

Research Article

SOCIO-ECONOMIC AND ENVIRONMENTAL IMPACTS OF PLANTAIN CULTIVATION IN BOUAFLE DEPARTMENT

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ABSTRACT

Like the main cash crops that dominate the department of Bouafé, plantain, which is a cash crop, has established itself as a food and economic crop. Production and marketing activities related to this crop are booming in the department. The aim of this article is to show the economic and social implications of plantain in the Bouafé department, as well as those linked to the environment. In this study, four hundred and twenty (420) producers were interviewed from January to April 2019. Successive visits were also made between 2019 and 2022. The results showed that plantain is beneficial to the population in terms of edible food and financial income in the department of Bouafé. However, the results also showed that its environmental impact needs to be taken into account.

Keywords: Bouafé, plantain, production, marketing, socio-economic and environmental impacts.

INTRODUCTION

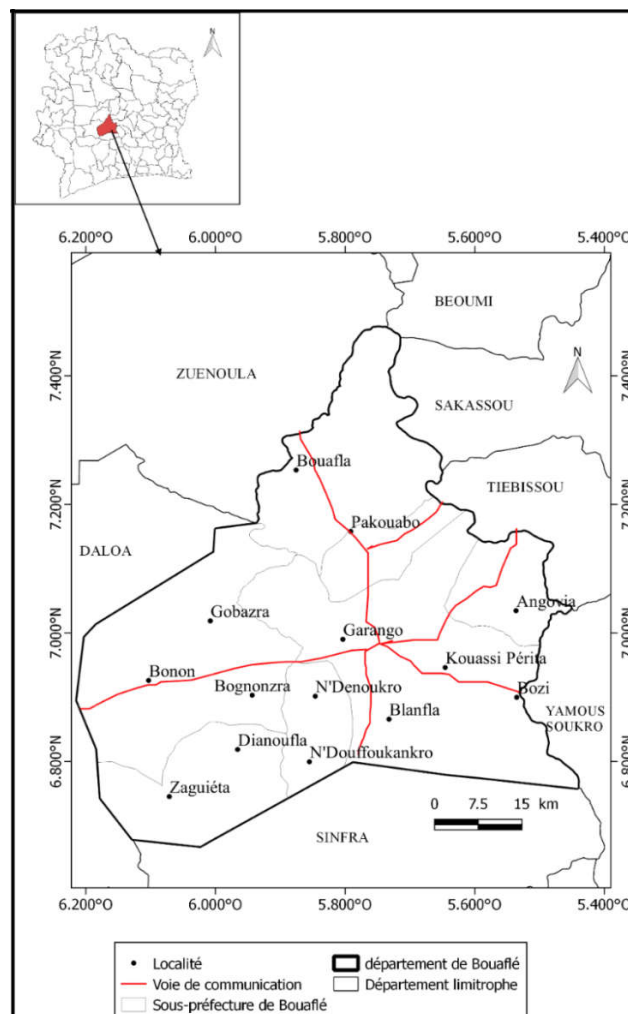
Agriculture is a key sector in the economies of African countries, particularly in West Africa. In terms of figures, for example, it employs more than 40% of the active workforce and is the main source of income for more than 25% of urban households (OECD/FAO, 2016, p. 70). According to ECOWAS (2015, p.13), over 55% of households in rural areas enjoy the benefits of this activity. In Côte d'Ivoire, one out of every two working people is employed in this sector (Ducroquet *et al.*, 2017, p. 9). Despite the strong presence of the population and the support of the authorities, the benefits of agriculture are less beneficial to its actors, and this exposes them to deficiency. To find a solution to this situation, various strategies have been adopted by local people. This is the case in Bouafé, a department in the centre-west of Côte d'Ivoire, where, in addition to traditional crops such as coffee and cocoa, the local people are promoting plantain. Today, the success of this crop in the department is relegating traditional crops to the second place, and its apparent effects are multiform and highly perceptible in this region. This observation has prompted us to analyse the socio-economic and environmental impact of the spread of this crop in the department. In other words, what are the various impacts associated with the adoption of plantain cultivation by the local population?

