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Motivations of *Cajanus Cajan* producers in Benin: A versatile crop facing abandonment despite its multiple uses

Ibidon Firmin Akpo[a]
Filikibirou Zakari Tassou[b]
Kassimou Issaka[c]
Zachee Houessingbe[d]
Nanyegbe Aimee Dededji[e]

[a,b,c,d]*Laboratory of Analysis and Research on Economic and Social Dynamics, Department of Rural Economy and Sociology, Faculty of Agronomy, University of Parakou, Parakou, Benin.*
[e]*Laboratory for Research on Innovation for Agricultural Development, Department of Rural Economics and Sociology, Faculty of Agronomy, University of Parakou, Parakou, Benin.*

✉ *zach.professionnel@gmail.com (Corresponding author)*

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ABSTRACT
This study examines the motivations of the few Cajanus cajan producers in Benin, a versatile and highly beneficial crop that receives little institutional support. Using a random sample of 240 producers from the Collines department, it applies Cronbach's Alpha to assess the internal consistency of their motivations. The resulting composite index was modeled using Seemingly Unrelated Regression (SURE) to analyze the determinants of this motivation. The findings reveal that the selling price, nutritional value, high market demand, high household food needs, declining soil fertility, and the predominance of weeds and pests are the factors with a strong contribution to the decision and action to produce Cajanus cajan. Farmers are more motivated by push factors than by pull factors, indicating that constraints play a more important role in their decision to cultivate this crop than opportunities. Age, literacy, formal education, membership in a group, farm size, and household size are the main determinants of the motivation to cultivate Cajanus cajan. These results suggest adapting agricultural interventions to local realities by valorizing the benefits of Cajanus cajan and creating attractive economic opportunities, such as access to credit and promotional projects, targeting young people and the most educated farmers in particular.

Contribution/Originality: This study makes an original contribution to the literature on Cajanus cajan in Benin by providing, for the first time, a novel empirical analysis of producers' motivations using an innovative combination of Cronbach's Alpha test and SURE modeling. It makes proposals for targeted interventions adapted to local realities.

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1. INTRODUCTION
Cajanus cajan is a legume renowned for its versatility and wide range of uses worldwide (Gargi et al., 2022; Yang et al., 2020). The leading producers are India and Myanmar, which together account for 83% of global production, followed by African countries such as Malawi, Tanzania, Kenya, and Uganda, contributing 14% (Makena, Ngare, & Kago, 2022). This crop is highly valued for both human and animal nutrition and is extensively used in traditional medicine to treat various ailments. Its mature seeds have a rich nutritional profile, containing 18.8% protein, 53% starch, 2.3% fat, 6.6% crude fiber, and 250.3 mg of minerals per 100 g. Its leaves are abundant in bioactive compounds,

including flavonoids, stilbenes, saponins, tannins, reducing sugars, resins, and terpenoids, which exhibit antioxidant, antibacterial, hypocholesterolemic, and anti-inflammatory properties. They are widely used to stop bleeding, relieve pain, eliminate intestinal parasites, and treat a variety of skin, liver, lung, and kidney disorders (Hardev, 2016; Mishra, Kumar, Joshi, & D'souza, 2018). Additionally, Cajanus cajan is employed in traditional medicine for managing diabetes, fever, dysentery, hepatitis, measles, and malaria (Rafiq, Muhammad, & Naeem, 2015).

As a perennial shrub, Cajanus cajan is drought-tolerant, produces plenty of biomass for forage, and enriches the soil with nutrients and moisture (Fossou, Ziegler, Zézé, Barja, & Perret, 2016). It is crucial for family farming, which constitutes a significant part of global agricultural production (Sayed, Ding, Odero, & Korohou, 2022; Vogel et al., 2023). It is also one of the most promoted legumes in developing countries where farmers face climatic hazards, land degradation, and limited access to productive resources (Mathew, Adeolu, Adelegan, & Ojogho, 2023; Sikandar et al., 2023).

Like other developing countries, agriculture in Benin is dominated by smallholder farmers who are vulnerable to the negative impacts of climate change (Akpa & Chabossou, 2024). In these farms, Cajanus cajan plays an important role, serving as food, a traditional medicine, and a source of income (Zavinon et al., 2020). It also helps with soil conservation and weed management (Kinhoégbè et al., 2020). Despite its many benefits, this crop receives little attention from policymakers and farmers (Kinhoégbè et al., 2020; Zavinon, Adoukonou-Sagbadja, Bossikponnon, Dossa, & Ahanhanzo, 2019). Cajanus cajan is not even included in the government's thirteen priority agricultural sectors (Ministry of Agriculture, Livestock and Fisheries (MAEP), 2017), and its production remains marginal. It is the fifth edible legume, after cowpea, voandzou, soybean, and peanut (Kinhoégbè et al., 2022).

