Indian Journal of Fibre and Textile Engineering (IJFTE)
ISSN: 2582-936X (Online), Volume-5 Issue-1, May 2025

A Farm Typology Based on a Modelling of Their Size on a Global Level

Soulé EL HADJ IMOROU

***Abstract:** To this day, cotton is one of the main cash crops in Benin, despite the emergence of certain crops that are considered less constraining. In sub-Saharan African countries, agriculture is essential for economic growth, which is necessary to reduce poverty and food insecurity. In the cotton-growing areas, the support given to farms in the framework of national actions or bilateral/multilateral cooperation is not based on a typology of farms to help identify what to do and measure what has been achieved. Differences in land area per capita and land productivity largely explained the variation in food security across sites. In agriculture, such grouping of farms might help for a better knowing and understanding of the structure and functioning of each farm group as well as the problems, opportunities, and needs in terms of policy intervention and support. This study aims to draw up a typology of cotton production based on area size. The present work aimed at establishing a typology of the cotton farms used as a first discriminatory factor, which was the farm size, measured by the size of land under cotton cultivation. This size may also reflect the crop's importance for farmers. Based on this factor or criterion, a first discrimination of cotton farms has been set, giving different groups of cotton farms. To this end, data were collected from 140 cotton growers in Benin. Using discriminant factors, a typology analysis based on farm size was carried out. The results showed that farm size is determined by socio-economic and demographic characteristics, as well as by access to production factors. Agricultural policies aimed at increasing cotton production can influence factors such as access to production inputs.*

***Keywords:** Cotton farm, Size, Typology, and Global Level*

Abbreviations:
SSA: Sub-Saharan Africa
GDP: Gross Domestic Product
GVPC : Groupement Villageois des Producteurs de Coton

I. INTRODUCTION

In the first two decades of the 21st century, sub-Saharan Africa (SSA) has changed rapidly for the better in many ways, counter to many outdated narratives [1]. Widespread rural poverty in Africa and the success of Asia's Green Revolution suggest that agriculture is a key sector for African development [2]. In sub-Saharan Africa, agriculture is the principal source of wealth and poverty reduction.

Manuscript received on 20 April 2025 | First Revised Manuscript received on 07 April 2025 | Second Revised Manuscript received on 05 May 2025 | Manuscript Accepted on 15 May 2025 | Manuscript published on 30 May 2025.
***Correspondence Author(s)**
Dr. Soulé EL HADJ IMOROU*, Département De Sociologie – Anthropologie, Faculté Des Lettres Arts Et Sciences Humaines, University of Parakou, BORGOU, Benin. Email ID: imorousoule@yahoo.fr, ORCID ID: 0009-0000-8350-7429

© The Authors. Published by Lattice Science Publication (LSP). This is an open access article under the CC-BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/)

In sub-Saharan African countries, agriculture is essential for economic growth, which is necessary to reduce poverty and food insecurity. Unfortunately, the performance of agriculture in sub-Saharan Africa has not been up to expectations and has been characterized over the decades by ups and downs [13]. The rural population has been unable to move out of poverty and food insecurity principally because they have not been able to transform their basic economic activity, which is agriculture [14]. Differences in land area per capita and land productivity largely explained the variation in food security across sites. Based on land size and market orientation, four household types were distinguished (subsistence, diversified, extensive, intensified), with contrasting levels of food security and agricultural adaptation strategies [3]. In Benin, the gross domestic product (GDP) per capita, agricultural value added, and the human development index have a long-run relationship [15].

The Sub-Saharan Africa (SSA) countries alone only contribute to a limited share of world cotton production, but when added to production from Francophone Africa Countries, their share of world exports is very significant, globally ranking second after the USA [4]. Countries [5]. A strong and positive connection is found between cotton export and economic growth, and a long-term relation between human capital and economic growth in Benin [16]. A rapid human capital development will increase the quality of the employment generation, and the country's economy will adjust upward [6]. In Benin, cotton has long been the core cash crop of rural livelihood systems until the mid-2000s, when multiple constraints, like the problem of input and seed, led to the demise of cotton production [7].

