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# **Soybean (*Glycine max* (L.) Merr.) Production in the Cameroonian Cotton Basin between the Dynamics of Structuring an Agricultural Value Chain and Sustainability Issues**

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Additional information is available at the end of the chapter

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## **Abstract**

Over the past ten years, the Cameroonian cotton front, in the Sudano-Sahelian region, has experienced dynamics in soybean production, resulting in significant changes in agro-systems. From a simple hut culture not referenced in regional agricultural statistics, since 2010, soybean ranks 2nd in legumes cultivated after peanuts, followed by cowpea and voandzou, yet culturally and economically more adopted by the populations. The rapid development of cultivated areas from 6,705 ha in 2008 to 15,020 ha in 2018 is indicative of the enthusiasm shown by farmers for this speculation which, despite the almost lack of supervision on the part of public authorities, now structures a real value chain with challenges for improving farmers' incomes, in a space where more than 80% of working people live from agricultural activities. The objective of this research is therefore to analyse the sustainability challenges of a productive and market dynamics built around speculation subject to strong demands of international competitiveness. The results show that the viability of this dynamics remains precarious through a set of constraints inherent in the proven inability of farmers to empower themselves to optimise production and control marketing, as well as the poor technical supervision of cultivation.

**Keywords:** soybean, dynamic agriculture, cotton front, Sudano-Sahelian, Cameroon

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## 1. Introduction

Price volatility of agricultural raw materials on international markets (cotton, cocoa, coffee, etc.)<sup>1</sup> and its consequences on national food production, as well as the recurrence of food crises in many African countries over the past fifteen years, have repositioned agricultural issues on the agendas of governments of both developing and developed countries and international institutions. In addition to the commitments made by States at the 1996 World Food Summit, notably the increase of budget allocation for agriculture by at least 10%, and on the occasion of numerous world meetings (G8 Agriculture Summit of 2009, G20 Agriculture of 2011...), international and national responses to these two major global crises have mainly mobilised two converging agronomic trajectories: agricultural intensification (in the sense higher yields through better access to synthetic inputs and irrigation), and crop diversification to increase domestic food supplies and improve farmers' incomes.

Soybean is a good example of the realisation of this second trajectory in the Sudano-Sahelian zone. Its dynamics of spatial diffusion and production observed in ten years is an invitation to put into perspective many pessimistic, even alarmist judgements, on the capacity of African agriculture to meet the multiple challenges of increasing and diversifying agricultural production, improving farmers' incomes and supplying domestic agro-industries. These judgements are based in particular on still weak agricultural growth to alleviate rural poverty, the low representativeness of agriculture in international trade, the impact of price cuts and fluctuations of the main export products on the producers who are gradually integrated into logics of market economy and productivity [2]. In this author's opinion, nothing in these trends led to think that African agriculture is preparing to face economic, social and ecological challenges whose magnitude is still unprecedented in history, thus positioning agriculture in Sub-Saharan Africa, in a unique situation compared to other continents.

Experimentation, support for the dissemination and development of soybeans in the Sudano-Sahelian area in Cameroon constituted a strategic option for the Cotton Development Company (SODECOTON). The idea was to create added value in the face of volatile cotton prices on international markets. Diversification aimed at meeting the revitalisation needs of a society polarised by the cotton sector (support for farmers' contractual production, export of fibres and production of vegetable oil based on cotton seeds).

Thus, since 2008, this area, which shelters the cotton basin, is experiencing a dynamics of soybean production which involves profound changes in Sudano-Sahelian agro-systems and participates in the (re) configuration of new market relations between producers, traders, distribution intermediaries and agro-industrial companies. Available official statistics indicate that regional production increased from 41 tonnes in 2007 to almost 14,000 tonnes in 2017, while the total production in Cameroon for the same period was 7,801 and 18,886 tonnes, respectively.<sup>2</sup> This development followed the global trend marked by significant growth over

<sup>1</sup>For example, [1], evaluating the rates of change of certain raw materials, notes that with an average variability of 25.8% over the period 2003–2012 according to the instability index calculated by the United Nations for trade and development (UNCTAD), cotton prices are among the most volatile, far ahead of those of wheat (18.2%) or coffee (17.3%).

<sup>2</sup>FAOSTAT <http://www.fao.org/faostat/fr/#data/QC> accessed on June 23, 2020.

the past 25 years (123% between 1996 and 2004), particularly in Latin America [3, 4]. Since 2010, soybean ranks 2nd among the legumes cultivated in the cotton basin after peanuts, followed by cowpea and voandzou, which are, however, culturally and economically more adopted by the populations [5, 6].

Nearly 60% of cotton producers have either abandoned cotton growing, diversified food crops or replaced those less profitable and poorly supervised by public and private actors supporting agricultural development (case of *Vigna unguiculata* L. walp - cowpea -). The dominant trend that consists in establishing monoculture plots causes agro-systems reconfiguration and modifies rotations.

In an increasing number of family farms, cotton has thus ceased to be the head of crop rotation for the benefit of soybeans and incidentally peanuts.

Most of the regional production fuels partially estimated<sup>3</sup> national and cross-border agro-industrial demand for Nigeria. Macroeconomic data show that Cameroon imports an average of 20,000 tonnes of soybeans worth approximately CFAF 10 billion<sup>4</sup> a year, and GMO soybean meal worth CFAF 14 billion,<sup>5</sup> hence the challenge to increase domestic supply to meet agro-industrial demand. The rapid evolution of cultivated areas from 6,705 ha in 2008 to 15,020 ha in 2018 (FAOSTAT, Op.Cit.) is indicative of farmers' enthusiasm for this speculation which benefits little from the supervision of public authorities. Its rapid development in the Cameroonian cotton basin, where the income of more than 80% of agricultural assets historically depends on the sale of cotton, creates a need to understand the challenges of this development.

The above context raises the following research question: Can the productive and market dynamics on soybeans support the construction of a sustainable value chain to meet agro-industrial demand and improve farmers' incomes? The objective of this research paper is to analyse the sustainability challenges of a productive and market dynamics built around a speculation which is subject to strong demands of international competitiveness and offers a strong potential for improving farmers' incomes. The reflection initiated is based on the postulate that soybean brings out the structuring elements of a value chain, but its viability remains precarious by a set of constraints inherent in the proven inability of farmers to empower themselves to optimise production and control marketing, as well as poor technical supervision of culture. These constraints jeopardise the prospects for the sustainability of a soybean value chain despite the guarantee of a proven agro-industrial market.

