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# ECONOMIC ANALYSIS OF AGROECOLOGICAL PRACTICES IN MALI, WEST AFRICA: A GENDER PERSPECTIVE

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## ABSTRACT

Agriculture forms the backbone of the economy in most Sahel countries, providing livelihoods for thousands of people. However, it currently faces significant ecological challenges, primarily due to decreasing rainfall, climatic risks and environmental degradation. This study aimed to assess the quality of life of people in the Sahel with limited access to productive resources. The specific objectives include identifying agro-ecological zones and analyzing the socioeconomic and demographic factors influencing gender-specific agro-ecological practices. The survey was conducted in three villages within the study area in Mali: Koulikoro, Ségou and Sikasso. Data were collected from 451 producers (both women and men), with 150 participants from Dougoumousso (Sikasso), 152 from Kobala Coura (Koulikoro), and 149 from Kondogola. The data were gathered using a semi-structured questionnaire during the 2020-2021 farming season. Data collection was conducted through random sampling. Descriptive statistics and multivariate models were used to analyze the data. The most common agroecological practices observed in the study area included plot plowing, hand cultivation and direct seeding. Additionally, producers engaged in practices such as organic manure application, soil and water conservation, and local crop processing, although access to training and technical support remains limited. The multivariate probit regression analysis revealed that the socioeconomic characteristics influencing agro-ecological practices vary significantly by gender in the agro-ecological zones of Mali. The gender variable was significant at the 1% level, with coefficients (β=-0.960***) and (β=-0.899***) indicating a negative impact on hand cultivation and direct sowing practices, respectively. Formal education, the age of producers, years of experience, and access to technical advice also significantly influence these practices. Agroecology emerges as a sustainable agricultural practice that minimizes chemical inputs and integrates both local and scientific knowledge. The study recommends focusing on training, better integration of women and young people, dissemination, and funding to effectively promote these practices and ensure the sustainability of agriculture in the Sahel. Overall, addressing the ecological challenges in the Sahel requires a comprehensive understanding of the socioeconomic and demographic factors influencing agro-ecological practices. This study highlights the importance of education, experience and technical advice in promoting sustainable agriculture and suggests targeted interventions to improve the livelihoods of producers in the region.

**Key words:** Malian agroecology, gender, agroecological practice, multivariate model, socioeconomic factors

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## RESUME

L'agriculture constitue le pilier de l'économie dans la plupart des pays du Sahel, offrant des moyens de subsistance à des milliers de personnes. Cependant, cette activité fait face à d'importants défis écologiques, principalement dus à la diminution des précipitations, aux risques climatiques, et à la dégradation de l'environnement. Cette étude vise à améliorer la qualité de vie des populations du Sahel ayant un accès limité aux ressources productives. Les objectifs spécifiques incluent l'identification des zones agroécologiques et l'analyse des facteurs socio-économiques et démographiques influençant les pratiques agroécologiques différenciées par genre. L'enquête a été menée dans trois villages de la zone d'étude : Koulikoro, Ségou et Sikasso. Les données ont été collectées auprès de 451 producteurs (femmes et hommes) répartis comme suit: 150 participants à Dougoumousso (Sikasso), 152 à Kobala Coura (Koulikoro) et 149 à Kondogola. Les données ont été recueillies à l'aide d'un questionnaire semi-structuré au cours de la campagne agricole 2020-2021. La collecte a été réalisée par échantillonnage aléatoire. Les statistiques descriptives et des modèles multivariés ont été utilisés pour analyser les données. Les pratiques agroécologiques les plus courantes observées dans la zone d'étude incluent le labour des parcelles, la culture manuelle et le semis direct. En outre, les producteurs pratiquent l'utilisation de fumier organique, la conservation des sols et de l'eau, ainsi que la transformation locale des cultures, bien que l'accès à la formation et à l'appui technique demeure limité. L'analyse de régression probit multivariée a révélé que les caractéristiques socio-économiques influençant les pratiques agroécologiques varient considérablement selon le genre dans les zones agroécologiques du Mali. La variable genre était significative au niveau de 1%. Les coefficients (β=-0.960***) et (β=-0.899***) indiquent un effet négatif sur les pratiques de culture à la main et de semis direct, respectivement. L'éducation formelle, l'âge des producteurs, les années d'expérience, et l'accès à des conseils techniques influencent également ces pratiques. L'agroécologie émerge donc comme une pratique agricole durable minimisant l'utilisation d'intrants chimiques et intégrant les savoirs locaux et scientifiques. L'étude recommande de se concentrer sur la formation, une meilleure intégration des femmes et des jeunes, la vulgarisation et le financement pour promouvoir ces pratiques et garantir la durabilité de l'agriculture au Sahel.