Improving the management of goat in rural areas and enhancing their ability to alleviate smallholder poverty requires a better understanding of the existing production systems [8]. In the cotton-growing areas of West and Central Africa, the support given to farms in the framework of national actions or bilateral/multilateral cooperation is not based on a typology of farms to help identify what to do and measure what has been achieved. Such a situation may result from the lack of a typology or, more frequently, the lack of actual and regular application of a typology [9]. It has been found that only well-equipped farms make a positive profit if we value family labour and organic manure. The other types of farms, with the level of yield recorded, had difficulty covering the costs involved in seed cotton production. In Benin, cotton farms in North-Central adopt more farming practices and

© Copyright: All rights reserved.

achieve better economic performance. Farms in the Centre adopt fewer cultivation practices and perform very poorly economically. Although the adoption score is low in the North, the farms perform well due to their accumulated experience and the efficient use of inputs, with very low intermediate consumption [10].

This study aims to analyse the typology of cotton farms based on their size. For this, data on cotton production were collected in Benin.

The rest of this paper is presented as follows. The next section is dedicated to the theoretical framework. The following section presents the materials and methods. The latest sections present the results and conclusion.

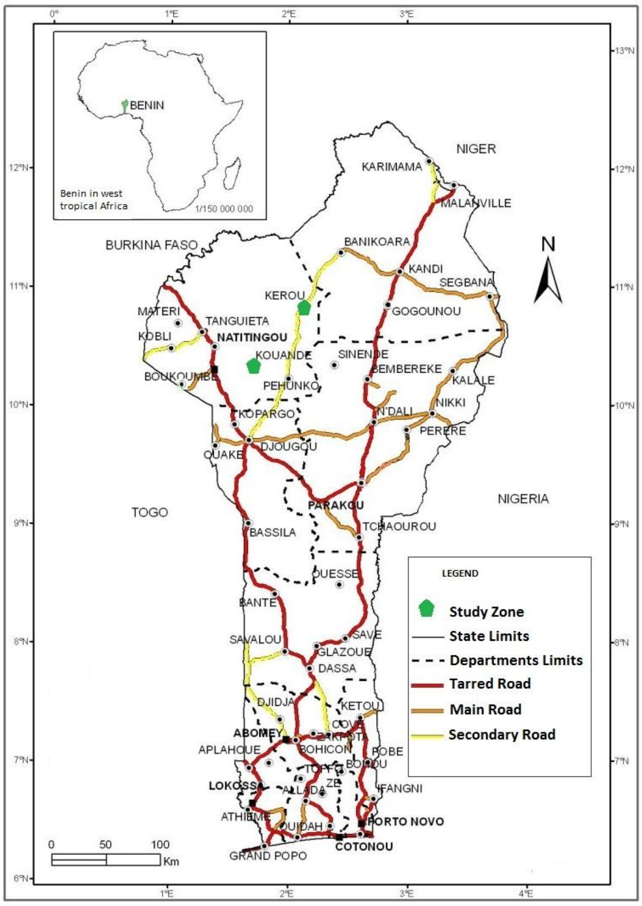
II. THEORETICAL FRAMEWORK

The typology refers to the determination of a small number of classes – groups with significant differences regarding some given interests, characteristics, and behaviours (Benedict et al., 1944). In agriculture, such grouping of farms might help for a better knowing and understanding of the structure and functioning of each farm group as well as the problems, opportunities, and needs in terms of policy intervention and support. A farm typology aims at: (i) classifying various farms in the same region within a limited number of relatively homogeneous categories, (ii) explaining the differences between farms to perform policy interventions designed for a particular type of farm [11]. That is, farm typology is a useful tool of agricultural extension and forecasting. To date, establishing a farm typology has become a common tool while addressing development actions or interventions that should take into account the socio-economic and demographic context of farms in rural areas. Moreover, farm typology is also used for the understanding of the dynamics and changes of a regional agriculture [12]. Based on a modelling of the farms - cotton farms - size, this work suggests a typology for understanding the current characteristics of cotton farms in the North-Western region of Benin.

III. MATERIALS AND METHODS

A. Study zone and data

The study zone is situated in the Northwestern region of Benin, a western tropical African country. In this region, two municipalities well known in cotton production have been selected. It is about Kouandé (10°19'54" North latitude and 1°41'29" East longitude) and Kérou (10°49'30" North latitude and 2°6'34" East longitude) (Figure 1). In both municipalities, the climate is soudano-guinean (Afrique Conseil, 2006a; 2006b). In each municipality, two villages (Firou and Kérou Centre in Kérou, Niékénébansou and Becket in Kouandé) have been selected according to their importance in cotton production.