The lack of interest in this versatile crop raises questions about the motivations of the few farmers who cultivate it. However, existing research focuses on its varietal diversity, yields, uses, economic aspects, and production constraints (Ayenan, Ofori, Ahoton, & Danquah, 2017; Issaka et al., 2024; Kinhoégbè et al., 2022; Zavinon, Fonhan, Atrokpo, Djossou, & Sagbadja, 2022). Producers' motivations remain little explored, although a better understanding of these would make it possible to predict their behavior (Swart, Levers, Davis, & Verburg, 2023). This study aims to identify incentive factors, assess their contribution to motivation, and analyze the determinants of this motivation. It makes an original contribution to the literature on Cajanus cajan in Benin by providing, for the first time, a novel empirical analysis of producer motivations using a combination of quantitative and qualitative approaches. The results will provide guidance for public strategies to promote and improve Cajanus cajan production in Benin.

The remainder of the article is organized into five sections. Section 2 outlines the research methodology, including the conceptual framework, study area, and data collection and analysis methods. Section 3 presents the analysis results, followed by Section 4, which discusses the findings. Finally, Section 5 concludes the study and highlights its policy implications.

2. MATERIALS AND METHODS

2.1. Conceptual Framework of the Study

Motivation is an inner force that guides individuals' observable behaviors (Sun, 2008), pushing them to act or abstain. It significantly influences decision-making by enhancing cognitive processes and activating brain regions such as the prefrontal cortex and nucleus accumbens (Wei, 2024). It orients actions towards goal achievement through reward anticipation and strategic risk-taking, improving decision-making outcomes in a variety of contexts. It can be intrinsic, arising from personal satisfactions such as pleasure or accomplishment, or extrinsic, linked to concrete incentives (Santovac & Popović, 2022). It is influenced by personal, psychosociological, and contextual variables (Cartwright & Cooper, 2008; Geen, 2019).

Shapero and Sokol (1982) model the origin of entrepreneurship by highlighting factors, called "triggers," which influence the decision to undertake entrepreneurial activities. Positive triggers include the discovery of a business opportunity or obtaining financing, while negative triggers can result from situations such as frustration at work, job loss, or personal difficulties. These two types of situations converge to motivate individuals to step out of their comfort zones and take action. This concept of triggers is transposable to the pull-push model, which distinguishes necessity motivations from opportunistic motivations (Harrison & Hart, 1983). "Push" factors correspond to negative triggers, while "pull" factors are associated with positive triggers. Pull motivation encourages action to seize an opportunity, often with the aim of maximizing gains or capitalizing on an unforeseen chance. In contrast, push motivation drives one to act under the constraints of responsibilities or external pressures, often to avoid negative consequences.

Moreover, in economics, decisions are analyzed through the prism of rationality, motivated by anticipated self-interest (Rizzo & Whitman, 2018) and the perception of rewards from action (Shenhav, 2024). In the agricultural context, crop choices are influenced by socioeconomic and agroecological imperatives, with preferences for high yields, resistance to pests, and tolerance to climatic disturbances varying by area and time (Ayenan, Danquah, Ahoton, & Ofori, 2017; Devi, Nayak, & Patnaik, 2021). This study uses Shapero and Sokol's pull-push model to analyze farmers' motivations for growing Cajanus cajan (Figure 1).

2.2. Description of the Study Area

The study was conducted in the Collines department, in central Benin. Agriculture is the main activity for local populations who mobilize the bulk of the national production of Cajanus cajan (Department of Programming and Planning of the Ministry of Agriculture, Livestock and Fisheries (DPP-MAEP), 2020). In collaboration with agents of the Territorial Agency for Agricultural Development (TAAD), three key municipalities (Bantè, Glazoué, Ouèssè) were identified for their importance in this production. During the exploratory phase, a preliminary census of Cajanus cajan producers was conducted, enabling the selection of three villages per municipality (Figure 2).

