in Cameroon for the treatment of coughs, skin infections, and burns (Ingram and Njikeu, 2011).

The tremendous benefits of beekeeping has led to the promotion of bee farming as a conservation positive activity in Cameroon as elsewhere; it is assumed to inhibit forest clearance, protect and aid forest management, and provide vital pollination services for forest ecosystems and agriculture (Nurse *et al.*, 1995; Hausser and Mpuya, 2004; Timmer and Juma, 2005; Brown, 2006; Biovision, 2007; Russell, 2008). The government of Cameroon recognized the importance of bee farming

sector and its role in poverty alleviation by creating a national department in 2006 in the Ministry of Fisheries and Livestock responsible for bee farming. Beekeeping is practiced in all the ten regions of Cameroon since it is an income generating activity which demands little start-up capital.

Due to the vast variability and diversity of the agro-ecological zones of Cameroon, production of honey varies from region to region. The major areas of honey production in Cameroon are the Adamawa savannah forest plateau, followed by the Northwest, West montane agriculture zone and Southwest highlands forests. However, some honey is produced in the East lowland forests, often wild harvested, as in the North and Extreme North (Ingram, 2009). Data from 2000 indicate that Cameroon had 12,000 beekeepers with 63,000 beehives and an average production of honey per beehive per year of 15 liters (Ingram, 2009). In 2009, the Northwest region was the second major production area of honey in Cameroon, with about 4,500 beekeepers producing an estimated 92,000 liters of honey (Ingram, 2009). Most of the honey produced in Cameroon is consumed in Cameroon but the un-conducive economic climate, combined with high levels of corruption, have created a consistently difficult business climate, illustrated by Cameroon's low ranking on the ease of doing business index of 166 out of 190 (World Bank, 2019). Irrespective of the socio-economic, technical and pathological constraints associated with beekeeping in Cameroon (Fotso *et al.*, 2014; Meutchieye *et al.*, 2018a), Cameroon's national beekeeping and honey production rank first in central Africa region.

Regardless of the diverse agro-ecological zones of Cameroon, a majority (91%) of colonies are made up of African honey bee, *Apis mellifera adansonii* usually yellowish in colour (Meutchieye *et al.*, 2018b). Both traditional, mobile bars and Kenyan Top Bar hives are practiced by beekeepers in Cameroon (Niba and Ingram, 2008; Mbogning *et al.*, 2011). Bee farming in Cameroon is progressively increasing as the number of beekeepers increases. This could be attributed to the fact that training beekeepers has been the avenue developed by NGOs and other small relief services in rural communities of Cameroon western highlands since the nineties (Njia, 1999; Abongu, 2001; Niba and Ingram, 2008; Baimenda, 2010).

It is, therefore, important to understand the status of honey bee industry in Cameroon so as to develop strategies which could help ameliorate production while reducing unemployment rate and alleviating poverty.

BEEKEEPING SECTOR IN CAMEROON

Beekeeping is an integral part of farming in most regions of the world and can either be practiced in small or large scales. In most countries, bee farming is done traditionally, while some farmers practice modern techniques of beekeeping. The Republic of Cameroon is made up of ten regions which include: Extreme North, North, Adamawa, East, Centre, South, Littoral, West, Northwest and Southwest. These regions have the potentials for beekeeping though there is a great distinction in the amount of honey produced per region. Nonetheless, the beekeeping sector in Cameroon is highly fragmented; therefore, the actual production and growth levels are not accurately quantified.