### 1.1 State of knowledge on the topic

Soybeans (*Glycine max* (L.) Merr.) are today one of the main and important sources of proteins (40–42%) and vegetable oil (18–22%) used in human food [7, 8]. However, as with many other crops, its yield is limited in Sub-Saharan Africa by several factors, including poor cultivation practices, inadequate choice of land for its cultivation, degradation of soil fertility, climate

<sup>3</sup>Household consumption remains marginal, soybeans having so far integrated the eating habits of the Sudano-Sahelian populations compared to the southern part of the country.

<sup>4</sup>EUR 15, 244, 900

<sup>5</sup>EUR 2,342,900

change [9]. The orientation of this research highlights three major issues that have so far structured the production axes of knowledge on soybeans: those relating to socio-economic diversification in rural Africa, those relating to energy diversification and the fight against climate change, and finally those inherent in the polarisation of soybean productive dynamics by the agrifood industry in Latin America and Sub-Saharan Africa.

### *1.1.1 Soybeans in socio-economic diversification challenges in African rural areas*

It was at the beginning of the 1970s that the IITA (International Institute of Tropical Agriculture) began its programme to improve African soybean lines, based on the crossing of high productivity lines of Asian origin and TGx lines (Tropical Glycine Cross). This work will, for example, enable Nigeria to boost the development of soybean production from 75,000 tonnes in 1980 (yield below 300 tonnes/ha) to 758,033 tonnes in 2018 (on average 1 tonne/ha) (FAOSTAT<sup>6</sup>). This speculation is now considered in Africa as one of the solutions that can improve the quality of food for populations, but also contribute to the diversification of farmers' incomes. Agronomic challenges for its establishment remain, however, significant; efforts aim at improving yield (1.2 tonne/ha on average), seed viability, fertilisation and inoculation of soybeans.

As early as the 1980s, soybean became part of the agro-systems of many countries in Sub-Saharan Africa to ensure self-sufficiency in foodstuffs, along with incentives. The lack of processing opportunities will lead farmers in many countries to abandon it. In Cameroon, its popularisation dates back to fifteen years, but domestic demand was quick to take off (agro-industries producing vegetable oil, infant flour and dairy products, animal feed). However, this dynamics is scientifically poorly documented apart from sparse statistics.

### *1.1.2 Soybeans in the global challenges of energy diversification and the fight against climate change*

The past twenty years have been marked by an intense development of production and uses of biofuels in the world. From 1996 to 2006, the tonnage increased from around 16 million tonnes to almost 46 million [10]. This recent expansion has strengthened the relationship between agricultural (cereals, oilseeds and pulses) and energy markets, a situation favoured by national and regional policies. In 2019, the European Union (EU) authorised the import of American soybeans for the production of biofuel until 2021. Available statistics show that 75% of the EU soybean market share is covered by US production. However, it should be noted that interest in soybeans as a fuel source contributes to its growth in countries such as Argentina, whose production of soy-based agro-fuel exceeded that of Brazil in 2011. Agri-fuels will therefore remain one of the engines of demand for soybeans, and analysts predict the probability of strong production growth by 2025 [11].

From an environmental point of view, soybeans are capable of capturing nitrogen from the air for their own growth and enrichment of their seeds with proteins, but also to fix it in the soil. Thus, its cultivation contributes to the fertilisation of the soil which would limit the prospects

<sup>6</sup> FAOSTAT (<http://www.fao.org/faostat/fr/#data/QC>), accessed on June 07, 2020.



of intensifying the use of chemical inputs and its corollary on the soils and water resources. Greenhouse gas emissions linked to seed production would be considerably reduced [12]. However, on the other hand, the extension of cultivated areas contributes significantly to deforestation and the degradation of plant cover [13, 14]. The impact of agricultural value chains on the environment increasingly underpins research dynamics, like the research initiative funded by the European Union through the “Value Chain Analysis For Development” Project (VCA4D) from 2016 to 2019, involving 24 countries in Sub-Saharan Africa, Central America and Southeast Asia.<sup>7</sup>

### *1.1.3 Food industry: A vector for accelerating the development of soybean farming*

The food industry is one of the industrial sectors that have experienced particularly remarkable development over the past 20 years. This development has been accompanied by an extraordinary diversification of the supply of processed products based on cereals, legumes, oilseeds, etc. Global meat consumption statistics, for instance, show that almost three-quarters of the world’s soybeans are used to feed animals, including poultry and pork. Between 1967 and 2007, pig meat production increased by 294%, that of eggs by 353% and that of poultry meat by 711%. Over the same period, the relative cost of these products has decreased. As the world’s primary source of animal feed, soybeans have become an indispensable part of the intensive agricultural model [4]. Soybeans make up the Bulk of Dairy products, Oils and Flours. Food industry has become a driving force for production in Sub-Saharan Africa through a network of national companies which polarise the productive dynamics particularly oriented towards organic production. This third axis needs to be documented with regard to innovations on technical routes, marketing and transformation.

## **1.2 Theoretical framework of the study**

The study mobilises the theory of spatial diffusion whose interest has been revived in contemporary geographic studies by [15, 16] with the contributions of [17–19]. These pioneering works emphasise the importance of temporality and spatiality in any diffusion process. Because any diffusion requires contacts between transmitters and receivers, these contacts implying contiguity or spatial connectivity [20, 21]. The theory is appropriate for studying the processes that involve the movement of materials, products, people, practices, or ideas together. It structures three main stages: the initial stage of appearance and progressive growth of the phenomenon observed, the intermediate stage of acceleration of growth, and the final stage of saturation and decay. In social sciences, the notion of diffusion is associated with innovation, from which it is inseparable. Introduction and popularisation trajectories of soybeans fit well with the dynamics of innovation according to Schumpeter (1934). This innovation supposes the combination of new things which propagate in an environment by causing irreversibilities in that environment’s evolution (varietal selection, technical routes,

<sup>7</sup> Agrinature, *Value Chain Analysis For Development* » (VCA4D) <https://europa.eu/capacity4dev/value-chain-analysis-for-development-vca4d-> (accessed on June 23, 2020).

choice of soils ...). The mobilisation of this theory will make it possible to decipher the trajectory of soybean diffusion in an attempt to grasp its sustainability.

The study uses the sector approach to complement the reality of the construction of the value chain analysed. Using [22] definition, a sector study is a very precise analysis of a whole system generated by a product. The concept refers to the economic analysis of a sequence of technically complementary physical operations enabling the creation, circulation and consumption of a good (or a service) [23, 24]. The supply chain approach constitutes an effective approach for structuring analysis in contexts of fragile institutional environments and failure of statistical information systems [25]. This fragility is inherent in the context of this study to the reliability of the data provided by the various contradictory sources of information. The mobilisation of this approach will make it possible to obtain knowledge on the functioning of the different segments that make up the sector, with a view to better deciphering the relationships between actors in these segments [26].