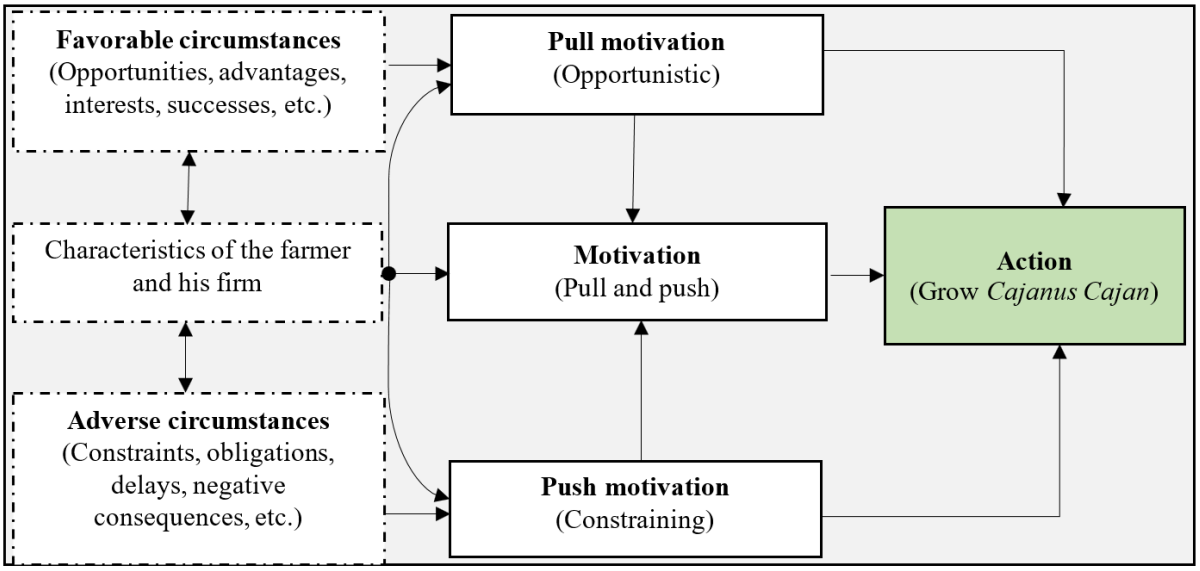

Figure 1. Links between determinants, motivation and action.

Note: The dashed rectangles are the personal, psychosocial and contextual variables. The solid white rectangles represent motivation and its components, while the green rectangle is the action to which motivation leads.

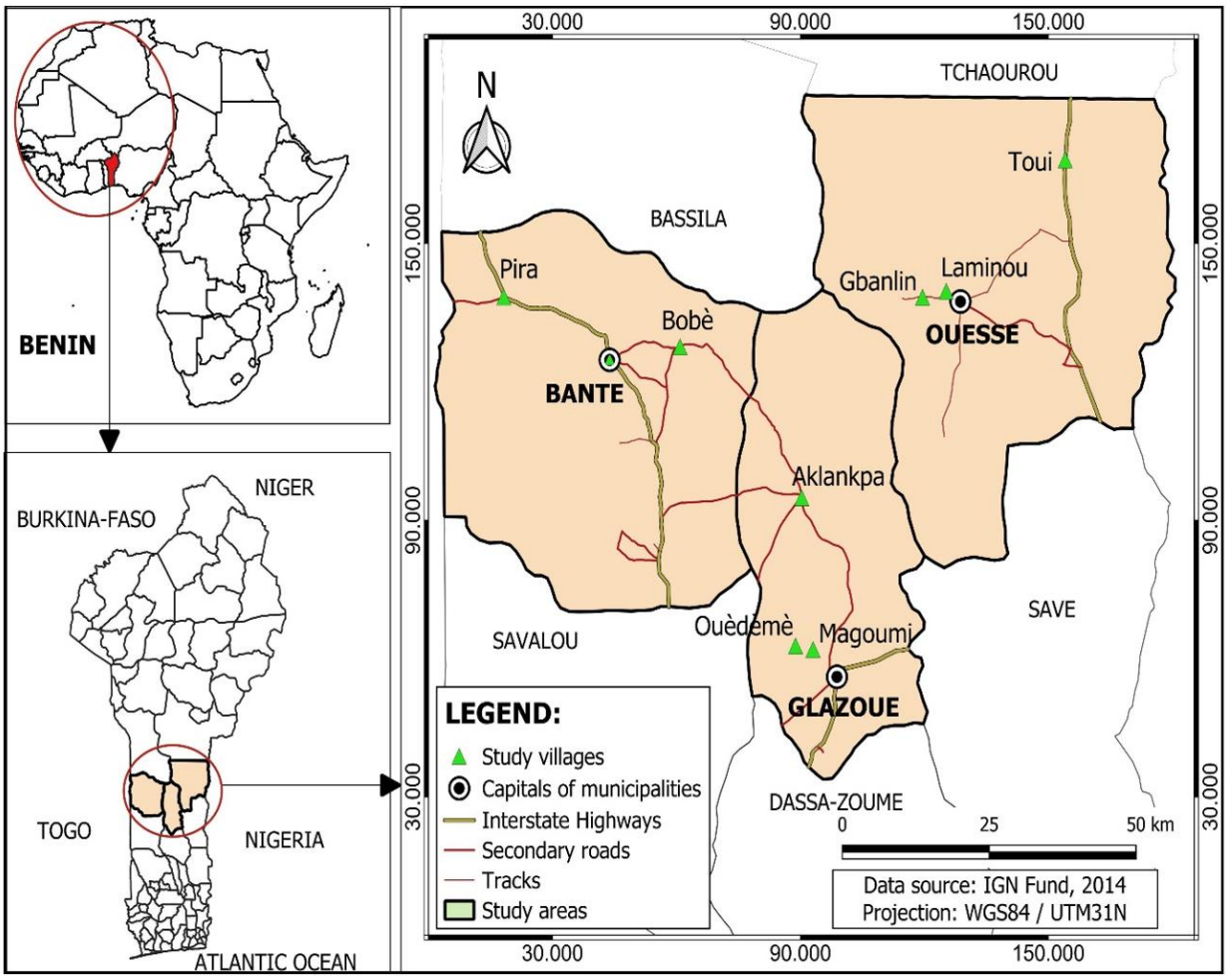

Figure 2. Geographic location map of the study area.