**Mots clés**: Agroécologie malienne, Genre, pratiques agroécologiques, modèle multivarié, facteurs socioéconomiques

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## INTRODUCTION

Malian agriculture contributes 41% to the country's Gross Domestic Product (GDP) and plays a crucial role in food supply, with only 7 million out of 43.7 million hectares of arable land being cultivated [1]. In response to the 2007/2008 global food crisis, many sub-Saharan African governments, including Mali, implemented strategies to boost agricultural productivity [2]. According to the United Nations' "World Population Prospects: The 2012 Revision," the global population is expected to rise from 7.2 billion to 9.6 billion by 2050, with the fastest growth in the least developed countries [3]. To feed this growing population, there is a pressing need to increase food production. However, the excessive use of agrochemicals to enhance productivity has led to environmental degradation and health risks [3].

Agroecology offers a sustainable alternative, minimizing inputs, enhancing natural resources, and integrating local and scientific knowledge [4]. It promotes equitable social relations, particularly between men and women, and supports the development of sustainable, economically viable agroecosystems. In Mali, women are integral to the agricultural chain, yet they often lack the resources needed to increase their productivity, such as access to land and control over production means [5]. They play a significant role in small livestock, local product processing, and food crops, but their contributions are often undervalued.

Agroecological practices in Mali include incorporating organic matter into the soil, water and soil conservation, soil defense and restoration techniques and agroforestry. Despite these practices, the relationship between agroecology and gender remains underexplored.

This study aimed to conduct a gender-sensitive economic analysis of agroecological practices in Mali. Specifically, it sought to :

- Characterize producers in agroecological zones based on their socioeconomic and demographic attributes.
- Identify key factors influencing the adoption of agroecological practices among men and women.
- Provide policy recommendations to promote gender-equitable and sustainable agriculture.

By addressing these objectives, the study contributes to bridging the knowledge gap on gender-specific dynamics in the adoption of agroecological practices in Mali.

### Literature Review

The study by D'Annolfo *et al*.[7] reviewed agroecology's social and economic performance, focusing on a framework and quantitative summary of farm-level techniques. The study found that while agroecology improved financial capital, there

was a lack of data on human and social capital. It identified a positive link between agroecological practices, such as direct seeding and the System of Rice Intensification (SRI), and increased farm profitability, efficiency and yields. Future research will address this gap by examining the differential impacts of these factors on male and female farmers in Mali.

Similarly, the research by Coulibaly *et al.* [8] examined the adoption of agroecological practices and identified a shift away from traditional millet-bean systems. Findings indicated that 60.4% of producers had participated in agroecological training, with 60.8% expressing interest in adopting these practices. Commonly implemented techniques included superficial plowing, the use of stone rows, zai and composting. The key factors driving adoption were crop yields, income, available resources, and training, with both training programs and access to equipment showing a positive influence. However, the study did not account for gender differences. Further research will explore how gender-specific barriers and motivators influence the adoption of these practices.

In the same vein, the study by Kpadenou *et al*. [9] examined the socio-economic factors influencing the adoption of agroecological practices in vegetable production in the Niger Valley, Benin. The Logit model analysis revealed that greater assets, higher education levels, and contact with NGOs positively influenced the adoption of biological, mechanical and pesticide-alternative practices. In contrast, gender, farming experience, and cultivated area size negatively impacted adoption. The use of improved seeds was positively associated with experience, education and group membership, whereas traditional practices were shaped by experience and resource availability.

Furthermore, the research conducted by Agbugba *et al*. [10] in the Amatole District of Eastern Cape found that the majority of maize producers were male, married, and had some level of education. Among them, 33% had 9–11 years of farming experience, 76% utilized irrigation, and 89% relied on farming as their primary occupation. Smallholder irrigators achieved higher yields and revenues compared to homestead gardeners, who faced lower profit margins due to higher input costs. However, this study lacked a gender perspective. Future research will analyze how factors like land tenure and input costs differentially impact men and women in adopting agroecological practices.