### 1.3 Adopted methodological approach

Data were collected using two approaches. The first focused on the statistical system on soybean production which combines the source of the Ministry of Agriculture through its branches at regional and divisional level on the one hand and that of FAO on the other hand. However, significant discrepancies between these two sources called for an arbitration which favoured data from the departmental branches closer to the field, despite the doubt about their reliability. This choice is supported by the monitoring of food production in the cotton area since 2006.<sup>8</sup>

The second approach was the subject of a diagnosis with actors of the sector through a questionnaire survey carried out between 2017 and 2019 among 500 farmers' members of the soybean producer groups chosen from the snowball technique. Questionnaires were directly administered to farmers in Touboro, Madingring, Mayo-Rey, Tcholliré sub-divisions, on the motivations for growing soybeans, marketing of the production, difficulties encountered, various types of support. Interviews were conducted with officials of the Soybeans Processing Industry of Cameroon (SOPROICAM), an agrifood company that governs the soybean sector in the Sudano-Sahelian zone, officials of the Cameroonian dairy company (Camlait) and service personnel of the Ministry of Agriculture premises.

Survey data were subjected to statistical processing in Excel to identify trends in production and marketing. Interviews were the subject of a qualitative treatment using the content analysis method.

In a first articulation, results present conditions and modalities of soybean farming in Cameroonian cotton basin. The second articulation describes the methods of building a value chain around speculation, and whose sustainability is questioned in a third articulation based on the difficulties and constraints raised by the stakeholders interviewed.

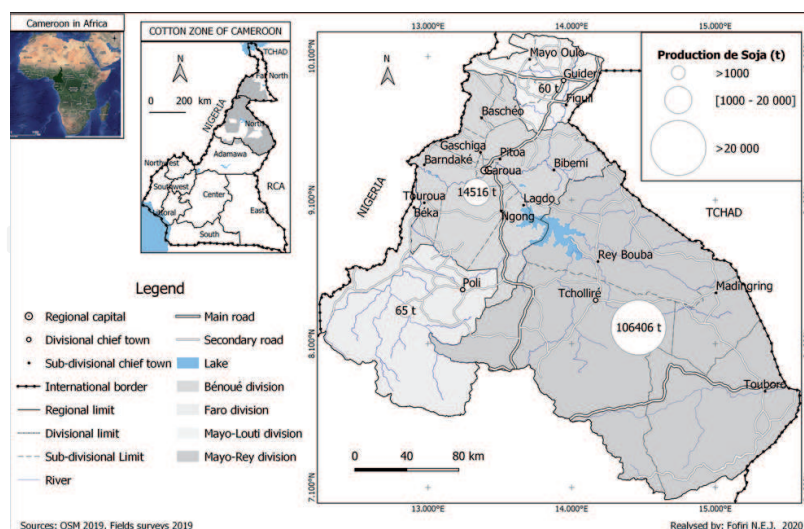
<sup>8</sup>Monitoring the development of food production in the Cameroonian cotton zone was the subject of a regional research project involving Cameroon, Chad and the Central African Republic from 2004 to 2009 [27].

## 2. Terms and conditions for developing soybean cultivation in the Cameroonian cotton basin

### 2.1 Cotton crisis as a vector to popularise soybeans

Cotton cultivation is at the heart of multiple challenges in the Sudano-Sahelian zone of Cameroon (Figure 1) [28–30]. The sector experienced a serious crisis from 2006 to 2011 following the constitution by China of large stocks of cotton fibre (EU-ACP, 2015), with the consequence of a drastic fall in production from 315,000 tonnes in 2005 to 180,000 tonnes in 2011 (FAOSTAT). The number of producers increased from 360,000 in 2006 to around 250,000 over the same period, following the drop in the purchase price of seed cotton from producers. The consequences of this fall in the purchase price were dramatic for the producer, given the function of supporting all the charges for agricultural inputs of food crops (cereals, legumes) that cotton plays [28, 29, 31]. They were more so for SODECOTON (drastic fall in the tonnage of exported fibre and seeds for the production of vegetable oil and cottonseed meal for animal feed).

In 2006, SODECOTON initiated a crop diversification project through a feasibility study of soybeans and sunflower as a rotation crop with cotton [32]. This initiative will be avant-garde to the most severe production crisis that SODECOTON will experience between 2008 and 2011, with respectively 185,000 tonnes of unginned cotton produced, 140,000 tonnes, 190,000 tonnes and 180,000 tonnes, compared to 315,000 tonnes in 2005 (peak production which has never reached SODECOTON again<sup>9</sup>). The results of the study foreshadowed the prospects for a possible diversification crop for soybeans,<sup>10</sup> mainly in the cotton front (Mayo-Rey Division) unlike sunflowers.



**Figure 1.** The Cameroonian cotton basin, a soybean production area.

<sup>9</sup>Data available on the FAO website (<http://www.fao.org/faostat/fr/#data/QC>), accessed on June 28, 2020.

<sup>10</sup>The so-called “local” soybean varieties (Houla 1, Houla 2, TGX-849-29-4D, Carrefour Nari, Ngong and Pitoa 2) had an average yield of 1600 kg / ha, more attractive than the varieties imported from IITA of Ibadan and Brazil [31].