[Fig.1: Study Zone]

The primary data of this study were collected by a sample of 140 cotton farms – the interviewee is the farm's head – randomly carried out, after a census of all cotton farms in the selected villages. Data related to socio-economic and demographic characteristics of farm heads – most of the time the household's head – and the access to production factors such as land, fertilisers, insecticides, and herbicides were collected. The data collection took place as a field study, using an individual survey enquiry questionnaire, structured and semi-structured interview guides. Some focus groups were also organised to collect data at the village level. The data analysis was performed by using the software Excel and STATA through tools such as the Lorenz curve, the Gini coefficient, some descriptive statistics (frequency, mean, and standard deviation), and a simultaneous modelling.

IV. METHODS

A. Criteria of Typology

To carry out a typology, the choice of classification criteria may include a limited number of variables (i) deduced from experience, (ii) selected "à dires d'expert", or (iii) based on a wide range of structure and functioning variables drawn from survey questionnaires. The present work aimed at establishing a typology of the cotton farms, using a first discriminatory factor that was the farm size, measured by the size of land under cotton cultivation. This size may also reflect the crop's importance for farmers. Based on this factor or

© Copyright: All rights reserved.

criterion, a first discrimination of cotton farms has been set, giving different groups of cotton farms. Subsequently, a simultaneous modelling of the obtained groups has been performed.

B. Modelling of the Farm's Size

Let's assume that the probability for a farmer to be in one of the farm groups is somehow correlated with the probability of being in another group. For modelling, such an assumption implies a set of equations that may be related not because they interact, but because their error terms are related. Following, this led to the formulation:

$$y_{ij} = \delta_{ij} x_{ij} + e_{ij} \quad \dots \quad (1)$$
$$\text{With } i = 1, 2, \dots, n \text{ and } j = 1, 2, \dots, m$$

In this equation, y_{ij} stands for the j^{th} farm group of the i^{th} farm. As a result, we have m equations, each of which has a set of explanatory variables x_{ij}, not necessarily the same, with x_{ij} a $k_j \times 1$ vector, and δ_j a $k_j \times 1$ vector of parameters. Therefore, we have a set of m linear models such as:

$$Y_j = \delta_j X_j + e_j \quad \dots \quad (2)$$

Where:
$Y_j = (y_{1j}, y_{2j}, \dots, y_{nj})$, $X_j = (x_{1j}, x_{2j}, \dots, x_{nj})$, and $e_j = (e_{1j}, e_{2j}, \dots, e_{nj}) \quad \dots \quad (3)$

Bringing equations [2] and [3], one comes up with the following system of equations:

$$\begin{cases} y_{i1} = \delta_{i1} X_{i1} + e_{i1} \\ y_{i2} = \delta_{i2} X_{2i} + e_{i2} \\ \vdots \\ \vdots \\ y_{im} = \delta_{im} X_{im} + e_{im} \end{cases} \quad \dots \quad (4)$$

Moreover, this system can be expressed more parsimoniously using matrix notation:

$$\begin{bmatrix} y_{i1} \\ y_{i2} \\ \vdots \\ \vdots \\ y_{im} \end{bmatrix} = \begin{bmatrix} X_{i1} & 0 & \cdots & 0 \\ 0 & X_{i2} & \cdots & 0 \\ \vdots & \vdots & & \vdots \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & X_{im} \end{bmatrix} \begin{bmatrix} \delta_{i1} \\ \delta_{i2} \\ \vdots \\ \vdots \\ \delta_{im} \end{bmatrix} + \begin{bmatrix} e_{i1} \\ e_{i2} \\ \vdots \\ \vdots \\ e_{im} \end{bmatrix} \quad \dots \quad (5)$$

C. Specification of the model

The endogenous variable to analyse is the farms' size grouped based on the land area under cotton cultivation. To identify the farm size determinants, two types of variables as been considered: the socio-demographic characteristics and the access to the production factors (Table). Naming X a vector of socio-demographic characteristics and Z a vector of production factors to which farmers have access, the system [4] becomes:

$$\begin{cases} y_1 = \gamma_1 Z_1 + \delta_1 X_1 + e_1 \\ y_2 = \gamma_2 Z_2 + \delta_2 X_2 + e_2 \\ \vdots \\ \vdots \\ y_n = \gamma_n Z_n + \delta_n X_n + e_n \end{cases} \quad \dots \quad (6)$$