MATERIALS AND METHODS

Location, physical and human environment of the study area.

The department of Bouafé covers an area of 3,980 km². It borders the department of Zuénoula to the north and the department of Sinfra to the south. To the east and west, the department shares borders with Yamoussoukro and Daloa respectively, as shown on figure 1. According to the RGPH (2021), it has a population of 467,702.

Figure 01: Study area: Bouafé Department



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Source: Personal surveys, 2019-2022

Production: NavanhanYEO,2022

Data collection and analysis of variables

This research focuses on the department of Bouaflé and the surveys were conducted between 2019 and 2021. Two types of data were therefore collected : secondary data and primary data. For the first type of data, collection was based on plantain production units, plantain-producing populations and plantain traders. The second type of data concerned archived research work on plantain production. Documentary research was carried out in university libraries (UAO, IGT), accredited research structures (IRD), ministries (MINADER, MINEF) and other structures (ANADER, CIDT, OCPV, etc.) to consolidate the results. Interviews were also conducted with certain authorities (administrative and village), certain regional directors (agriculture and others), and managers of cooperative societies to complete the secondary data. Field surveys of plantain growers were also carried out during this period. Four hundred and twenty (420) farm managers were selected to serve as the sampling frame using the producers' law sampling method as the base sample and extrapolated to the various villages chosen as the observation units in each sub-prefecture. Using the hybrid method, which is a combination of the reasoned choice method and the random method, fourteen (14) villages were chosen as observation units. In addition to the questionnaires used in these surveys, we used a digital camera to take various photographs. Software such as Word 2013, Excel 2013 and QGIS 2.18 were used to process the data and produce tables, graphs and maps.

RESULTS

Plantain, a source of direct and indirect income.

The results of the surveys showed that plantain provides income for growers. The data in Table 1 show that this income is distributed by bracket, ranging from 100 000 FCFA to 500 000 FCFA. At departmental level, these results show that 59% of growers have incomes of less than 100 000 FCFA. 21% had incomes of between 100 000 CFA and 200 000 FCFA, 12% had incomes of between 200 000 FCFA and 300 000 CFA and 8% had incomes of over 500 000 FCFA.

Table 01: Distribution of stakeholders according to income from the plantain economy during a financial year in the department (%).

Earned income bracket	Number (N)	Proportion (%)
Less than 100 000 FCFA	245	59
From 100 000FCFA to 200 000 FCFA	90	21
From 200 000 CFA to 300 000 CFA	52	12
More than 500 000 FCFA	33	08
Departmental group	420	100

Source: Personal surveys, 2019-2022

The results of the surveys reveal that the profits made by plantain growers in the region differ. On the one hand, there are those who make huge profits, and on the other, those who make less. According to the surveys, the reasons for this are linked to the number of years they have been in business. They indicate that the major producers are those with a great deal of experience in the business. Some of them have been in business for more than 20 years, while others have been in business for at least 10 years. This wealth of experience has enabled them to develop strategies for making large profits. As for low-income producers, the surveys show that they have very little experience (less than three years).

Paying social security contributions and acquiring a large amount of socio-economic and agricultural equipment thanks to the income generated by plantain.

The various incomes generated by plantain ensure the social and material well-being of producers. In this respect, the results of the surveys showed that the income generated by plantain enabled farm managers to meet their social expenses (food, health, schooling, various ceremonies, etc.). At departmental level, for example, analysis of the data in Table 2 shows that resources from bananas enabled over 38% of farmers to provide medical services. These resources were also used to send 51% of farmers' children to school. According to these results, 11% of farmers were also able to pay their water and electricity bills.

Table 02: Proportion of secondary social charges taken into account at departmental level (%).