1. Honey Production System

Honey production system in Cameroon is fast improving from traditional to modern bee hives practices. In most parts of the country, beekeepers are on the move of modifying their production system (from traditional cylindrical designed hives, mobile bar to Kenyan top bar) so as to meet up with production. It has been as a culture in many parts of the country to adopt a particular production system which is cost benefit. For instance, in Oku-Northwest region, a majority (87%) of beekeepers use traditional cylindrical designed hives, made from bamboo, raffia and grasses, and traditional grass smokers during harvest (Ingram *et al.*, 2020). According to these beekeepers, traditional hives are influenced by customs, the low weight, the availability of resources in the forest at no financial cost and easy construction method (Ingram *et al.*, 2020). In the Mayo Banyo highlands-Adamawa region, most hives (95%) are fixed with mobile frame, built with available materials and conical in shape but of low quality (Fig. 1a) (Meutchieye *et al.*, 2018b), as well as Kenyan top bar hives (Fig. 1b) (Mbogning *et al.*, 2011). In fear of theft and wild bush fire, most beekeepers place their hives at 1~6 m on tree tops. Both traditional and modern bee hives are practiced by beekeep-



Fig. 1a. Example of beehives used in Mayo Banyo Division (Meutchieye *et al.*, 2018a).



Fig. 1b. Bee hives used in Nkoteng. Source: ERD, 2018.

ers in most parts of the country. Both governmental (MINEPIA) and non-governmental (ANCO, HONCO, BERUDEP, SNV, WHINCONET, Guiding Hope and Oku Honey Cooperative) organization are putting effort to enhance the production of quality beekeeping products.

2. Honey Production and Other Hive Products

Beekeeping is an ancient activity practiced in Cameroon since the nineties (Njia, 1999). Honey production

being one of the direct contributions of beekeeping practices (ARSD, 2000), it adds more value to the country's economy through sales and job provision. In Cameroon, honey production is quite low comparatively to its numerous apicultural resources needed for beekeeping. This could be attributed to poor management practices such as the use of local hives, non treatment of hives, and local harvesting methods. However, the improvement of indigenous knowledge through the introduction of modern beekeeping technologies is showing a positive change in the beekeeping industry in many African countries.

Recently, in all the regions of Cameroon, majority (>70%) of installed hives are colonized (Meutchieye *et al.*, 2018b), indicating the country's potentials for beekeeping. Irrespective of the percentage of hives colonized, honey production varies from region to region with the Adamawa region being the most productive (about 93% of total country's production) followed by the Northwest and West regions (Meutchieye *et al.*, 2018b). The average number of hives per beekeeper also varies widely between regions. The national average being 11 hives and varies from 68 hives in Adamawa, 16 hives in the Northwest and 3 hives in the Southwest and West regions (Ingram and Njikeu, 2011). The total number of beekeepers in Cameroon was estimated at a minimum of 20,000 in 2009 (Republic of Cameroon, 2008).

Almost everywhere in Cameroon, honey is the most extracted (100%) beehive product (Fig. 2a), followed by bee wax (94.2%) (Fig. 2b) while propolis and pollen are far less extracted (9.6% and 3.6%, respectively) by beekeepers (Njia, 1999; Abongu, 2001; Baimenda, 2010; Fotso *et al.*, 2014; Meutchieye *et al.*, 2018a). Honey production and value per region is represented on Table 1. The estimated honey produced per region varies from 3.1 million liters in the Adamawa region to about 28 thousand liters in the North and Extreme north regions (Table 1). Adamawa is first in terms of wax production, followed by the Northwest, West, Southwest, South, East, North and Extreme North (Table 1). Royal jelly is equally produced in a small minute quantity. Average annual honey production per hive was estimated at 10.5 to 12.5 liters (Ingram and Njikeu, 2011). This production depends on the number of hives per farmer which is influenced by abundance of flowering savannah plants in the Adamawa region (Tchoumboue *et al.*, 2001; Founadoudou, 2007; Mbogning *et al.*, 2011). The interval

between hive installation and harvesting is usually less than a year and most beekeepers care less about the interval (Tchoumboue *et al.*, 2001). In Cameroon, most beekeepers carry out harvesting once a year (97%), at night (69%), with February and June being the main periods of harvest. Production of honey and other beekeeping products in Cameroon is on a rise due to increasing number of beekeepers since 2011 (INS, 2013, 2015, 2017).

Though Cameroon has the potential for beekeeping, little reliable information on beekeeping industry in Cameroon is available.