2.3. Sampling Technique and Sample Size

Cajanus cajan producers constitute the research units of this study. A sampling frame established during the exploratory phase made it possible to select producers randomly. The number of respondents per village is proportional to the number of producers identified. In total, 240 producers were surveyed, or 80 per commune, with a number varying from 20 to 35 per village.

2.4. Types of Data and Collection Methods

Two main types of data were collected in this study: qualitative data, used to identify potential incentive factors, and quantitative data, used to assess the contribution of each factor to producer motivation.

2.4.1. Identification of Incentive Factors by Focus Groups

In order to list the factors likely to encourage farmers to cultivate Cajanus cajan, an exploratory qualitative survey was conducted. It consisted of group interviews to collect data systematically and simultaneously through guided exchanges, thus revealing collective perspectives and a deeper understanding of associated experiences and beliefs (Akter et al., 2017). This method allows for a deeper understanding of the social reality on the ground (Yegbemey, Aloukoutou, & Aihounton, 2020). Following Ruhl's (2004) guidelines, each interview session gathered 10 to 15 Cajanus cajan producers per village, including both men and women. One session was held per village, following participatory communication steps: introduction of the research and objectives, participant introductions, explanation of participation rules, open discussion on Cajanus cajan cultivation and production motivations, and conclusion. Researchers facilitated the discussions without imposing questions or suggesting preconceived answers, using broad, open-ended prompts such as: "What does cultivating Cajanus cajan mean to you?" "What motivates you to produce Cajanus cajan?" and "Why did you start growing Cajanus cajan?"

At each stage, participants were given ample time to engage in discussions and reach a consensus when necessary. Notes were taken during the interviews, and, with participants' consent, key parts of the discussions were recorded. The collected data were then transcribed and analyzed using content analysis following the steps outlined by Erlingsson and Brysiewicz (2017): identifying and condensing meaning units, coding the data, and categorizing key themes. By integrating these findings with existing literature, this approach enabled the identification of potential incentives for Cajanus cajan cultivation (Table 1).

Table 1. Potential incentives for the production of *Cajanus cajan*.

Pull factors			Push factors		
Code	**Postman**	**Justification**	**Code**	**Postman**	**Justification**
Pull1	Strong demand in the market	Its high demand and attractive price encourage farmers to invest in order to increase their profits.	Push1	Decrease in soil fertility	It attracts farmers to restore nutrient-poor soils because it enriches the soil and prevents its degradation.
Pull2	High selling price		Push2	Variability of unpredictable climatic conditions	It offers an alternative to unpredictable weather conditions, thanks to its tolerance and resilience.
Pull3	Ease of cultivation and maintenance	It attracts with its low labor and resource requirements, maximizing output with little effort and cost.	Push3	Financial risks associated with monoculture	It reduces financial risks and stabilizes income by decreasing dependence on a single crop.
Pull4	Adaptability to agroecological conditions	Its adaptability to local conditions offers valuable flexibility, reducing risks associated with climatic variations.	Push4	Need for high expenditure on other crops	Its low input and strength requirements protect against rising input prices and labor scarcity.
Pull5	High nutritional value	Rich in protein, fiber, and nutrients, it from Angola meets the demand for healthy food products.	Push5	Difficult access to inputs from other crops	Thanks to its less complex input requirements, it helps to circumvent the increase in input prices observed since 2018 in Benin.
Pull6	Existence of a project in the sector	A project can encourage farmers to invest by creating an enabling environment.	Push6	High household food needs	It provides an energy supply to workers and is suitable for large households with high food demand.
Pull7	Ease of access to credit	Access to credit enables investment in inputs and labor, removing financial barriers.	Push7	Low resistance of other crops	Tolerant and resilient, it helps avoid diseases, pests, and harsh conditions, ensuring stable yields.
Pull8	Ability to improve soil fertility	By fixing atmospheric nitrogen, it preserves soil fertility for sustainable productivity.	Push8	Predominance of weeds and pests	By smothering weeds and resisting pests, it reduces competition for resources and the risk of loss.
Pull9	Resistance to weeds, diseases and pests	Its resistance to weeds, diseases, and pests reduces maintenance costs and efforts.	Push9	Government intervention in determining prices of other crops	In Benin, agricultural policies influence the prices of certain crops, pushing farmers towards the Cajanus cajan, which currently escapes these regulations.
Pull10	Medicinal virtues of the plant	Its medicinal properties increase its demand and value for farmers and consumers.			

Note: The justification columns contain a summary of the arguments identified during the group interviews as well as those from the literature.