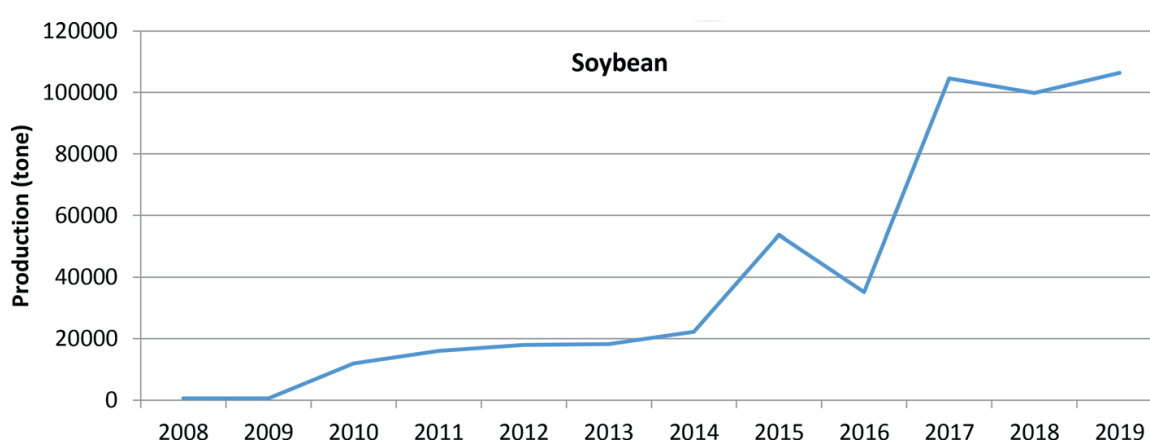


The SODECOTON diversification project was implemented as from the 2008 agricultural season through two strategic pillars: the pre-financing of agricultural inputs (fertilizers, herbicides) intended for soybeans for cotton producers<sup>11</sup>; and the purchase of crops. The rapid increase in production (**Figure 2**) however, was followed by four difficulties which led to the termination of the project after 2011:

- Persistence in 2011 of the cotton crisis and its consequences on the financial resources of SODECOTON leading to the end of the pre-financing of inputs and the purchase of soybean crops;
- Competition from Nigerian traders with producers to the detriment of SODECOTON, resulting in a low level of recovery of pre-financing of inputs;
- Increasing immobilisation of unsold stocks of soy products (oil cake, vegetable oil), prices being considered higher than those of cotton seed products on domestic markets;
- Technological difficulties encountered in processing more rustic soybeans than cotton seeds.

The cessation of the crop diversification project as a consequence of the above difficulties will stimulate a new productive and market dynamic supported by Nigerian wholesalers whose prices on the domestic markets are twice higher than those offered by SODECOTON and Soyabeans Processing Industrial of Cameroon (SOPROICAM), a cooperative company engaged in the purchase and industrial processing of soybeans, to conquer the regional market. The sale of crops on domestic markets becomes a direct source of income for producers, in an environment marked by permanent cash flow tensions.

Thus, between 2011 and 2016, cotton ceased to be the head of rotation in crop rotations in favour of soybeans for 40% of producers interviewed. This proportion was 60% after 2017, with a strong trend towards the proliferation of monoculture farms by clearing new plots.



**Figure 2.** Evolution of soybean production in the cotton basin of Mayo-Rey (2008–2019).

<sup>11</sup> SODECOTON has for twenty years adopted the incentive policy for cotton production by providing credit inputs intended for the production of food crops to cotton producers only. This policy will simply be accentuated on soybeans as part of the crop diversification project.

## 2.2 Towards a dynamics of extension of the production basin

In the North Region, the main production basin of the entire Sudano-Sahelian region, the cultivated area increased from less than 6,000 ha in 2008 to 68,000 ha in 2019.<sup>12</sup> The activity brings together nearly 50,000 producers, at least 35% of whom have abandoned cotton growing in favour of soybeans. And owing to their status as crops which are almost entirely intended for the domestic and cross-border market, the two speculations compete as much in the use of space as in family and salaried agricultural labour.

From a spatial point of view, soybeans are indeed developing in the new cotton basin of the Mayo-Rey Division, opened within the framework of the “Programme of migration and agricultural support services” implemented by the State of Cameroon from 1974 to 1997. This programme made it possible to move and supervise the settlement of more than 200,000 migrants from the Far North Region to areas with high agricultural potential in the North Region [33] (**Figure 2**). The two speculations are therefore cultivated by so-called “non-native” populations for whom access to land remains a challenge because of the socio-cultural barriers which limit their access to land ownership in settlements. Local populations have always lived their presence as a form of spoliation of their land [34]. In this context of precarious land, the average cultivated area per producer is small (1 ha), with however at least 50% of farms between  $\frac{1}{4}$  and  $\frac{3}{4}$  ha. This proportion is justified by the fact that soybeans are almost entirely cultivated by family farms (FF) which also ensure the production of foodstuffs intended primarily for self-consumption (millet/sorghum, corn, cowpeas, groundnuts). Thus, with an average yield of 1 tonne/ha, EFA production oscillates between 500 and 800 kg, or 5 to 8 bags of 100 kg. It is therefore essentially an atomised production on small areas exploited for an average duration of 5 years from the clearing. In some cases, soybeans are grown in rotation with corn one to two years to capitalise on residual effects of nitrogen. Despite this situation, which translates into a context of land insecurity for most producers, soybean monoculture farms are, nevertheless, developed on 5–15 ha, despite their low mechanisation. However, the overall increase in areas by clearing and deforestation will soon come up against the areas set aside for environmental protection (Bénoué and Bouba-Ndjidda national parks; Areas of Hunting Interest which cover nearly 50% of the North Region).

From a labour point of view, almost essentially manual production justifies the use of family labour force adapted to the crumbling context of plots on the one hand, and hired labour for farms greater than or equal to 2 ha on the other hand. According to technical soybean routes, the labour force is called upon to perform several tasks (**Table 1**):

- Preparing fields (clearing and/or cutting down of trees for the creation of new plots, burning);
- Sowing;
- Crops maintenance (fertiliser and herbicide spreading, weeding);
- Harvests;
- Threshing soybeans for seeds extraction.

<sup>12</sup>Source: North Regional Delegation for Agriculture and Rural Development (2020).

	Jan.	Feb.	Mar.	Apr	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Indicative period	Until March		As from the 10th of March			As from the 15th	As from the 15th	During the two months		From the 15th to November		Until March
Activities	Continuous marketing		Land identification/field preparation			Early sowing	Late sowing	Crop maintenance		Start of the harvest		Threshing and marketing

**Table 1.** Distribution of tasks according to the soybean agricultural calendar.

The spread of labour-intensive tasks over ten months in the year (March to December) has thus contributed to the development of a subsector of agricultural workers who have become essential in the productive dynamics, remuneration being paid by task. For agricultural workers, this is an immediate source of income that is beginning to structure a seasonal migratory flow to soybean production areas. In addition, the growing use of labour force, whether family or salaried, is increasingly a factor in the variation/reduction of areas devoted to other food crops (millet/sorghum, maize, cowpeas, peanuts, cotton) due to the overlapping of agricultural calendars which puts the execution of agricultural tasks in competition. Cotton is more demanding in terms of labour force, and conversely, does not provide immediate income, the producer being just as dependent on uncertain payment terms. Overall, this growing craze for soybean cultivation underpins the consolidation of the producers' strategic link in the construction of a value chain.