3. Market System for Honeybee Products in Cameroon

According to Transparency International in 2009, Cameroon is a lower middle income poor country ranked as one of the most corrupt countries in the world with high incidence of bribery (141 out of 180) in 2008 with a very difficult business environment in which it operates. This problem is further exacerbated by the poor banking system (World Bank, 2009) which creates an un-conducive environment to start and maintain a good business. Until 2009 (period within which Cameroon joined



Fig. 2a. Extracted and packaged honey. Source: Photos from a beekeeper in the West Region of Cameroon.



Fig. 2b. Pollen and Bee wax extracted. Source: Photos from a beekeeper in the West Region of Cameroon.

Table 1. Annual average apiculture production and value per region 2003~2009

Region	Honey production (litres)	Honey value (FCFA)	Wax production (kg)	Wax value (FCFA)	Hive product value (FCFA)	Total value apiproducs (FCFA)
Adamaoua	3,101,700	1,723,400,000	225,000	519,126,090	342,000	2,242,868,090
Centre	15,026	22,499,104	–	–	–	22,499,104
East	347	51,470,000	20	–	–	51,470,000
Northwest	104,006	51,802,475	1,861	1,595,012	1,155,500	54,552,987
South	1,068	1,598,416	40	–	–	1,598,416
Southwest	39,689	43,638,000	106	7,200	–	43,645,200
West	48,900	66,825,000	106	–	–	66,825,000
North & Ex. N	28,434	42,575,503	20	–	–	42,575,503
Total	3,339,170	2,003,808,497	454,200	520,728,302	1,497,500	2,526,034,300
Value US\$		4,483,802		1,016	3,351	5,652,355

Source: Ingram, 2014

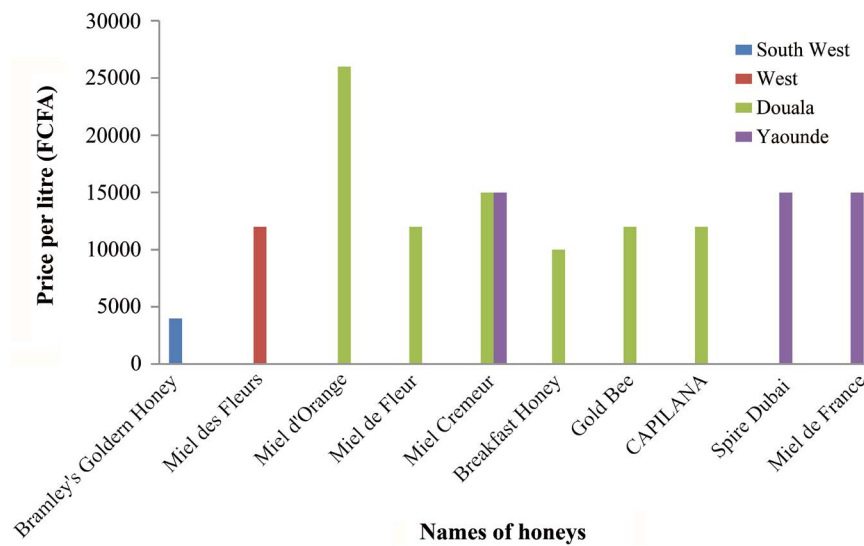


Fig. 3. List and prices of imported honey (Erasmus *et al.*, 2006).

the European honey market), Cameroon had no regulations on hive product quality, production and processing, imports and exports. This impacted much on the market system of apicultural products and widened consumers' preferences on the choice of honey. Consumers prefer some honey to others due to taste, price, and the source of production. The prices of both brown and white honey varies across the country due to transportation and packaging costs (glass jars in Yaounde, plastic buckets in Oku), and increased willingness and ability to pay in the larger cities (Ingram *et al.*, 2020). In Cameroon, increased price of beekeeping materials and hired labour could potentially influence the price of honey. The Oku white honey in the Northwest region was sought in the country's urban areas, fetching a higher price than other honeys (Erasmus *et al.*, 2006). The price of honey has increased from 2,000 FCFA to 4,500 FCFA and from 1,200 FCFA to 2,500 FCFA for white and brown honey respectively between 2008 to 2017 (Table 2).