In another context, Adekambi *et al*. [11] conducted a study on the adoption of integrated soil fertility management (ISFM) measures in northern Benin, employing a multivariate probit model to analyze farmer decision-making processes. The study assessed the simultaneous adoption of multiple ISFM practices and examined the socioeconomic, institutional, and farm-level characteristics that influenced these

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decisions. The results indicated that factors such as the distance from the farmer's residence to the village center, membership in farmer groups, frequency of contact with agricultural extension agents, the total area under cultivation, livestock ownership, and the availability of agricultural labor significantly affected adoption behavior. These findings underscored the role of both physical access and social networks in facilitating the dissemination and uptake of ISFM measures, while also highlighting the importance of resource endowments and institutional support in promoting sustainable agricultural practices.

The research conducted by Milheiras *et al.* [12] examined the effects of farmer perceptions, socio-economic conditions, and agricultural practices on food security and well-being. The findings indicated that the adoption of agroecological techniques positively influenced well-being. Furthermore, access to knowledge and extension services was positively correlated with increased use of these techniques. The study showed that even when combined with conventional methods, agroecological practices improved food security and overall well-being. However, gender-specific impacts were not assessed.

Moreover, Edewor *et al.* [13] investigated the influence of land ownership and gender on the adoption of climate-smart agriculture (CSA) in Nigeria. The study reported generally low adoption rates, with male-headed households exhibiting higher levels of uptake than their female-headed counterparts. Social capital and nativity were found to exert a stronger influence on adoption than either land ownership or gender, underscoring the critical role of community networks and local integration in facilitating CSA diffusion. The authors recommended the implementation of gender-sensitive policies to enhance adoption rates, complemented by strategies aimed at strengthening social capital, fostering knowledge exchange, and promoting inclusive participation within farming communities.

Additionally, a study focusing on Haor inhabitants in Bangladesh found that 80% of farmers were under 50 years, 17% had secondary education and 43% had primary education [6]. Household sizes varied, with half having 1–5 members and 47% having 6–10 members. The average farm size was 2.2 acres. The study highlighted that family size and farm size significantly affect income, although it did not address gender differences.

Finally, Le *et al*. [14] conducted a study on sustainable green tea production in northern Vietnam, highlighting the central role of tea as a key cash crop for local livelihoods. By using comparative analyses of conventional and agroecological management practices, the authors found that long-term reliance on conventional cultivation methods contributed to soil degradation and environmental pollution, threatening the long-term productivity and sustainability of tea plantations. In

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contrast, agroecological management approaches characterized by organic inputs, reduced chemical use, and soil conservation practices led to notable improvements in soil quality, including significant increases in soil organic matter content and higher pH levels. Interestingly, conventional practices were associated only with a modest rise in soil nitrogen levels (from 0.15% to 0.20%), suggesting limited benefits compared to the broader ecological gains observed under agroecological systems. These findings reinforced the argument that transitioning from conventional to agroecological management can deliver both environmental and agronomic benefits, while safeguarding the sustainability of high-value cash crops such as tea.

### Research Aim and Objective

The existing literature highlights the benefits and challenges of agroecological practices, but it lacks gender-specific insights, especially in the Malian context.
This study addresses that gap by :

- Conducting a gender-sensitive economic analysis of agroecological practices.
- Identifying socioeconomic and demographic factors affecting adoption by men and women.
- Proposing policy recommendations for equitable and sustainable agricultural development.

## MATERIALS AND METHODS

### Data Source and Collection

The data for this study were collected through the FAIR-SAHEL Project in Mali, which spans 1,241,328 km² and has a population of approximately 21.4 million, with 73% living in rural areas. Agriculture, particularly family farming, is crucial to the economy, employing 80% of the workforce and contributing nearly 40% to GDP. The study focused on three agro-ecological zones: Baguinéda (irrigated rice farming), Kléla (cotton and maize agriculture) and Cinzana (cereals and legumes). Surveys were conducted with 451 producers across three villages, a total of 451 producers, both women and men, were selected through snowball sampling method and data was managed using STATA software. The Table 1 presents the gender distribution of participants across three villages: Kobala-coura, Kondogola, and Dougoumousso. A total of 451 individuals participated in the study, with 297 females (66%) and 154 males (34%). The data indicate that in each village, there were more female participants than male participants, reflecting a higher level of engagement from women.