Type of social charges	Number (N)	Proportion (%)
Medical care	161	38
Schooling	215	51
Payment of various bills (CIE-SODECI)	44	11
Total	420	100

Source: Personal surveys, 1999-2022

In addition to social security contributions, the results show that the resources generated by plantain have enabled farmers to acquire movable and immovable assets, as shown in Table 3 (A.B).

Table 03: Breakdown of movable and immovable property acquired in the department in proportion (%).

A: Household appliances

Typology	Number	Proportion
of assets	(N)	(%)
Laptop	267	64
Television	69	17
Satellite dish	65	15
Solar panel	18	04
Total	419	100

B: Wheeled machinery

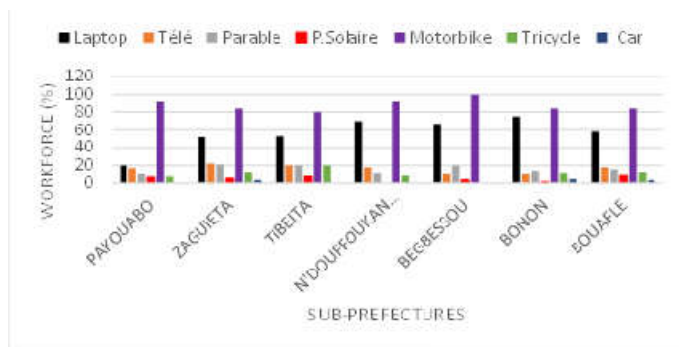
Typology	Number	Proportion
of assets	(N)	(%)
Motorbike	364	87
Tricycle	48	11
Car	08	02
Bike	00	00
Total	420	100

Source: Personal surveys, 1999-2022

These results show that 64% of plantain growers have also acquired mobile phones, 17% television sets, 15% satellite dishes and 4% solar panels. 87% of growers have acquired 2-wheeled motorbikes, 11% three-wheeled motorbikes (tricycles) and only 2% cars.

In the sub-prefectures, the data in Figure 2 show that in N'douffoukankro, 70% of growers have acquired mobile phones thanks to their plantain income.

Figure 02: Types of goods acquired by plantain growers in sub-prefectures, in percentages (%).



Source : Personal surveys, 1999-2022

In Pakouabo, 17% acquired televisions, in Bégbéssou 20% satellite dishes, and in Tibéita 7% solar panels. The graph also shows that in the sub-prefectures of Zaguiéta, 84% of farmers have bought two-wheel motorbikes, and in Bonon, 12% have bought tricycles. In the Bouaflé sub-prefecture, 3% of farmers said they had a car thanks to their income from plantain, as shown in photo 1.

photographic plate 1: Some capital goods acquired by plantain growers



Source : Personal surveys, 1999-2022

Income from plantain production is also used to maintain and expand plantain farms, as shown in Table 4.

Table 04: Proportion of farmers by farm expenses in percent (%).

Types of services	Number (N)	Proportion (%)
Purchase of inputs	271	65
Purchase of equipment	96	23
Expansion of farms	53	12
Total	420	100

Source: Personal surveys, 1999-2022

The data in the table show that, in addition to other uses of income from plantain, 65% of the farm managers surveyed said they used part of their income to buy agricultural inputs. 23% used it to buy equipment, tools and other items, and 12% said that they used these resources to expand their farms by buying more land. The results of the investigations as a whole highlighted the fact that the resources generated by plantain cultivation serve the daily lives of farmers by providing them with social and material well-being. The results also showed that plantain growing has an impact on the environment.

Plantain production: an activity with harmful environmental impacts.

The results of the department-wide surveys showed that plantain production makes the collection sites unhealthy, according to the opinion of one hundred and forty (140) producers, as shown in table 5.