2.4.2. Measuring Farmers' Motivations Through Individual Interviews

After identifying the factors that may encourage Cajanus cajan cultivation, a questionnaire was designed, digitized, and administered to 240 farm managers using the KoboCollect mobile application. To evaluate the significance of each factor in farmers' motivation, a five-point Likert scale was used (1 – Strongly disagree, 2 – Somewhat disagree, 3 – Neutral, 4 – Somewhat agree, 5 – Strongly agree) (Batonwero, Agalati, & Degla, 2022; Jankelová, Joniaková, Romanová, & Remeňová, 2020). The questionnaire included statements such as: Pull1 – "I grow Cajanus cajan because it sells easily in the market," Pull10 – "I grow Cajanus cajan because the plant has several medicinal properties," Push1 – "I grow Cajanus cajan because my soil fertility is declining," and Push3 – "I grow Cajanus cajan to diversify my crops and reduce financial risks."

2.5. Data Analysis Methods

Descriptive statistics were combined with econometric models to analyze data collected at three different levels.

2.5.1. Calculating the Reliability of Motivation Measurement Scales

Farmers' responses to the motivation subscales (pull or push) were tested with Cronbach's Alpha to assess the reliability of the scales (Menozzi, Fioravanzi, & Donati, 2015). This test measures internal consistency, showing that correlated items measure the same phenomenon (Kotian, Varghese, & Motappa, 2022). Cronbach's Alpha coefficient provides an overall index of this consistency and identifies problematic items that could be removed from the scale. The general formula for calculating the α coefficient is provided by Laurencelle (2021):

$$\alpha = \left(\frac{k}{k-1}\right)\left(1 - \frac{\sum_{i=1}^{k}\sigma_i^2}{\sigma_T^2}\right) \quad (1)$$

Its alternative formula is.

$$\alpha = \frac{kr}{1+r(k-1)} \quad (2)$$

With:

k Number of items making up the scale. σ_i^2 Variance of the i th item.

i 1,2,…k. σ_T^2 Variance of the whole scale.

r Average of the correlation between items or the average inter-correlation.

The coefficient α varies from 0 to 1, where a value close to 1 indicates a strong correlation between the items, while a value close to 0 indicates the opposite (Kotian et al., 2022). Taber (2018) recommends an α greater than or equal to 0.70 to validate a scale. A lower value indicates poor consistency, suggesting the rejection of the scale or the removal of irrelevant items. In this study, this reference value ($\alpha \geq 0.70$) from Taber was considered.

2.5.2. Calculation of Producers' Motivation Scores

The mean motivation scores (MMS) for each factor were calculated using the following formula (Singh & Hiremath, 2010).

$$\text{MMS} = \frac{\text{DI actuel} - \text{DI minimal}}{\text{DI maximal} - \text{DI minimal}} \quad (3)$$

With MMS the average motivation score and DI the degree of importance of the factor in the decision to cultivate the *Cajanus cajan*.

Then, for each motivation subscale (Pull or push), the composite motivation index (CMI) was estimated (Kindemin, Houssingbe, Hougni, Labiyi, & Yabi, 2023). The formula for the CMI is.

$$\text{CMI} = \frac{\sum \text{MMS}}{\text{NF}} \quad (4)$$

With CMI, the composite motivation index and NF, the total number of items for each subscale.

Student's t-test was used to compare the means of the pull (CMIpull) and push (CMIpush) motivation indices, and analysis of variance (ANOVA) was used to assess differences in means between study areas. Three levels of significance were defined: 1% if $p \leq 0.01$; 5% if $0.01 < p \leq 0.05$; and 10% if $0.05 < p \leq 0.10$. These thresholds define the degree of confidence to conclude that the observed differences are not due to chance.

2.5.3. Modeling the Determinants of Producers' Motivation

To identify the socio-demographic factors influencing motivation scores for Cajanus cajan cultivation, a Seemingly Unrelated Regression (SURE) model was applied. Introduced by Zellner (1962), this method enables the simultaneous estimation of multiple regression equations, each with its own dependent variable, while accounting for potential correlations between error terms. The SURE model assumes that certain common factors influence all regression equations, alongside specific factors unique to each equation (Zhang, Ma, Zhang, Ling, & Jenelius, 2024). In this study, the composite motivation indices CMIpull and CMIpush are quantitative variables potentially shaped by unobserved common factors, such as individual preferences, structural constraints, or local agricultural dynamics.

The SURE approach is particularly well-suited here, as it enhances the efficiency of parameter estimation compared to separate models like multiple linear regression or Tobit. Although pull and push motivations are modeled separately, they may share unobserved characteristics that simultaneously influence producers' decisions. The SURE model's key assumption that errors across equations may be correlated due to common unmeasured factors aligns well with this context. For instance, factors such as resource access, past farming experience, and market dynamics may simultaneously impact both pull and push motivations for cultivating Cajanus cajan. By accounting for these correlations, the SURE model provides a more robust and precise analysis of the determinants of farmers' motivations,

mitigating potential estimation biases arising from omitted interdependencies (Nasri & Zhang, 2019; Tiong, Ma, & Palmqvist, 2025).