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## Data Analysis

To achieve the specific objectives, statistical and econometric methods were employed. Descriptive and inferential statistics were used to analyze the first objective, while a multivariate probit model was applied for the second.

For the first objective, the socio-economic and demographic characteristics of producers were analyzed by village and gender using both descriptive (crosstabulations, percentages, means, standard deviations) and inferential (t-test, chi-squared) statistics. The key variables considered included gender, age, marital status, level of education, main and secondary activities, years of farming experience, and the type of agroecological practices used.

For the second objective, the study aimed to identify the determinants of agroecological practice (AP) adoption across genders in the three villages. The research question was: *Which socioeconomic and demographic factors influence the adoption of agroecological practices differently for men and women?* The research hypothesis tested was that certain socioeconomic variables such as education, experience and access to resources significantly influence the gender-based adoption of APs.

The multivariate probit (MVP) model was used to analyze gender-based determinants of agroecological practice (AP) adoption in Mali. Unlike single-equation models, the MVP accounts for interrelated practices, examining how explanatory variables influence each practice while considering correlations between unobserved factors and adoption decisions. These correlations, whether complementary or substitutable, are crucial for accurate analysis [11]. Ignoring them can lead to biased estimates. The MVP model offers a more precise understanding of AP adoption by incorporating these interdependencies.

Consider the $ith$producer $(i = 1, \dots, N)$ faced with a decision whether to adopt the available APs. Suppose that $U_0$ represents the advantage for the producer to obtain other management practices and suppose $U_k$ represents the advantage of the adoption of the $kth$ AP: where $k$ denotes the set of available APs namely: the choice of plowing of the plots $(P)$, plowing with hand $(M)$, direct sowing $(S)$. The farmer decides to adopt the $kth$ AP if $Y_{ik}^* = U_K^* - U_0 > 0$. The benefit $(Y_{ik}^*)$ that the farmer derives from the adoption of $kth$ AP is a latent variable determined by observed socio-economic, demographic characteristics of the producer and his field $(X_i)$ and the error term $(\varepsilon_i)$:

$$Y_{ik}^* = Genre\alpha_k + X_i^*\beta_k + \varepsilon_i \quad (k = P, M, S) \qquad (1)$$

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Since this study seeks to investigate the factors influencing the adoption of agroecological practices, with particular attention to gender dynamics and disparities. By analyzing according to gender, equation (1) is rewritten as follows:

$Y_{ik}^{*} = X_i^{*}\beta_k + \varepsilon_i \quad (k = P, M, S)$ (2)if Gender= Male

$Y_{ik}^{*} = X_i^{*}\beta_k + \varepsilon_i \quad (k = P, M, S)$ (3)if Gender= Female

In the study, other factors were included because gender alone cannot be part of the model. The study found that more variables are needed to accurately capture the differences and relationships in the data.

In the multivariate model, where the adoption of several APs is possible, the error terms jointly follow a multivariate normal distribution (MVN) with null conditional mean and variance normalized to unity (for the identification of the parameters) where :$(uP, uM, uS). \sim MVN\ (0, \Omega)$

**Model Specification**

The multivariate probit model has already been used in several empirical studies assessing the factors that influence the simultaneous adoption of several agricultural technologies [15].

The empirical specification is expressed as follows:

$$AP_k = X_1^{*}\beta_{Genre} + X_2^{*}\beta_{Age} + X_3^{*}\beta_{alphabetisation} + + X_4^{*}\beta_{educformelle} + X_5^{*}\beta_{Nbre\ year-work-parcel} + X_6^{*}\beta_{married} + X_7^{*}\beta_{widowed} + X_8^{*}\beta_{group} + X_9^{*}\beta_{segou} X_{10}^{*}\beta_{acces\_terre} + X_{11}^{*}\beta_{acces\_cred\_agricole} + X_{12}^{*}\beta_{acces\_techn\_cult\_agent\_agri}$$

**Explanation of the variables**

- $\boldsymbol{AP_k}$ (Agriculture practices)
- $\boldsymbol{X_1}$ (Gender): A dummy variable indicating the gender of the individual. 1=male, 0= otherwise.
- $X_2$ (Age): The age of the individual in years.
- $X_3$ (Literacy): A binary variable indicating whether the individual is literate or not. 1=literate, 0=illiterate.
- $X_4$ (Formal Education): A binary variable indicating whether the individual has received formal education. 1=yes, and 0 if otherwise.
- $X_5$ (Number of years working on a plot): The number of years the individual has worked on a farm plot.
- $X_6$ (Marital Status): A dummy variable indicating the marital status of the individual. 1=married, and 0 if otherwise.
- $X_7$ (Widowed): A binary variable indicating whether the individual is widowed. 1=widowed, 0= notwidowed.