### **3. Dynamics of building a soybean value chain**

Michael Porter (1986) who is the author of the value chain concept developed it in his reference book "Competitive Advantage". The value chain describes all the activities necessary to carry out a product or a service from its conception, through different phases of production to its distribution to final consumers, then to its destruction after use. It breaks down activity into sequences of elementary operations and identifies sources of potential competitive advantage. This breakdown improves the overall performance of the value chain by strengthening each link and links between links.

As production is only one of the stages in creating added value, knowing the dynamics of building soybean value chain involves breaking down all of the activities that structure it, all linked to each other.

#### **3.1 Tentative assessment of financial effects induced by the marketing of regional soybean production**

Regional soybean production follows two marketing trajectories: contract buying and free selling on domestic markets. The first trajectory is supported by the Soybeans Processing Industry of Cameroon (SOPROICAM) which has set up a network of 20,000 farmers present in more than 2000 producer organisations. The contractual relationship is framed by two provisions guaranteeing the supply to producers of inputs (fertilisers and herbicides) at the start of the crop year and the obligation to deliver the crops to SOPROICAM at a price fixed in advance by the two parties. The kg fixed for the 2018–2019 agricultural campaign was CFAF 170 (or EUR 0.259), against CFAF 120–150 (EUR 0.182–0.228) on the domestic market. For this campaign, this company collected 6,000 tonnes of soybeans (60,000,100 kg bags) worth CFAF 1,020,000,000 (EUR 1,554,980). The unsatisfied purchase forecast for this campaign was 20,000 tonnes, which would have generated in the production segment alone a money supply in circulation in the region of CFAF 3.4 billion (EUR 5,183,270).

The second trajectory is organised around a network of wholesalers who source from producers in rural markets. These wholesalers act as intermediaries for cross-border or domestic

agrifood companies. For example, the Cameroonian dairy company (Camlait), an agrifood company based in Douala, introduced, in 2019, 581,203 kg soybeans (5812 bags of 100 kg) in the manufacturing process of its milk-based products (Nouriss, Breaksoy and Riverr). This quantity represents between CFAF 69,744,360 and CFAF 87,180,450<sup>13</sup> depending on the price in rural markets. In addition to food products, soybeans are one of the main feedstocks for poultry feed. Domestic demand, however, remains unevaluated, as does that of Nigerian agrifood companies, which have supplied Nigerian wholesalers with an important soybean purchasing channel for the past decade.

The attempt to assess the financial effects generated from proven national demand reveals the existence of significant economic potential, the optimisation of which would contribute to improving the incomes of farmers directly involved in trade relations with other links of the value chain. Despite uncertainties in the regional production data noted in the methodological framework, reaching 100,000 tonnes of production since the 2018 agricultural campaign would thus represent a minimum annual monetary value of CFAF 12.5 billion (EUR 19,056,100) for producers at the average price on the rural market. This estimate does not include the production of isolated basins in the Far North Region, which is not taken into account in this study. It does not equally include the added value generated by other links in the chain (distribution, transformation).

### 3.2 Structuring elements of a soybean value chain

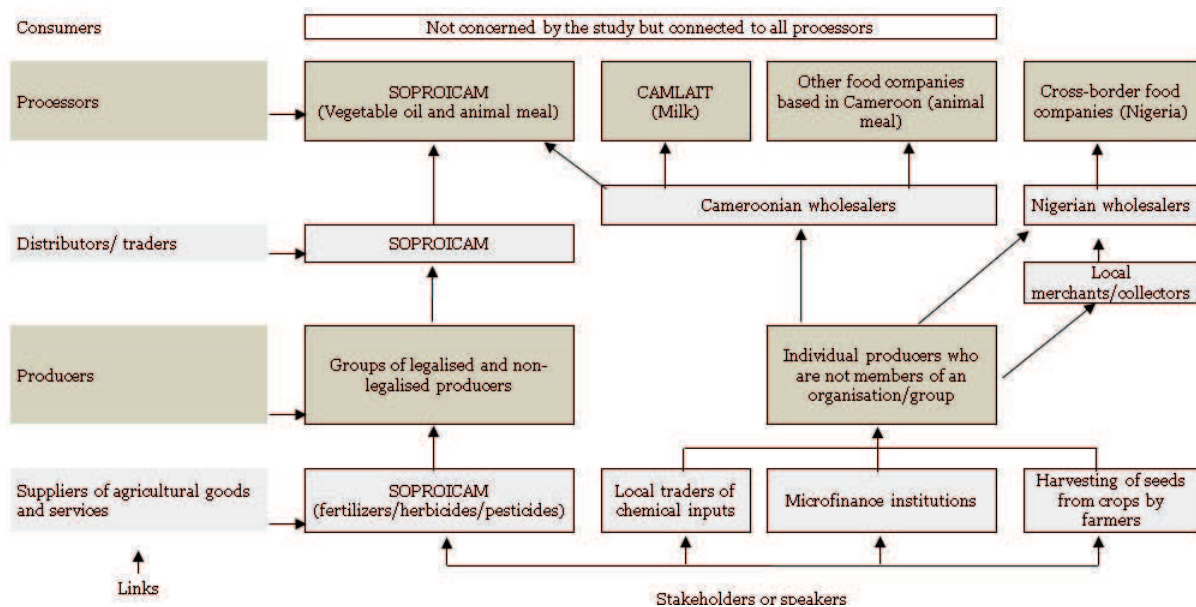
The marketing trajectories analysed above highlight convincing elements in the structuring of a value chain that links four links (supply of basic goods and services, production, distribution, transformation) (**Figure 3**).

The first link is built around four uncoordinated actions which nevertheless make it possible to effectively support the supply of basic agricultural services (seeds, fertilisers, herbicides and financing). Within the framework of its contractual relationship with producer groups, SOPROICAM ensures the supply of inputs to groups that express demand. These are mineral fertilisers of ternary combination N (nitrogen) - P (phosphate) - K (potassium) of formulation 12-24-12 and 20-10-10, as well as herbicides (glyphosate, roundup). The first formulation is specific to the production of legumes whose natural nitrogen production potential directs mineral requirements more towards phosphate. The second formulation which is more suited to the cultivation of maize, responds to a specific request from farmers to the company to support cereal production intended for self-consumption. This company also plays the role of guarantor with micro finance establishments for the granting of loans to producers.