The mathematical relationship between motivation indices (R) and socio-demographic characteristics (X) is as follows:

$$\begin{cases} R_{1i} = \alpha_1 + \sum_j \beta_{1j} X_{ij} + u_{1i} \\ R_{2i} = \alpha_2 + \sum_j \beta_{2j} X_{ij} + u_{2i} \end{cases} \quad (5)$$

With:

R_{1i} and R_{2i}:	Respectively, the CMIpull and CMIpush of producer i.	α_1 and α_2:	Constant terms.
X_{ij}:	The sociodemographic factor j of producer i.	j:	The number of socio-demographic characteristics.
u_{1i} and u_{2i}:	Error terms.	B:	The regression coefficients associated with X.

All statistical analyses were conducted using Stata software. The model's explanatory variables include farmers' sociodemographic and economic characteristics, such as:

Producer age: Age influences experience and the accumulation of agricultural knowledge (Caffaro, Roccato, de Paolis, Cremasco, & Cavallo, 2022), which can impact the motivation to cultivate *Cajanus cajan*. Older farmers, with their extensive expertise, may perceive this crop as a reliable option within their production systems but may also be resistant to change (Caffaro et al., 2022). In contrast, younger farmers, who are generally more open to innovation, may be motivated by new agricultural techniques (Novisma & Iskandar, 2023) such as integrating *Cajanus cajan* to enhance soil fertility. Therefore, age can either facilitate or hinder the motivation to cultivate this legume, depending on the context.

Local language literacy: The ability to read and understand information in the local language can enhance access to technical knowledge and market opportunities (Rantissi, 2024). Literate farmers are better equipped to interpret agricultural recommendations and manage their activities independently. This skill can, therefore, influence their motivation to cultivate Cajanus cajan, a crop with numerous benefits.

Formal education: Higher levels of education are often linked to greater adaptability to innovations and improved farm management strategies (Sarie, Mohammad, Jamin, & Ramlan, 2023). Educated farmers are more likely to recognize the economic and environmental benefits of certain crops. As a result, education can foster more informed decision-making and strengthen motivation for cultivating strategic crops like Cajanus cajan.

Membership in a producer group: Being part of a farmer organization facilitates access to information, inputs, and markets (Donkor, Dela Amegbe, Ratinger, & Hejkrlik, 2023). Group membership can also enhance motivation to cultivate crops like Cajanus cajan by fostering knowledge exchange and mutual support among producers.

Farm size (cropland area): The amount of available cropland affects a producer's capacity to diversify crops and allocate land to lower-priority crops (Singh, Guleria, Vaidya, & Sharma, 2020). Larger farms may provide greater flexibility to integrate Cajanus cajan into the farming system, whereas smaller farms may limit this option.

Household size (number of individuals): Larger households often require more diverse agricultural production to meet both food and economic needs (Basantaray, Acharya, & Patra, 2024). This can influence the motivation to cultivate Cajanus cajan, either for subsistence or as an additional source of income.

Engaging in a secondary activity: An additional source of income can influence a farmer's production decisions (Ahmadzai, 2020). It may reduce the motivation to cultivate Cajanus cajan by limiting the time available for farming or, conversely, enhance it by providing financial resources for greater investment in production. Table 2 displays the specific variables and definitions.

Table 2. Explanatory variables of the regression model.

Variables	Definition	Expected sign
Age of producer	Age of head of household.	±
Literacy in local language	Ability to read and write in the local language. (1=Yes, 0=No)	+
Level of formal	The producer's level of education. (1=Yes, 0=No)	+
Membership of a producer group	Affiliation with an agricultural organization. (1=Yes, 0=No)	+
Farm size	Total area of land available for agricultural production.	+
Household size	Total number of people in the household.	+
Engaging in a secondary activity	Participation in an income-generating activity outside agriculture. (1=Yes, 0=No)	±

3. RESULTS

3.1. Profile of Respondents

The analysis of the socio-demographic characteristics of the respondents (Table 3) shows that the majority (75%) are men, married (87.50%), without formal education (61.67%) or literacy in the local language (80.42%). Only 39.58% belong to a producer group, and 26.25% have an activity outside agriculture. The respondents are, on average, 45 years old, with 22 years of agricultural experience and 7 years in the production of Cajanus cajan. The average size of their arable land is 10.26 hectares, with 10 members per household.

Table 3. Sociodemographic characteristics of respondents.