Following the same transformation from [4] to [5], the equation [6] becomes:

$$\begin{bmatrix} y_{i1} \\ y_{i2} \\ \vdots \\ \vdots \\ y_{im} \end{bmatrix} = \begin{bmatrix} Z_{i1} & 0 & \cdots & 0 \\ 0 & Z_{i2} & \cdots & 0 \\ \vdots & \vdots & & \vdots \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & Z_{im} \end{bmatrix} \begin{bmatrix} \gamma_{i1} \\ \gamma_{i2} \\ \vdots \\ \vdots \\ \gamma_{im} \end{bmatrix} + \begin{bmatrix} X_{i1} & 0 & \cdots & 0 \\ 0 & X_{i2} & \cdots & 0 \\ \vdots & \vdots & & \vdots \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & X_{im} \end{bmatrix} \begin{bmatrix} \delta_{i1} \\ \delta_{i2} \\ \vdots \\ \vdots \\ \delta_{im} \end{bmatrix}$$
$$+ \begin{bmatrix} e_{i1} \\ e_{i2} \\ \vdots \\ \vdots \\ e_{im} \end{bmatrix} \quad \dots \quad (7)$$

Such equation system can be estimated using the "Seemingly Unrelated Regression" (SURE) method.

Table-I: Explanatory Variables Including in the Model

Variables	Codes	Types [a]	Modalities	Expected Signs
Socio-economic and demographic characteristics (Z)				
Municipality	MUN	D	Kouandé=0 ; Kérou=1	±
Age	AGE	C	-	±
Sex	SEX	D	0=Female ; 1=Male	±
Schooling	SCH	D	No = 0 ; Yes = 1	±
Literacy	LIT	D	No = 0 ; Yes = 1	±
Side activity (ies)	SACT	D	No = 0 ; Yes = 1	±
Household's size	HSIZ	C	-	±
Contact with extension	EXT	D	No = 0 ; Yes = 1	±
Access to the production factors (X)				
Access to land	TERR		No = 0 ; Yes = 1	±
Length of land use	EXPL	C	-	+
Access to cotton fertilisers	ENCT	D	No = 0 ; Yes = 1	+
Access to cotton insecticides	INSE	D	No = 0 ; Yes = 1	+
Access to herbicides	HERB	D	No = 0 ; Yes = 1	+
Access to maize fertilisers	ENGM	D	No = 0 ; Yes = 1	+
Access to credit	CREDI	D	No = 0 ; Yes = 1	+

[a] Types : D = Discontinuous variables ; C = Continuous variables

Source: Field study data, 2020

© Copyright: All rights reserved.

V. RESULTS

A. Socio-Economic and Demographic Characteristics

From the descriptive statistics summarized in Table 2, cotton production in the study area is mainly a men's activity. Household heads involved are aged about 37 2020s on average, all married, and the majority have a side activity. The levels of schooling (formal education) and literacy are relatively low, while the household sizes are relatively large. Moreover, all farmers are in contact with extension services.

Table-II: Socio-Economic and Demographic Characteristics

Qualitative Variable	Frequency	Percentage
Sex	--	--
Female	02	1.40
Male	138	98.6
Side activity	116	82.9
Schooling	29	20.70
Literacy	49	35
Contact with extension	140	100
Quantitative Variables	**Mean**	**Standard deviation**
Age	36.93	11.75
Household's size	15.22	10.01

Source: Field study data, 2020

B. Access to the Production Factors

Some production factors are accessible for all farms while others are not (Table 3). The cotton farms have full access to land, cotton fertilizers, and cotton insecticides. The average area under cotton per farm is 3.05 ha, with an average using length of about 10 2020s. In addition, all producers assumed the land availability. Full access to cotton fertilizers and insecticides is due to the fact that cotton producers belong to farmers' associations (GVPC1). This membership entitles access to cotton inputs such as fertilizers and insecticides. However, respectively 90%, 55%, and 10.7% of the sampled farmers have access to herbicides, maize fertilisers, and agricultural credit. The access to herbicides is a farmer's strategic choice, considering the quantity of labor available. The specific maize fertilizers allow farmers to use the normal dose of cotton fertilizers, without having to apply the same cotton fertilizers for other crops (maize for instance). Finally, access to capital through agricultural credit is still limited because of the current cotton path problems that have led to the farmers' discouragement and loss of interest in producing the crop.