Farmers' growing interest in soybeans has, however, led to the development of the chemical input marketing activity through a network of small distributors who supply rural markets. However, a weak segment of this link remains the supply of seeds, most of which are harvested. Since the introduction and popularisation of varieties adapted to ecology by SODECOTON from 2007 to 2010 (so-called "local" varieties: Houla 1, Houla 2, TGX-849-29-4D, ESA, SJ 235; varieties from the IITA collection of Ibadan in Nigeria: TGX 1448 2E, TGX 1485 1D and TGX 1910 14F), seed production has no longer been the subject of a specific

<sup>13</sup> Or EUR 106,325 and EUR 132,906.





**Figure 3.** Graphical representation of the soybean value chain in the Sudano-Sahelian region of Cameroon.

research or experimentation programme. Consequently, the seeds in circulation come from the repeated reuse of seeds taken from the crops. Production is therefore mainly ensured from so-called “all-coming” varieties resulting from these re-uses. This context is partly maintained by the absence of specific requests on varieties by food companies. Colour therefore is the only criterion for differentiating soybeans between red and white.

The second link in the value chain brings together two categories of producers. The first brought together nearly 20,000 producers in groups whether they have a legal existence or not with the administration in charge of cooperative companies. The second concerns producers who are not involved in any form of collective dynamics. The first initiatives to organise soybean producers emerged from 2011 in the Mayo-Rey Division and will quickly evolve towards the creation of increasingly structured groups despite the low legalisation rate observed (less than 10%). As noted above, SOPROICAM maintains a network of more than 2000 groups. The file of cooperative societies in the North Region references ten legalised cooperatives of soybean producers since 2017, including six in the only Mayo-Rey Division which provides 80% of the production in the North Region (**Table 2**).

Women represent 20% of the group members. This small proportion could be explained by the density of labour-intensive tasks on the one hand, and the immediate financial profitability that the sale of soybeans provides arousing great interest among men on the other hand.

The third link represents the heart of the value chain. It is made up of SOPROICAM and a network of Cameroonian and Nigerian wholesalers, two actors in the governance of the soybean sector. Their respective role in marketing has already been explained in the functioning of the trajectories presented above (2.1.). If it is true that the first actor has invested in the control of the sector from the field to the factory, wholesalers meanwhile are agents of execution of the strategic choices of agrifood companies expressed through the formulation of quantitative and qualitative needs.

Sub-division	Number of cooperatives	Number of members
Rey-Bouba	1	700
Tcholliré	1	1000
Madingring	1	650
Touboro	3	2000

Source: Surveys of producers' cooperatives and base of cooperative societies of the North Regional Delegation for Agriculture and Rural Development (April 2020).

**Table 2.** Spatial distribution of cooperative producers of soybeans in Mayo-Rey (2019).

No.	Denomination	Products developed	Geographical location
1	SOPROICAM	- Vegetable oil - Oil cakes	Douala
2	CAMLAIT	- Nourished, - Breaksoy - Riverr	Douala
3	NT Foods S.A.R.L (Tanty, brand name)	- Soybeans flour - Reine custard powder infant soybeans porridge - Tanty custard powder	Yaoundé
4	Nkam Feed Company	Provende (poultry feed)	Yaoundé
5	Cameroon Provender Company	Provende (poultry feed)	Bafoussam

Source: authors' compilation.

**Table 3.** Main agri-food companies processing soybeans in Cameroon.

The fourth link brings together all of the processing companies whose activities relate to the production of vegetable oil, dairy products, edible flours, oil cakes and animal feed. The study identified five main companies under Cameroonian law, soybeans being one of the main raw materials in the production process (**Table 3**).

The existence of the above four links and the market relationships between them confirm the presence of structural elements in a soybean value chain. The growing investment of distribution and processing players in supporting the productive dynamics testifies today's challenges for a need to perpetuate regional supply to meet increasing domestic and cross-border demand.

#### 4. What prospects for the sustainability of the soybean value chain in the Sudano-Sahelian zone in Cameroon?

The growing statistics on soybean production are likely to obscure the constraints which constitute potential vectors of weakening the productive dynamics noted above. Indeed, the

diagnosis of the organisation and functioning of production as a strategic link in the value chain highlights three major constraints relating to the structuring of producers, the provision of agricultural services and the functioning of market.

With regard to the first constraint, the collaboration model implemented by SOPROICAM tends to polarise all producers towards the creation of structured and legalised groups. Despite the current proliferation of independent wholesalers, consolidating the distribution link means moving towards the establishment of true merchant cooperatives. This future trend implies for producers to build real organisations whose legal existence constitutes a foundation of credibility vis-à-vis other actors in the value chain. However, the low proportion of registration by the competent administration of existing structured groups with a view to obtaining the status of cooperatives results in difficulties in opening accounts in financial and banking establishments due to the lack of a reliable guarantee; refusal to pay membership fees by members; leadership struggles and internal confidence crises.

From the point of view of the provision of agricultural services, the support of distribution players to producers constitutes a dusting which, far from boosting production, keeps farmers in a spiral of dependence on buyers. Several farmers denounce the low level of inputs supplied by SOPROICAM (less than 40–50% of the needs expressed) in exchange for the exclusive purchase of the crops. The fixing of the purchase price at the start of the crop year thus reinforces this dependence of farmers on the company. This context therefore contributes to the establishment of an unsustainable debt cycle in the medium and long term by farmers, many of whom opt for direct sales on domestic markets.

This second constraint is also marked by the absence of a seed sector to sustainably increase yield. With an average yield of 1 tonne/ha, soybean productivity does not bode well for the prospects of sustainable growth, thus justifying the intensification of land clearing and deforestation to expand the cultivated areas, despite the virtual absence of mechanisation of production and technical supervision by State services.

As a corollary to the above, the regional soybean market is characterised by inter-annual price instabilities that are highly detrimental to farmers in terms of making production forecasts due to market uncertainty. In 2012 for example, the kg of soybeans cost CFAF 220 (EUR 0.335) against CFAF 120–150 (EUR 0.182–0.228) between 2017 and 2019. The strong presence on the domestic markets of Nigerian wholesalers frequently subject to variations in the cost of Naira (devaluation) is a factor which reinforces market uncertainties.

Ultimately, beyond the institutional will displayed to support the soybean sector by the launch in 2014 of a dedicated agropolis in the Far North Region, it is difficult to see concrete actions on the ground, strengths of the State for the benefit of key players.