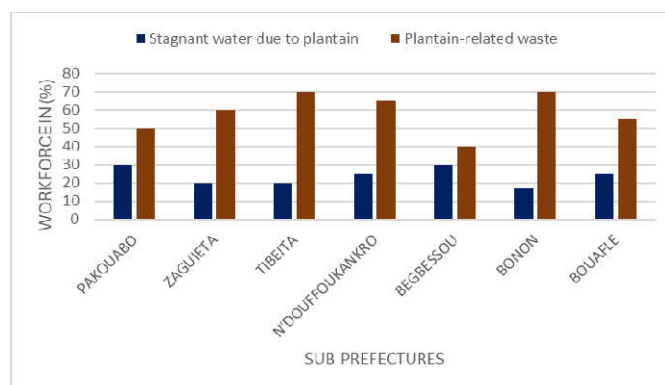
Table 05: Proportion of farmers' opinions on the nature of the environment in percent (%).

Sources of ugliness	Number (N)	Proportion (%)
Stagnant water	32	23
Rubbish from plantains	84	60
Rubbish not due to plantains	24	17
Total	140	100

Source: Personal surveys, 1999-2022

According to this data, 60% of growers attribute this unhealthiness to piles of dead stems, flowers or shoots. For 23%, unhealthiness is also caused by stagnant water from plantain waste (banana stalks and dead stems). In addition to the effects of dead banana stalks and waste, 17% of growers mentioned the action of banana trucks and tricycles. For the latter, the action of the tyres of these machines silt up the cracks they have left and accentuate the stagnation of water on the collection sites. In the sub-prefectures, these opinions on the effect of stagnant water and plantain waste are presented in Figure 3.

Figure 03: Soil destruction activities linked to plantain production in the sub-prefectures in percent(%).



Source : Personal surveys, 1999-2022

With regard to unhealthy conditions linked to stagnant water caused by plantain waste, 30% of producers surveyed in the Pakouabo and Bégbéssou sub-prefectures shared this opinion. The results also show that 25% of growers in N'douffoukankro and Bouaflé reported this source of unhealthy conditions. In Zaguiéta and Tibéita, the survey data show that 20% of farmers support this view (photo 1). This opinion is also shared by 17% of growers in Bonon.

Photo 01: Stagnant water at a collection site



Source : Personal surveys, 1999-2022

With regard to the share of dead flower stalks or dead stems, identified as a source of unhealthiness and environmental pollution as shown in photo 2, the results show that 70% of plantain growers in Tibéita and Bonon approve. In the sub-prefectures of Zaguiéta and N'douffoukankro, 60% and 65% of growers respectively shared this view. In Bégbéssou, the results confirm that 40% of producers agreed. In the Pakouabo sub-prefecture, the graph also shows that 50% of producers are of this opinion. This was also the case for 55% of farmers surveyed in Bouaflé.

Photo 02: Dead flower stalks or stems at a collection site

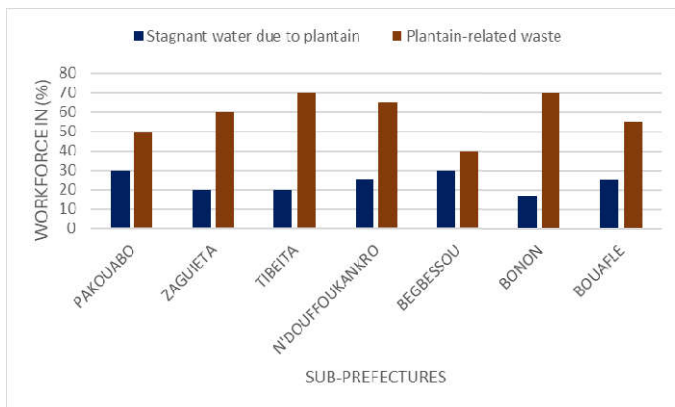


Ugandan ugliness in Garango(S/p of Bouaflé)

Source : Personal surveys, 1999-2022

In this environmental degradation due to plantain farming activities, research have also shown that, in addition to the unhealthy living environment that is most visible, vegetation is also affected. This is illustrated by the data in Figure 4.