Though the price of honey is increasing, honey is being imported and sold in major cities in Cameroon (Fig. 3). Honey produced in Cameroon is also exported to other neighboring countries. A small quantity of bee wax is equally exported to neighboring countries within Central Africa and Nigeria. For instance, without considering porous road borders, it was estimated that 30,000 to 50,000 liters of honey was exported to Congo, the Central African Republic and Gabon while 50,000 to 150,000 liters to Nigeria and Chad (Ingram, 2014). The

Table 2. Price of Oku white and brown honey sold by Oku Honey Co-operative

Year	Price (FCFA)/liter	
	White honey	Brown honey
2008	2,000	1,200
2009	2,000	n/a
2010	2,000	n/a
2011	2,500	n/a
2012	2,500	1,500
2013	3,000	n/a
2014	3,500	n/a
2015	3,500	n/a
2016	4,000	n/a
2017	4,500	2,500

Source: Ingram *et al.*, 2020. Key: n/a = Not available

price of imported honey varies from region to region and city to city (Fig. 3). In Cameroon, imported honey is expensive (varying from 4,000 to 26,000 FCFA per liter) than domestic honey. The type and prices of the different imported honey sold in Cameroon is presented in Fig. 3.

AGRO-ECOLOGY OF BEEKEEPING IN CAMEROON

The vegetative structure and climatic condition of Cameroon has given rise to five main agro-ecological

zones which include: Zone I (Soudano-Sahelian), Zone II (High Guinea Savanna), Zone III (Western Highlands), Zone IV (Humid forest with mono-modal rainfall), Zone V (Humid forest with bimodal rainfall). The diverse vegetation of Cameroon encompasses four sub species of *Apis mellifera* which include: *Apis mellifera adansonii*, *Apis mellifera monticolar*, *Apis mellifera scutellata* and *Apis mellifera jemenitica* (David, 2017). Cameroon is rich with many species of melliferous plants which are suitable for beekeeping and a few poisonous tree species (Maisels and Forboseh, 1999; Aizen *et al.*, 2008). A few examples of these melliferous plants include: *Acanthus* sp, *Adamsonia digitala*, *Aframomum* sp, *Ageratum conyzoides*, *Albizia adianthifolia*, *Albizia gummifera*, *Albizia zygia*, *Arenga pinnata*, *Aspilia Africana*, *Cola* sp, *Erythrina senegalensis*, *Eucalyptus* sp, *Agave sisalana*, *Alchornea cordifolia*, *Arachis hypogaea* and *Citrus* sp. The abundance of these plants species has created a favourable environment for beekeeping in Cameroon. It has been documented that honey and pollen production depends on the abundance of some plants species (Segeren *et al.*, 1996).

THE VALUE OF BEEKEEPING IN CAMEROON

Beekeeping being an environmentally friendly activity, has contributed much economically and ecologically (Ajabush, 2018). Bees are known to pollinate many crops and the honey produced serves as food and a source of income to beekeepers, marketers and even the government.

1. Ecological Importance

Beekeeping is an important ecological (pollination) and environmental (major Non Timber Forest product) activity in the highland and savannah areas of Cameroon. Sustainable beekeeping reinforces forestation, good forest management and provides an alternative livelihood to activities such as hunting. This has led to the promotion of bee farming as a conservation positive activity in Cameroon as elsewhere (Nurse *et al.*, 1995; Hausser and Mpuya, 2004; Timmer and Juma, 2005; Brown, 2006; Biovision, 2007; Russell, 2008). The diversity of crops cultivated in Cameroon could be aided by honey-

bees since *Apis mellifera* L. has been found to pollinate flowers, horticultural crops and vegetables worldwide (Porter and Penny, 2017). In Cameroon, promoting beekeeping practices could significantly enhance environmental and financial stability.