Qualitative variables	Response terms	Absolute frequency	Relative frequency (%)
Sex	Female	60	25.00
	Male	180	75.00
Marital status	Bachelor	12	5.00
	Bride	210	87.50
	Divorced	4	1.67
	Widower	14	5.83
Formal education	No	148	61.67
	Yes	92	38.33
Literacy in local language	No	193	80.42
	Yes	47	19.58
Membership of a group	No	145	60.42
	Yes	95	39.58
Engaging in a secondary activity	No	177	73.75
	Yes	63	26.25
Quantitative variables		**Average**	**Standard deviation**
Age		44.50	10.95
Experience in agriculture		21.15	12.66
Cajanus cajan production experience		6.60	7.31
Total area available in ha		10.26	8.66
Number of individuals in the household		9.33	7.21

3.2. Reliability of Motivation Measurement Scales

The ten items to measure pull motivation show internal consistency greater than 0.70 (Table 4). If one item is deleted, the alpha varies from 0.730 (Pull4) to 0.803 (Pull6). Cronbach's alpha (α) for the entire subscale is 0.788, indicating strong internal consistency. For push motivation, the nine items also show internal consistency above 0.70. If one item is deleted, the alpha ranges from 0.835 (Push9) to 0.877 (Push6). Cronbach's alpha (α) for the entire subscale is 0.870, indicating strong internal consistency. In summary, the motivation subscales exhibit high Cronbach's alpha (α) values, suggesting that the items consistently measure motivational factors for *Cajanus cajan* cultivation, thus ensuring the internal validity of the measures.

3.3. Distribution of Scores and Motivation Indices

From the perspective of opportunities (Table 4), the main factors motivating farmers to cultivate Cajanus cajan are a high selling price (0.61), nutritional value (0.60), and high market demand (0.53). Easy access to credit (0.07) and projects for this crop (0.13) contribute little to motivation. In terms of constraints, the most significant factors are household food requirements (0.77), declining soil fertility (0.57), and weeds and pests (0.53). Government intervention on the prices of other crops (0.24) and climate variability (0.25) play a lesser role.

The means of the pull, push, and global motivation indices are 0.39, 0.42, and 0.40, respectively (Table 4). The difference in means between CMIpull and CMIpush, significant at 1%, indicates that farmers have more push motivation. This means that incentive constraints are stronger than opportunities.

The results reveal an uneven distribution of motivation indices across the study areas (Table 4). Farmers in Ouèssè exhibit the highest pull, push, and overall motivation indices, whereas those in Bantè have the lowest. In Bantè, the push motivation index exceeds the pull motivation index (0.29 versus 0.27), as is also the case in Ouèssè (0.67 versus 0.57). In contrast, in Glazoué, the pull motivation index surpasses the push motivation index (0.34 versus 0.29). These differences are statistically significant at the 1% level, indicating that in Bantè and Ouèssè, Cajanus cajan cultivation is primarily driven by constraints, whereas in Glazoué, it is more opportunity-driven. This trend may be linked to the presence of the international market in Glazoué.

3.4. Determinants of Producer Motivation

Pull motivation is correlated with push motivation (r=0.80) at the 1% threshold (Table 5). The SURE regression model is therefore appropriate to simultaneously identify the determinants of these motivations. The analyses show that the variations in the pull and push motivation indices are explained at 35.7% (Adj_R2=0.357) by the explanatory variables of the model, with a significance at the 1% threshold. The explanatory variables explain 25.5% and 24% of the variations in pull and push motivation, respectively. Both models are highly significant at 1%. The direction and significance level of the influences of the explanatory variables vary according to the equations.

Farmer age has a positive influence on the pull motivation index at the 5% level, indicating that as farmers grow older, their pull motivation for cultivating Cajanus cajan increases. Conversely, literacy in the local language has a negative effect on pull motivation at the 5% level and on push motivation at the 1% level, suggesting that literacy reduces the motivation to cultivate Cajanus cajan. Similarly, formal education significantly decreases both pull and push motivations at the 1% level. Membership in a producer group enhances pull motivation at the 1% level. Farm size is positively correlated with both pull and push motivation indices at the 1% level, indicating that a larger cultivable area increases motivation. Lastly, household size positively affects push motivation at the 5% level, suggesting that larger households are more inclined toward push motivation.

Table 4. Reliability of scales and distribution of motivation indices.

Items	Alpha if item deleted	Cronbach's alpha (α)	Motivation score (MMS)
Pull factors			
Pull1	0.784	0.788	0.53
Pull2	0.777		0.61
Pull3	0.731		0.44
Pull4	0.730		0.30
Pull5	0.737		0.60
Pull6	0.803		0.13
Pull7	0.799		0.07
Pull8	0.783		0.48
Pull9	0.749		0.48
Pull10	0.777		0.27
Push factor			
Push1	0.874	0.870	0.57
Push2	0.845		0.25
Push3	0.853		0.29
Push4	0.865		0.42
Push5	0.844		0.32
Push6	0.877		0.77
Push7	0.853		0.37
Push8	0.851		0.53
Push9	0.835		0.24

Composite motivation index (CMI)	**Study areas**				**ANOVA test**
	Together	Bantè	Glazoué	Ouèssè	
Motivation pull	0.39	0.27	0.34	0.57	F=270.02***
Motivation push	0.42	0.29	0.29	0.67	F=487.18***
Overall motivation	0.40	0.28	0.31	0.62	F=546.04***
t-test (Pull and push)	t = -3.29***				

Note: *** significant at 1% ($p \leq 0.01$).