Table-III: Access to Production Factors

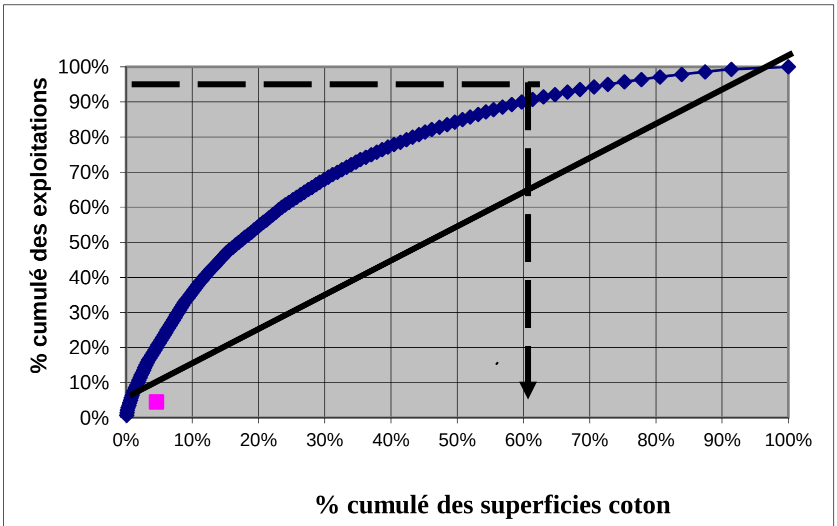
Qualitative Variables	Frequency	Percentage
Access to land	140	100
Access to cotton fertilisers	140	100
Access to cotton insecticides	140	100
Access to herbicides	126	90
Access to maize fertilisers	77	55
Access to credit	15	10,7
Quantitative Variables	**Mean**	**Standard-deviation**
Length of land	9.78	8.02
Farm's size (Land under cotton)	3.05	4.12

Source: Field study data, 2020

C. Typology of the Cotton Farms

i. Distribution of the Cotton Farms' Size

The Lorenz curve and the Gini coefficient (Figure 2 provide a first view of the distribution of the farms' size within the sample. It comes out that 10% of the farms hold 40% of the total area under cotton within the sample.



Gini Coefficient

$$G = 1 - \frac{1}{140}\sum(Y_i + Y_{i+1})$$

with i = 1, …, 140

G = 0.51

[Fig.2: Lorenz Curve and Gini Coefficient Showing the Distribution of the Cotton Farms' Size]

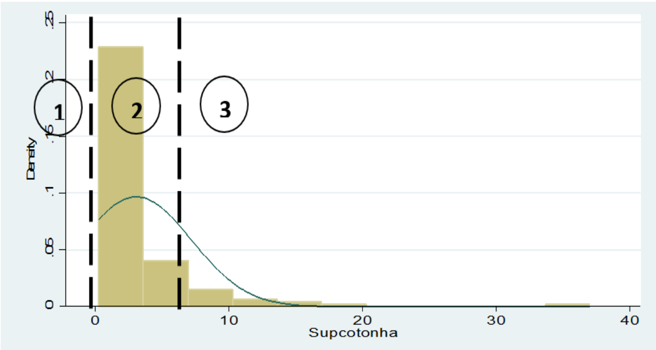
Source: Field Study Data, 2020

© Copyright: All rights reserved.

This unequal distribution of farms' size implies different farms' structures, needs, and later on different policy intervention.

D. Discrimination of Cotton Farms Regarding Their Size

As the Lorenz curve and the Gini coefficient, the Figure 3 shows a high inequality in farms size distribution. Moreover, there are many small size farms with very few large size farms. The farm's size (area of land under cotton cultivation) has been used as a first criterion of discrimination. The purpose of this first discrimination is to set up relatively homogeneous classes of farms.



[Fig.3: Lorenz Curve and the Gini Coefficient]

Source: Field study data, 2020

Considering the farm's size distribution, three groups of farms have been set up: the small farms, the medium farms, and le large farms (Table 4).

Table-IV: Classification of the Cotton Farms According to Their Size

	Farms Type	Size (under cotton cultivation) in hectare
1	Small farms	$S \leq 3.5$
2	Medium farms	$3.5 < S < 10$
3	Large farms	$S \geq 10$

Source: Field study data, 2020

That is, all three groups as been used as endogenous variables in the next steps of the study.

E. Modelling the farms' size

While modelling the farms' size, variables such as contact with extension, access to land, cotton fertilisers, and cotton insecticides have been dropped because they were constant with no variability within the sample. With the remaining variables, the Seemingly Unrelated Regression estimation gave the results summarized in Tables 5 and 6. The correlation matrix of the residuals (Table 5) shows negative correlations, highly significant at 1%. This result suggests that the smaller the error to characterize a group of farms with certain criteria, is smaller; more the error to characterize the other groups of farms with the same criteria is. This trend reveals differences in the main characteristics that describe the best of each farm group.