2. Economic Importance

Bee products are considered Non Timber Forest Products (NTFPs). Beekeeping practice is an important economic activity in Cameroon despite the poor market system. Bee products (honey, wax, pollen,) have high value and are providing both primary and secondary sources of income to many families. Beekeeping is a sustainable income generating activity in Adamawa region as well as Northwest, West and Southwest where it is estimated that one bee hive can yield 11,500 CFA francs to 13,900 CFA francs per year (Matso *et al.*, 2011). While honey is used as food and sold in local markets, wax is used in the food, cosmetic and pharmaceutical industries. In Cameroon, some beekeepers from the Northwest (7%) and Ngoundere (29%) mix honey with water to brew a sweet, openly fermented alcoholic drink called *sha* or *shah* in the Northwest, *ntop* when mixed with raffia palm wine, and *kuri* or *koori* in Adamawa (Ingram, 2014). Bee products are also valued for medicinal purposes in the treatment of cough, skin infections and burns.

Bee products exported to other countries generate income to the government through tax paid by exporters. The demand for honey and other hive products in the world market is quite high as compared to the current production. According to Ingram (2014), the apiculture value chain and prices in Cameroon demonstrated that beekeepers sell 86 to 94% of their honey for income generation while only 6 to 10% and 2 to 4% is for home consumption and gift, respectively. It is estimated that over 30,000 Cameroonians are involved in beekeeping especially non timber exploiters and those not involved in agriculture. This has created chances for job opportunities from beekeepers to marketers and finally exporters, thus reducing unemployment rate in the country.

CHALLENGES OF BEEKEEPING IN CAMEROON

Beekeepers in Cameroon are facing production con-

straints (Inades, 2000) including but not limited to increasing climate change and deforestation rate, absconding, pests and predators, application of toxic agro-chemicals, poor hive management, poor harvesting techniques, and existence of poisonous flowering plants.

1. Increasing Climate Change and Deforestation Rate

According to the Millennium Ecosystem Assessment (2005), habitat loss, overexploitation and unsustainable use of natural resources are major threats to biodiversity loss. Nectar and pollen are the basic food of each honey bee colony (Crane, 1999). Honey and pollen production depends on the abundance of some plant species (Segeren *et al.*, 1996). Some of these plant species have been exploited by man for millions of years (Crane, 1999). Low honey production could be attributed to the flowering cycles of some melliferous plant species, resulting in significant variations in pollen and nectar flow (Cheek *et al.*, 2000; Ingram, 2014). In Cameroon, apart from normal seasonal variations, 97% of beekeepers indicated that the local climate had changed, affecting honey production. It has been noted that increasing climatic variations in the last few years with an increase in extreme events: strong winds and heavy rain falls, a prolonged dry season, more seasonal variability and increased bush fires negatively affected honey and wax production (Ingram *et al.*, 2020).

In Cameroon, above 2300 m, about half the forest cover had been converted to crop or savannah between

1978 and 2001 (Momo, 2009). In Kilum Ijim, beekeepers complaint that forest fragmentation, deforestation and degradation is decreasing the availability of forage sources, noting a decrease in melliferous species such as *Prunus Africana* (Ingram *et al.*, 2020). Though traditional community councils and the Ministry of Forestry and Wildlife are putting forward measures to limit deforestation rate, much is still to be done.

2. Absconding

Cases of abandoned honey bee colonies could be attributed to lack of forage, incidence of pests and predators, poor harvesting techniques, sanitation problem, bad weather condition, bee diseases, drought, overgrazing, deforestation and shortage of water (Fig. 4) (Sahle *et al.*, 2018). Many studies have reported that about 30% empty hives recorded in Cameroon resulted from absconding and poor hives handling (Founadoudou, 2007; Matso *et al.*, 2011; Fotso *et al.*, 2014; Meutchieye *et al.*, 2018a).

3. Pests and Predators

A number of pests and predators have been identified in honey bee colonies from different regions in Cameroon. Some of which include: small hive beetle (*Aethina tumida*), Dynastid (rhinoceros) beetle, Wax moths (*Galleria mellonella* and *Megaselia grisella*), bee louse (*Brachymeria sp.*), phorid (*Megasella scalaris*), and ants (*Monomorium cryptobium*, *Dorylus molestus*, *Anochetus* sp, *Oecophylla longinoda*, *Camponotus chrysurus*, *Discothyrea mixta*, *Crymatogaster depressa* and *Tetramorium* sp)



Fig. 4. Abandoned hives caused by invaders (termites). Source: Environnement-Recherche-Developpement (ERD), 2018.