Figure 04 : Soil destruction activities linked to plantain production in the sub-prefectures in percent(%).



Source : Personal surveys, 1999-2022

The results of surveys on this subject showed that the activities associated with the establishment and maintenance of plantain farms have a negative impact on the forest environment and soils. In the opinion of respectively 47% and 43% of farmers in Pakouabo and Tibéita, the use of wildfire to set up plantain farms affects the natural vegetation. In Zaguiéta, 18% of farmers said the same. In the sub-prefectures of N'douffoukankro, Bégbéssou, Bonon and Bouaflé, less than 6% of farm managers supported this view. The investigations carried out in the various sub-prefectures also demonstrated the effects of this clearing on the forest cover and soils. The results show that for 40% of farmers in Pakouabo, Tibéita and Bégbéssou, clearing destroys the vegetation cover and exposes the soil to erosion. In the sub-prefectures of Bonon and Bouaflé, 35% of farmers noted this. In Zaguiéta and N'douffoukankro, less than 26% of farmers reported this.

In addition to wildfires and land clearing, which are used as cultivation techniques in the creation of farms, whose effects are less beneficial for vegetation and soil, the results also indicated some other dangers linked to herbicides and pesticides. For 77% of farmers in N'douffoukankro, herbicide spraying is harmful to the environment. In their view, by destroying surface vegetation, herbicide infuses affect outcropping watercourses and have a long-term penetrating effect on the various water tables. This is also the position of 60% of farmers in Bégbéssou and Bonon, and 61% of farmers in Bouaflé. In Zaguiéta, the results show that 57% of farmers share this opinion in Tibéita and 17% and 13% in Pakouabo. The income received from plantain production helps growers in their daily lives by enabling them to meet social and community charges and to purchase movable and immovable property. However, the activities associated with growing and producing this crop have a negative impact on the environment.

DISCUSSION

While the study showed it, the socio-economic benefits of plantain production in the Bouaflé department, as attested by other authors such as Lare, (2017, p. 174), off-season market gardening also provides income and contributes to poverty reduction in rural areas, Ale, (2016, p. 342) ; Botsoe, (2001, p. 72) and de Diarra *et al.*, (1998, p. 342) have also attested this. It is important to stress that the surveys also uncovered constraints to plantain production. According to the results of these investigations, these constraints, by hampering production, influence costs and indirectly affect the well-being of producers. In this respect, the surveys indicated that the sector suffers from a shortage of labour, as highlighted in other sectors by Kouadio Akissi *et al.*, (2022).

Although the study mentioned the involvement of everyone in plantain cultivation, despite this problem, it also showed that the proportion of women and young people is still low. The proportion is 19% for women and 81% for men. Diby (2023b, p. 366) has also studied this unequal relationship between men and women in rubber cultivation, where the proportion of women hardly reaches 7%. In addition to this constraint, there are those linked to disease and climate. Balimwacha (2020, p. 13) mentioned this in the results of his research into the constraints on plantain development in the Beni region of Congo. In his findings, he established that in addition to the constraints linked to climatic variability, which have a negative impact on production, plantain is also exposed to bacterial and viral diseases. According to the author, these diseases attack banana cultivars, affecting yields and wiping out production.

While the results of our research have confirmed the advantages of this type of production in terms of guaranteed income for producers, it is also important to stress that these resources are no longer a guarantee for producers today. It is no longer a guarantee for producers because of the high cost of living and the instability of kg prices. The literature has shown that these prices vary according to supply and the weight of the banana bunch. Kwa *et al.*, (2019, p. 31) make this point in their study, noting, for example, that the diversity of units of measurement for food crops, in this case plantain on the markets (per bunch, in hands, per banana finger, in cartons), is a difficulty in calculating the price per kilo. In their view, these units vary according to the market, the variety, the actor, the type of transaction and the period are at the root of the flexibility of the costs of banana bunches on the market. Damme (2008, p. 51) has also shown this in Rwanda, where she notes that, as with other food products, the State does not set the price of plantain bunches. In addition to these difficulties, the surveys highlighted those linked to poor soil fertility management and a lack of quality planting material. These difficulties, according to the surveys, sometimes discourage growers and push