Table-V: Correlation Matrix of Residuals

	Small Farms	Medium Farms	Large Farms
Small Farms	1.00	--	--
Medium Farms	-0.56	1.00	--
Large Farms	-0.24	-0.18	1.00
Breusch-Pagan test of independence: chi2(3) 58.739,00 ; Probability 0.000			

Source: Field study data, 2020

The variability of the socio-economic and demographic characteristics and the access to given inputs included in the regression explain 17.79%, 31.35%, and 16.14% of the variability observed in the small, medium, and large farms, respectively. The remaining part of the unexplained variability might be due to factors not included in the model, such as farmers' experience in cotton production, soil quality, etc. The medium farms equation in the system is the best explained (highest R-squared and highest number of significant parameters). Moreover, both equations of the system are significant at 1%, and all the constants are non-significant. The model seems to be quite appropriate for the prospective analysis.

From the results of the model, the farms' size is determined by both socio-economic and demographic characteristics, as well as access to the production factors. However, from one farm group to another, the determinants are different. Therefore, one might characterize the farms using different criteria. In this way, the small farms are mainly determined by the level of literacy of the farm head, his household's size, and access to herbicides and credit. The level of literacy and literacy and access to herbicides have positive and significant effects on small farms at 1% and 5% levels, respectively. The household's size and the access to credit have negative and significant effects on small farms at 1% and 10% respectively.

The medium farms are mainly determined by the municipality view as demographic criterion (positive and significant at 1%), the age of the head (positive and significant at 5%), his level of schooling (negative and significant at 5% level), his household's size (positive and significant at 1%), and the access to credit. (positive and significant at 5%).

The large farms are mainly determined by socio-demographic characteristics such as: the age of the farmer (negative and significant at 1%), the level of schooling (positive and significant at 1%), and the household's size (positive and significant at 5%).

© Copyright: All rights reserved.

Table-VI: Results of the Seemingly Unrelated Regression Model

Variables	Small farms		Medium farms		Large farms	
	Coefficient	P>z	Coefficient	P>z	Coefficient	P>z
Socio-economic and demographic characteristics						
Municipality	-0.013 (0.197)	0.945	1.211*** (0.424)	0.004	0.872 (0.841)	0.299
Sex	-0.264 (0.643)	0.681	0.691 (1.385)	0.618	0.229 (2.744)	0.933
Age	.0.001 (0.001)	0.919	0.035** (0.015)	0.023	-0.085*** (0.030)	0.006
Schooling	-0.085 (0.195)	0.659	-1.058 **(0.420)	0.012	2.419*** (0.832)	0.004
Literacy	0.640*** (0.167	0.000	-0.360 (0.360)	0.317	0.437 (0.713)	0.540
Household's size	-0.023*** (0.008)	0.009	0.061*** (0.019)	0.001	0.081** (0.038)	0.034
Side activity	0.121 (0.208)	0.559	-0.158 (0.449)	0.724	0.5309966	0.551
Access to the production factors						
Length of land use	0.001 (0,011)	0.917	-0.019 (0.023)	0.424	0.037 (0.047)	0.428
Maize fertilisers	0.091 (0.172)	0.596	-0.402 (0.370)	0.278	-0.707 (0.734)	0.335
Herbicides	0.553** (0.280)	0.048	-0.073 (0.603)	0.903	-0.612 (1.196)	0.609
Credit	-0.448* (0.246)	0.091	1.751*** (0.570)	0.002	-0.943 (1.129)	0.403
Resume of the model						
Constant	0.960 (0.701)	0.171	-1.73 (1.511)	0.252	1.657 (2.993)	0.580
Observations	140		140		140	
Parameters	11		11		11	
R-square	0.1779		0.3135		0.1614	
Chi2	30.30***		63.95***		26.95***	
Probability	0.0014		0.0000		0.0047	

NB: The values in bracket are the standard-errors
*, **, *** significant at 10%, 5%, and 1%, respectively

Source: Field study data, 2020

F. Characterisation of the Cotton Farms

From the previous results, Table 7 presents a typology of the cotton farms in the study area. Small farms are likely to be held by small-sized households without access to credit. However, most of them have access to herbicides. The medium farms are likely to be held by medium-sized households