## 5. Conclusion

In this study, we have proposed to analyse the sustainability issues of the productive and market dynamics built around soybeans, speculation subject to strong demands for international competitiveness and which at the same time has a strong potential for improving

farmers' incomes. The conditions and modalities for the development of this speculation corroborate the importance of temporality and spatiality in the soybean diffusion process, which is driven by SODECOTON in the face of the persistent context of the cotton crisis. The productive dynamics described responds to the spatial diffusion trajectory structured in three stages: the initial stage of appearance and growth of soybean cultivation from 2008, the intermediate stage of acceleration of growth observed since the 2015–2016 agricultural season, and the final stage of saturation and decay not yet started. The temporality of the first two stages testifies to the rapidity of the environment penetration through technical innovation which combined varietal selection, technical routes, choice of soils, trading strategy. This speed also shows the capacity of Sudano-Sahelian farmers to take ownership of innovations and optimise their value.

However, from an agronomic point of view, the low productivity (on average 1 tonne/ha) is evidence of the weight of the constraints which limit the optimisation of the productive potential of almost 2 tonnes/ha revealed by experimental trials in 2006, mainly on local varieties. The study highlights in particular the virtual absence of mechanisation of production, a situation affecting both medium and large farms from a spatial point of view, as well as the absence of a seed industry with the corollary of the use of so-called “all-comers” seeds. The major environmental issues in the Sudano-Sahelian region call for priority to be given to the development of intensification trajectories for soybean cultivation.

The growing development of production, although backed by a spatial sprawl trajectory, offers the opportunity to build a value chain that articulates four strategic links: provision of agricultural services, production, distribution and processing. As pointed out above, the investment of distribution and processing players in supporting the productive dynamics testifies to the challenges that the need to perpetuate regional supply raises today. The mobilisation of the value chain approach will have made it possible to grasp the relationships existing between the categories of actors that make up the value chain and to identify their weaknesses. The attempt to assess the financial effects induced by the marketing of regional production has above all revealed the potential that soybean speculation abounds in terms of the circulation of annual money supply.

Ultimately, the results obtained corroborate the hypothesis which maintained that soybean brings out the structuring elements of a value chain, but its viability remains precarious by constraints inherent in the proven inability of farmers to empower themselves to optimise production and control the marketing and poor technical supervision of the crop. It appears that these constraints are jeopardising the prospects for the sustainability of a soybean value chain despite growing demand. The control of all the activities of the chain by private actors constitutes a risk of reinforcement of dependence of farmers who are strongly subjected to the strategic choices of these actors. This observation suggests that public authorities should be strongly challenged in their regulatory role, but above all to support local dynamics by facilitating some procedures, such as streamlining the procedures for creating accounts to increase the proportion of cooperatives registered with the administration in charge of agriculture. The seed sector is a strategic segment which is almost neglected. The sustainability challenges of the soybean value chain are therefore strongly questioned.

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## Conflict of interest

The authors declare no conflict of interest.

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## References

- [1] Diasso Yankou, « Dynamique du prix international du coton: aléas, aversion au risque et chaos », *Recherches économiques de Louvain*, 2014/4 (Vol. 80), p. 53-86. DOI: 10.3917/rel.804.0053. URL: <https://www.cairn.info/revue-recherches-economiques-de-louvain-2014-4-page-53.htm>
- [2] Griffon M. (2003). 'Quand l'agriculture africaine va-t-elle commencer à répondre aux enjeux du futur ?' (Griffon M. 2003). In *Cahiers Agricultures*, Volume 12, pp. 141-143.
- [3] Arvor Damien. Etude par télédétection de la dynamique du soja et de l'impact des précipitations sur les productions au Mato Grosso (Brésil). Sciences de l'Homme et Société. Université Rennes 2, 2009. Français. tel-00422109v2
- [4] WWF. 2014. The growth of soy: Impacts and solutions. WWF International, Gland, Suisse.
- [5] Nyahnone T J., 2017. Le développement de la culture du soja dans les fronts d'extensions cotonniers du Nord-Cameroun: Le cas du Mayo-Rey. Mémoire de master de géographie, Université de Ngaoundéré, 135p.



- [6] Nitchou Wakponou Darryl Neil (2018). *Les enjeux environnementaux du développement de la chaîne de valeur soja dans le bassin cotonnier du Nord-Cameroun: cas des arrondissements de Touboro et de Madingring*, Mémoire de master de géographie, Université de Ngaoundéré, 165p
- [7] Mehmet Oz., 2008. Nitrogen rate and plant population effects on yield and yield components in soybean. *African Journal of Biotechnology* Vol. 7 (24), pp. 4464-4470, 17 December, 2008, pp 4464-4470.
- [8] Baboy L., Kidinda L., Kilumba M., Langanu S., Mazinga M., Tshipama D., Kimuni L., 2015. Influence du semis tardif sur la croissance et le rendement du soja (*Glycine max*) cultivé sous différents écartements à Lubumbashi. RD Congo. *International Journal of Innovation and Applied Studies*, pp 104-109.
- [9] Kananji G., Yohane E., Siyeni D., Kachulu L., Mtambo L., Chisama B., Mulekano O., 2013. A Guide to Soybean Production in Malawi. Department of Agricultural Research Services (DARS), Lilongwe, Malawi. Retrieved November 29
- [10] Dronne Y., Forslund A., Gohin A., Guyomard H., Levert F. (2007). 'Impacts du développement des biocarburants aux États-Unis et dans l'UE sur les marchés internationaux de produits de grandes cultures'. In *Oilseeds and fats, Crops and Lipids (OCL)*, VOL. 14 N° 6 novembre-décembre 2007, pp. 347-353 (<https://www.ocl-journal.org/articles/ocl/pdf/2007/06/ocl2007146p347.pdf>).
- [11] Hart Energy, 2013. Global biofuels outlook to 2025. Global biofuels center (<https://ubra-bio.com.br/sites/1800/1891/PDFs/InformacaodoSetor/2013BiodieselPrimer.pdf>).
- [12] Schneider A., Huyghe Christian (Coord.), 2015. *Les légumineuses pour des systems agricoles et alimentaires durables*, Versailles, Editions Quae, Collection Technology & Engineering - 512 p. ([https://books.google.cm/books?id=OyQ0CgAAQBAJ&pg=PA381&lpg=PA381&dq=Sojaxe,+2013&source=bl&ots=Ia8f0L7cn3&sig=ACfU3U3JH8Dwf9\\_tteL5lsnHlkZokekE9g&hl=fr&sa=X&ved=2ahUKEwivw4zA5MHqAhUL3BoKHXT\\_CvIQ6AEwEnoEAcQAQ#v=onepage&q=Sojaxe%2C%202013&f=false](https://books.google.cm/books?id=OyQ0CgAAQBAJ&pg=PA381&lpg=PA381&dq=Sojaxe,+2013&source=bl&ots=Ia8f0L7cn3&sig=ACfU3U3JH8Dwf9_tteL5lsnHlkZokekE9g&hl=fr&sa=X&ved=2ahUKEwivw4zA5MHqAhUL3BoKHXT_CvIQ6AEwEnoEAcQAQ#v=onepage&q=Sojaxe%2C%202013&f=false))
- [13] Le Tourneau François-Michel (2004). Jusqu'au bout de la forêt ? Causes et mécanismes de la déforestation en Amazonie brésilienne. In, *Mappe Monde* (ISSN: 0764-3470), Montpellier, Published by Maison de la géographie, numéro 75, pp. 1-25.
- [14] Guéneau Stéphane, « Durabilité des chaînes globales de valeur du soja et de la viande de bœuf en Amazonie: conséquences d'une gouvernamentalité néolibérale », Brésil(s) [En ligne], 13 | 2018, mis en ligne le 31 mai 2018, consulté le 23 juin 2020. URL: <http://journals.openedition.org/bresils/2468> ; DOI: <https://doi.org/10.4000/bresils.2468>
- [15] Hågerstrand T. (1952). « The propagation of innovation waves ». *Lund studies in geography*, ser. B, n° 4.
- [16] Hågerstrand T. (1957). « Migration and area ». *Lund studies in geography*, sery. B, n° 13.
- [17] Saint-Julien Th. (1985). La diffusion spatiale des innovations. Montpellier GIP RECLUS, coll. « RECLUS Modes d'Emploi ».