them towards other crops such as rubber and oil palm. With regard to the use of the financial resources generated by plantain, even if the results do not indicate this, the surveys and the literature (Damme, 2008, p. 51) have revealed that there is also a fringe of producers who do not make use of them. We also note that, while the results confirmed the thesis of the negative effects of plantain diet residues on people's quality of life on the one hand, and its effects on the environment in the context of setting up and maintaining farms on the other, it is also essential not to conceal its environmental and other spin-offs. The investigations carried out in the department and the literature consulted in this context have shown that these benefits are the result of the ecosystem services provided by the plantain tree.

With regard to the use of stems, for example, although they are a source of disfigurement, surveys and research have shown that they are also used to feed livestock. Kwa *et al.*, (2019, p.39) emphasised this point, noting that all plantain by-products (skins, false trunks, stems, damaged fruit) can be used, after grinding, to produce feed for livestock. This use of by-products was also the subject of a paper by Angboet *et al.*, (2017), who demonstrated the use of banana co-products in pig farming in Côte d'Ivoire.

Research by Bello Pérez *et al.*, (2012, pp. 1796-1,808) also showed that dried plantain peel can be used to make powders containing pectins and certain antioxidant compounds that are good for food. Their research has also shown that if this skin is dried, crushed and packaged, it can produce biogas to help combat global warming and protect the environment. With regard to the impact of the establishment of banana farms on the plant cover raised by the results, Kwa *et al.*, (2019, p. 88) argue that although this is a factual situation, it is not always the case, because plantain plays a secondary role on some farms. They point out that this crop is always associated with other plants and, for the most part, is used to shade young plants for two to three years before disappearing. According to Sangollo (2022, p. 75), it is an essential resource in this agroforestry cropping system. Taking this further, Kwa and Temple (2019, p. 16) mentioned that the main banana silviculture system also provides soil cover through the use of crop cycles and ground cover (herbaceous) plants. By doing so, it keeps the land bare, limits dust build-up and improves air quality. Another author, Valentini, (2007, p. 35) goes further in his research by indicating that plantain is a climate regulator in the agro forestry system as a carbon sequestrator. As for soils, while the results point to plantain destruction, for Hesselink and Thevathasan (2014, p. 11), banana is also a tree species. As such, it protects the soil from the beating effect of raindrops to limit runoff and erosion. Also, like the rubber tree, which is an ecological species par excellence, due to the low use of phytosanitary products on farms (Diby, 2017, p. 104); Kwa *et al.*, (2019, p. 93) have also noted that the farming techniques favoured on banana farms minimise the use of chemical phytosanitary inputs. For them, this is an act of sustainable management of ecosystem resources and environmental protection. Kwa and Temple (2019, p. 39), for example, indicate that in Asia and Latin America, the stems are used to make an organic fertiliser that is used in banana plantations to limit the use of industrial fertilisers.

CONCLUSION

The study on the socio-economic and environmental impacts of plantain production in the Bouaflé department showed that, as a provider of financial resources, plantain also has an impact on the environment. The results confirmed that the financial resources garnered by those involved in this crop have enabled them to meet their family's social expenses, acquire movable and immovable property, and participate in community life and the development of their region. In addition to these benefits, the results also highlighted

the harmful effects of the activities linked to the cultivation of this crop, on the one hand on the living environment, which has been tarnished by the residue of dead shoots and stagnant water, and on the other hand on the plant environment, which is in decline. While the results of the study have highlighted the role of plantain in the department of Bouaflé, it is appropriate in view of the difficulties identified by the surveys in the plantain sector, to carry out a future study s on the entire value chain of the sector.

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