Table-VII: Typology of Cotton farms

	Small Farms	Medium Farms	Large Farms
Socio-economic and demographic characteristics			
Farm size (ha)	1.55 ± 0.82	5.61 ± 1.64	16.68 ± 9.24
Municipality	--	Kérou	--
Age (years)	--	43 ± 13.62	31.57 ± 5.99
Schooling	--	Non	Yes
Literacy	No	--	--
Household's size	12.53 ± 8.19	24 ± 11	23.57 ± 7.54
Access to the production factors			
Access to herbicides	Yes	--	--
Access to credit	No	Yes	--

Source: Field study data, 2020

VI. CONCLUSION

The objective of this paper is to analyse the typology of cotton farms based on a modelling of their Size. The method allows to the characterization of each farm group using meaningful criteria. Therefore, different criteria might be used for characterizing different farm groups. The farms' size is determined by both socio-economic and demographic characteristics, as well as access to the production factors. The results also show that cotton farms can be classified into three categories: small farms, medium farms, and large farms. The agricultural authority can use these results to promote cotton production in West Africa.

DECLARATION STATEMENT

I must verify the accuracy of the following information as the article's author.

- **Conflicts of Interest/ Competing Interests:** Based on my understanding, this article has no conflicts of interest.
- **Funding Support:** This article has not been funded by any organizations or agencies. This independence ensures that the research is conducted with objectivity and without any external influence.
- **Ethical Approval and Consent to Participate:** The content of this article does not necessitate ethical approval or consent to participate with supporting documentation.
- **Data Access Statement and Material Availability:** The adequate resources of this article are publicly accessible.
- **Authors Contributions:** The authorship of this article is contributed solely.

REFERENCES

1. Jayne, T. S., & Sanchez, P. A. (2021). Agricultural productivity must improve in sub-Saharan Africa. Science, 372(6546), 1045-1047. DOI: https://doi.org/10.1126/science.abf5413
2. Diao, X., Hazell, P., & Thurlow, J. (2010). The Role of Agriculture in African Development. World Development, 38(10), 1375-1383. DOI: https://doi.org/10.1016/j.worlddev.2009.06.011
3. Chabi Simin Najib, D., Fei, C., Dilanchiev, A., & Romaric, S. (2022). Modeling the impact of cotton production on economic development in Benin : A technological innovation perspective. Frontiers in Environmental Science, DOI: http://dx.doi.org/10.3389/fenvs.2022.926350
4. Douxchamps, S., Van Wijk, M. T., Silvestri, S., Moussa, A. S., Quiros, C., Ndour, N. Y. B., Buah, S., Somé, L., Herrero, M., Kristjanson, P., Ouedraogo, M., Thornton, P. K., Van Asten, P., Zougmoré, R., & Rufino, M. C. (2016). Linking agricultural adaptation strategies, food

© Copyright: All rights reserved.