- [18] Saint-Julien Th. (1992). « Diffusion spatiale ». Encyclopédie de géographie. Paris Economica.
- [19] Gould P., DiBiase D., Kabel J. (1990). « Le SIDA la carte animée comme rhétorique cartographique animée ». Mappemonde, n° 1.
- [20] Dumolard Pierre. Accessibilité et diffusion spatiale. In: Espace géographique, tome 28, n°3, 1999. pp. 205-214; doi: <https://doi.org/10.3406/spgeo.1999.1254> [https://www.persee.fr/doc/spgeo\\_0046-2497\\_1999\\_num\\_28\\_3\\_1254](https://www.persee.fr/doc/spgeo_0046-2497_1999_num_28_3_1254)
- [21] Maudet Jean-Baptiste, « La diffusion spatiale à l'épreuve des rodéos. Les hybridations taumachiques de l'Europe à l'Amérique », *Ethnologie française*, 2011/4 (Vol. 41), p. 667-675. DOI: 10.3917/ethn.114.0667. URL: <https://www.cairn.info/revue-ethnologie-francaise-2011-4-page-667.htm>
- [22] Terpend N. (1997). *Guide pratique de l'approche filière. Le cas de l'approvisionnement et de la distribution des produits alimentaires dans les villes*, DT/18-97F, FAO, Collection « Aliments dans les villes », 34 p.
- [23] Labonne M. (1987). 'Sur le concept de la filière en économie agro-alimentaire'. In Kermel-Torrès Doryane (ed.), Roca P.J. (ed.), Bruneau Michel (ed.), Courade Georges (éds). *Terres, comptoirs et silos: des systèmes de production aux politiques alimentaires*, Actes du Colloque « Séminaire interdisciplinaire sur les Politiques Alimentaires », Paris, ORSTOM, pp. 137-149.
- [24] Aragrande Maurizio (1997). *Les approches disciplinaires de l'analyse des SADA*, Communication présentée au Séminaire sous-régional FAO-ISRA « Approvisionnement et distribution alimentaires des villes de l'Afrique francophone », Dakar, 14-17 avril 1997, Collection « Aliments dans les villes », 55 p.
- [25] Temple L., Lançon F., Montaigne E., Soufflet J-F. (2009a). 'Introduction aux concepts et méthodes d'analyse de filières agricoles et agro-industrielles'. In *Economies et Sociétés*, Série « Systèmes agro-alimentaires », AG, n°31, 11/2009, pp. (1803-1812).
- [26] Scott G. et Griffon D. (1998). *Méthodes pour analyser la commercialisation agricole dans les pays en développement*, Montpellier, CIRAD, Paris, Karthala, Lima, CIP/Apartodo, 495 p
- [27] Ndjouenkeu R., Fofiri Nzossie E.J., Kouebou C. P., Njomaha C., Koussou Miand O., Gremombo A. 2010. *Le maïs et le niébé dans la sécurité alimentaire urbaine des savanes d'Afrique centrale*, Communication présentée au Symposium Innovation & Sustainable Development in Agriculture and Food, CIRAD-INRA-Montpellier SupAgro (28 juin – 01 juillet 2010, Montpellier, France)
- [28] Devèze Jean-Claude, « Le coton, moteur du développement et facteur de stabilité du Cameroun du Nord ? », *Afrique contemporaine*, 2006/1 (n° 217), p. 107-120. DOI: 10.3917/afco.217.0107. URL: <https://www.cairn.info/revue-afrique-contemporaine-2006-1-page-107.htm>
- [29] Levrat R., 2009. *Le coton dans la zone franc depuis 1950. Un succès remis en cause*, Paris, Editions L'Harmattan, Collection Etudes africaines, 248 p.
- [30] Folefack Denis Pompidou. *Coordination des acteurs dans un contexte de crise: le cas de la filière coton au Cameroun depuis 1990*. Economies and finances. Université

Rennes 2; Université Européenne de Bretagne, 2010. French. <NNT: 2010REN20030>. <tel-00597413>

- [31] Folefack et NTSOU BAKWOWI Jeshma, Cokou KPADE Patrice. J. Appl. Biosci. 2014. La crise de la filière cotonnière et sécurité alimentaire au Nord Cameroun, in: Journal of Applied Biosciences 75:6221-6231
- [32] Wey J et Ibrahima S., 2006. *Cultures de diversification: Étude de faisabilité du soja et du tournesol dans la zone cotonnière du Nord Cameroun*, Rapport CIRAD, 55 p. ([http://agritrop.cirad.fr/559886/1/document\\_559886.pdf](http://agritrop.cirad.fr/559886/1/document_559886.pdf))
- [33] Fofiri Nzossie E.J., 2013. *Les déterminants de l'offre alimentaire vivrière dans les villes du Nord-Cameroun*, Thèse de Doctorat de géographie économique, Université de Ngaoundéré, Cameroun, 441 p. (<https://tel.archives-ouvertes.fr/tel-01092376>)
- [34] Seignobos C. (2006). 'Colloque international SFER "Les frontières de la question foncière", Montpellier, France, 2006, 21 p.