Fig. 5. Bees' comb heavily infested by Wax moth (*Galleria mellonella*). Source: Meutchieye *et al.*, 2018a.

(David, 2017). In the Adamawa and Northwest regions where honey production is high, most beekeepers face severe pest attack due to poor colony management which could be attributed poverty. It has been reported that ants cause severe economic loss in honey production by killing bees and subsequently robbing their products (Tesfaye, 2014). In the Adamawa region, Meutchieye *et al.* (2018a) observed bee combs being infested by hive moths in poorly managed hives (Fig. 5).

4. Application of Agrochemicals

The use of fertilizers and pesticides by farmers in controlling crop pests, weeds and other flies is harmful to other living organisms including honey bees. Beekeepers visiting their colonies are not safe from the toxic effects of these chemicals. It had been reported that synthetic pesticides and fertilizers have potential negative effects on human health (El Moniem *et al.*, 2008).

5. Poor Harvesting Methods

Management of honey bee colonies has been a real challenge in the Adamawa region where honey production is relatively high. It was reported that poor hives handling resulted to 30% empty hives recorded in the Adamawa region and elsewhere in the republic (Founadoudou, 2007; Matso *et al.*, 2011; Fotso *et al.*, 2014; Meutchieye *et al.*, 2018a). The use of fire or direct smoke during harvesting could destroy brood and possibly reduce the size of the colony.

6. Poisonous Flowering Plants

During flowering season, bees can forage on some poisonous plants which could be detrimental to them. For

instance, Maisels and Forboseh (1999) reported some tree species (*Anona senegalensis*, *Chinipodium* and *Afromomum* spp.) in the Kilum-Ijim forest - Cameroon that bees hates due to their poisonous nature. Beekeepers are scared of these trees since they are unable to control the activities of the worker bee.

METHODS OF ENHANCING THESE CHALLENGES

Beekeepers have adopted different strategies to remedy the harmful effects of honey bee pests. Some beekeepers raise their hives at a certain height, cover with aluminium paper, and narrow the hive entrance to prevent larger insects. Most beekeepers remove old combs and practice regular visits of hives to prevent wax moth and other possible intruders. However, Meutchieye *et al.* (2018b) reported that pests' invasion was very common and treatments nonexistent in the Adamawa region.

CONCLUSION AND RECOMMENDATION

In Cameroon, beekeeping is an ancient agricultural activity practiced in many regions. It is estimated that more than thirty thousand Cameroonians are involved in beekeeping. Both traditional and modern beekeeping techniques are adopted by beekeepers. Honey and bee wax are the main hive products extracted while pollen, royal jelly and propolis are less harvested. Though honey and bee wax are preferred, production is still low. However, honey production is rising with time due to modern practices and high demand at the domestic and export markets. Adamawa, Northwest, West and Southwest are the major honey producing regions in the country. Honey is harvested yearly and twice a year depending on the locality and management techniques adopted by the beekeeper. The country has five agro-ecological zones with abundant melliferous plant species suitable for beekeeping. Irrespective of the rich vegetation that favours beekeeping, beekeepers are faced with many constraints. Some of which include: increasing climate change and deforestation rate, absconding, pest and predators, application of toxic agro-chemicals, poor hive management, poor harvesting methods, and existence of poisonous flowering plants. Despite these constraints,

Cameroon has the potentials of producing twice the present production of honey and other hive products.

It is highly recommended that:

The government of Cameroon through the Ministry of Forestry and Wildlife should reinforce the strategic plan of forest management by sensitizing the local population on the detrimental effects of deforestation.

Beekeepers should be aware of the devastating effects of poor harvesting methods and empower themselves prior to harvesting.

The Ministry of Environment and Nature Protection should let known to beekeepers, the harmful effects of agrochemicals and pest on honey bee colonies.

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