security and vulnerability : Evidence from West Africa. Regional Environmental Change, 16(5), 1305-1317. DOI: https://doi.org/10.1007/s10113-015-0838-6
5. Fok, M. (2004). Progress and challenges in making productivity gains in cotton production by smallholders in Sub-Saharan Africa (SSA). https://agritrop.cirad.fr/520556/1/ID520556.pdf
6. Jacquet, I., Wang, J., Zhang, J., Wang, K., & Liang, S. (2022). An Understanding of Education in Supporting Cotton Production : An Empirical Study in Benin, West Africa. Agriculture, 12(6), Article 6. DOI: https://doi.org/10.3390/agriculture12060836
7. Maboudou Alidou, G., & Niehof, A. (2020). Responses of Rural Households to the Cotton Crisis in Benin. Sustainability, 12(10), Article 10. DOI: https://doi.org/10.3390/su12104207
8. Koné, S., & Fok, M. (2021). Typology for action of the cotton farms in Cote d'Ivoire. https://www.cabidigitallibrary.org/doi/full/10.5555/20220048795
9. Ollabodé, N., Obe, M. M., Kpadé, C. P., & Sekloka, E. (2024). Typologie et performances économiques des exploitations cotonnières au Bénin. Économie rurale, 387(1), 49-67. DOI: https://doi.org/10.3917/ecru.387.0049
10. Capillon, A., & Manichon, H. (1979). Une typologie des trajectoires d'evolution des exploitations agricoles (principes, application au developpement agricole regional) [France]. Comptes Rendus des Seances de l'Academie d'Agriculture de France, 65. https://agris.fao.org/search/en/providers/123819/records/647357f953aa8c8963072d6b
11. Cristofini, B. (1985). La petite région vue à travers le tissu de ses exploitations. https://agris.fao.org/search/en/providers/122439/records/647472702d3f560f80aaf6cc
12. Zellner, A. (1962). An Efficient Method of Estimating Seemingly Unrelated Regressions and Tests for Aggregation Bias. Journal of the American Statistical Association, 57(298), 348-368. DOI: https://doi.org/10.1080/01621459.1962.10480664
13. Soun, B., Saini, Dr. H. K., & Brar, Dr. K. K. (2023). Study on Properties of Sisal-Cotton Union Fabrics Developed in Handloom and Power-Loom for Textile Application. In Indian Journal of Fibre and Textile Engineering (Vol. 3, Issue 1, pp. 1–4). DOI: https://doi.org/10.54105/ijfte.a2405.053123
14. P.Ramakrishnan, An Examination on Production and Marketing of Cotton in Srivilliputtur Taluk. (2019). In International Journal of Innovative Technology and Exploring Engineering (Vol. 9, Issue 2S2, pp. 468–472). DOI: https://doi.org/10.35940/ijitee.b1218.1292s219
15. Chilukoti., G. R., Venkatesh, B., Chavhan, Md. V., & Kumar, M. S. J. (2020). Colour Strength and Washing Fastness Properties of Cotton Fabric Dyed With Kasunda Flower Extract. In International Journal of Recent Technology and Engineering (IJRTE) (Vol. 8, Issue 5, pp. 2019–2022). DOI: https://doi.org/10.35940/ijrte.e5038.018520
16. R.I., R., I.D., M., M.A., G., & T.O, T. (2020). Changing the Cotton Fiber Temperature. In International Journal of Engineering and Advanced Technology (Vol. 9, Issue 3, pp. 974–977). DOI: https://doi.org/10.35940/ijeat.b3992.029320

AUTHOR'S PROFILE

Soulé EL-HADJ IMOROU, Born on October 2, 1976, in Parakou, completed his primary education in Pèrèrè. After obtaining his Brevet d'Etude Premier Cycle (BEPC), he continued his secondary education at the Collège d'Enseignement Général Hubert Koutoukou Maga in Parakou, where he obtained his Baccalauréat Série D. After this first university degree, Mr. EL-HADJ IMOROU enrolled at the University of Abomey-Calavi, where he successively obtained a Bachelor's and a Master's degree in Sociology. He also obtained a Diploma of Specialized Higher Studies (DESS) from the Faculty of Economics and Management (FASEG) of the University of Abomey-Calavi (UAC). But Mr. Soulé EL-HADJ IMOROU did not stop there. He then enrolled in the Multidisciplinary Doctoral School of the Faculty of Letters, Arts and Human Sciences (FLASH) of the University of Abomey-Calavi (UAC), where he obtained his DEA. After his DEA, he also very honorably defended his Single Doctoral thesis in Sociology-Anthropology; Specializing in Development Sociology at the same school under the supervision of Professor Emeritus Albert NOUHOUAYI. In 2016, Mr. EL-HADJ IMOROU was recruited to the University of Parakou as an Assistant in the Faculty of Letters, Arts and Human Sciences (Specializing in Sociology). He teaches at this university in disciplines such as: Introduction to Descriptive Statistics in the Social Sciences; Sociology of Education; Quantitative and Multivariate Analysis in the Social Sciences; Local Development Economics; Community Development and Decentralization; Introduction to Social Psychology. Mr. EL-HADJ IMOROU was appointed Head of the Division/Relations with National Universities of Benin by memorandum No. 3083/R-UP/SG/AC/SRH/SA of December 26, 2017, concerning the appointment and redeployment of staff at the University of Parakou. He was then appointed by memorandum No. 1492/R-UP/VR-AA/VR-RU/VR-CIPIP/SG/AC/SRH/SA of April 3, 2021, as Deputy Head of the Department of Sociology-Anthropology. Currently Head of the Department of Sociology at the University of Parakou, with the rank of Associate Professor of the CAMES Universities, Mr. EL-HADJ IMOROU is the author of several articles published in national, regional, and international journals. He has also participated in several national and international workshops, conferences and symposia, where he has presented papers on highly relevant topics.

Disclaimer/Publisher's Note : The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of the Lattice Science Publication (LSP)/ journal and/ or the editor(s). The Lattice Science Publication (LSP)/ journal and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.

© Copyright: All rights reserved.