Table 5. Determinants of motivation to cultivate *Cajanus cajan*.

Variables	Motivation pull		Motivation push	
	Coefficient	SD	Coefficient	SD
Age of producer	0.001**	0.008	0.001	0.01
Literacy in local language	-0.06**	0.03	-0.12***	0.03
Formal education	-0.08***	0.02	-0.09***	0.03
Membership of a producer group	0.08***	0.02	0.04	0.03
Farm size (Cultivable area)	0.005***	0.001	0.007***	0.001
Household size (Number of individuals)	0.001	0.01	0.004**	0.001
Engaging in a secondary activity	-0.01	0.02	-0.01	0.03
Constant	0.44***	0.04	0.50***	0.05
Equation summary				
Obs.	240		240	
RSME	0.134		0.177	
R square	0.255		0.240	
Chi2	82.42		75.96	
Probability	***		***	
Correlation	0.806***			
Overall model summary				
R2	0.375			
Adj_R2	0.357			
F	19,923			
Chi2	112,968			
Probability	***			

Note: *** significant at 1% ($p \leq 0.01$); ** significant at 5% ($0.01 < p \leq 0.05$).

4. DISCUSSION

The study shows that push motivation is significantly higher than pull motivation, indicating that incentive constraints are more important than opportunities for Cajanus cajan production. Factors such as the need to meet household food requirements and address agronomic challenges, including declining soil fertility, weed proliferation, and pest infestations, are the primary reasons for growing Cajanus cajan. In contrast, market opportunities, such as high selling prices and strong demand, play a secondary role. These findings confirm that, in developing countries, farmers are often motivated by necessity rather than opportunity. In Benin and Zimbabwe, farmers adopt practices to meet urgent needs (Masere & Worth, 2022; Thoto et al., 2024), while in Tanzania, they focus on opportunities for cost reduction and market access (Sariah & Mmbando, 2022). Furthermore, Larweh and Abukari (2022) note that farmers act out of both necessity and opportunity.

The analyses show the influence of the socio-demographic characteristics of the producers on their motivation. Among others, the increase in the age of the farmer enhances his opportunistic motivation to cultivate Cajanus cajan. This finding is similar to that of Moumenihelali, Abbasi, and Karbasioun (2023) regarding older farmers motivated by pluriactivity in rice farming in Mazandaran, Iran. This suggests that aging farmers see their motivations evolve towards personal aspirations and growth opportunities. In contrast, Maican et al. (2021) indicate that young farmers are motivated by economic opportunities and individual development.

Furthermore, local language literacy and formal education can reduce farmers' motivation to cultivate Cajanus cajan by exposing them to more lucrative economic alternatives and changing their aspirations towards activities perceived as more prestigious (Marpaung, Aureli, & Cahya, 2024). Membership in a producer group improves pull motivation by providing better access to information and training (Kindemin et al., 2023). Increasing the area of arable land enhances pull and push motivation by allowing for larger-scale production and crop diversification, which increases profit opportunities and resilience (Vernooy, 2022). Finally, a larger household, requiring more resources, positively influences push motivation, increasing production to ensure food security and family well-being, with additional labor facilitating the intensification of Cajanus cajan production (Hardev, 2016).

5. CONCLUSION

This study examined the motivations of Cajanus cajan producers by assessing various incentive factors, categorized into pull and push factors. The motivation indices reveal that push motivation, driven by constraints such as high household food needs, declining soil fertility, and the prevalence of weeds and pests, is stronger than pull motivation, which is linked to opportunities like high selling prices and the crop's nutritional value. The predominance of push motivation suggests that farmers cultivate Cajanus cajan primarily out of necessity rather than by choice, indicating limited awareness of the potential benefits associated with this crop. Age, farm size, and household size positively influence farmers' motivation to cultivate Cajanus cajan, whereas literacy in the local language and formal education level have a negative effect. These findings provide valuable insights for optimizing Cajanus cajan production in Benin. By considering farmers' diverse motivations and adapting interventions to local contexts, policymakers can develop more effective strategies to support producers, enhance food security, and promote the crop's value. Increasing awareness of Cajanus cajan's benefits could strengthen farmers' pull motivation. Additionally, creating attractive economic opportunities, such as improving access to credit and developing promotional initiatives, could encourage young farmers and those with higher education levels to adopt this crop. This study primarily relies on self-reported, cross-sectional data, offering an initial analysis of farmers' motivations. A longitudinal approach would provide deeper insights into how motivations evolve over time. Future research should also examine market dynamics and Cajanus cajan's value chains to identify opportunities for value addition, enhance profitability for producers, and facilitate its integration into sustainable agricultural systems.

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Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.
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