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- $X_8$ (Group): This variable represents a specific group of individuals, such as a socio-economic or regional group. It is important to clarify what this group represents.
- $X_9$ (Segou): A binary variable indicating whether the individual resides in the Segou region. 1=resides in Segou, 0=does not reside in Segou.
- $X_{10}$ (Access to land): A binary variable indicating whether the individual has access to agricultural land. 1=has access, 0= no access.
- $X_{11}$ (Access to agricultural credit): A binary variable indicating whether the individual has access to agricultural credit. 1=has access, 0=no access
- $X_{12}$ (Access to agricultural extension services): A binary variable indicating whether the individual has access to an agricultural extension agent for advice or assistance. 1=has access,0=no access.

## RESULTS AND DISCUSSION

### General gender characteristics

Table 2 presents key gender-based differences that may have influenced the adoption of agroecological practices. On average, women were older (39 vs. 32 years), owned slightly larger plots (0.42 ha vs. 0.28 ha), and had more years of farming experience (13 vs. 5 years) compared to men. These characteristics especially experience and land access are important factors potentially shaping their approach to agroecological techniques. In terms of livestock, women managed smaller animals such as goats and sheep, while men were more involved in cattle production. These differences, all statistically significant, may partly explain gendered preferences in agroecological practice adoption.

Table 3 shows that the majority of farmers in all three villages were married, with around 91-92% married, 4-5% single and a small percentage widowed or divorced.

Table 4 reveals very low formal education levels in all zones, with 66% of men and 77% of women lacking formal education. Only 16% of men and 6% of women completed secondary education, with early marriage and dropout rates contributing to the educational gap. Higher education was rare, pursued by just 4% of men and 2% of women. Literacy rates were slightly higher for women (7%) compared to men (0%), possibly due to targeted educational programs for women.

### Determinants of Agroecological Practice Adoption: Multivariate Probit Model Analysis

The results of the multivariate probit model (Table 5) revealed that the adoption of agroecological practices was influenced by a combination of socioeconomic and demographic factors. These results highlighted the complexity of decision-making in agricultural contexts and emphasized the relevance of integrating gender as an explanatory variable.

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To begin with, gender played a significant role in the adoption of hand cultivation and direct seeding. Men were less likely to adopt these two practices compared to women, with coefficients of β = –0.960 and β = –0.899, respectively ($p < 0.01$). This could be explained by the fact that women managed smaller plots and were more accustomed to traditional, labor-intensive techniques, as noted by D'Annolfo *et al*. [7], who emphasized the importance of labor division in shaping agroecological behaviors.

Similarly, age had a positive influence on direct seeding (β = 0.0155, $p < 0.1$), suggesting that older producers tended to prefer this practice. This contradicted some findings in the literature, which associated innovation adoption more strongly with younger farmers, but it might have reflected the reliance of older farmers on traditional sowing methods [17,18].

Furthermore, formal education showed a dual influence: it positively affected hand cultivation (β = 0.442, $p < 0.05$), but negatively affected direct seeding (β = –0.524, $p < 0.01$). This surprising result contrasted with the common assumption that education fosters the adoption of improved practices [19, 22]. It was possible that more educated producers were more oriented toward modern or conventional techniques rather than agroecological alternatives.

Moreover, farming experience significantly promoted the adoption of all three practices (β = 0.0471, 0.041, and 0.0236, respectively, all statistically significant). This supported the idea that accumulated knowledge and familiarity with land conditions enhanced openness to agroecological methods, though it partially contradicted Manda *et al*. [20], who noted that high experience levels might lead to risk aversion and resistance to change.

In addition, locality was another key determinant. Producers in Ségou were significantly more likely to adopt direct seeding (β = 0.370, $p < 0.05$) but less likely to engage in hand cultivation (β = –1.571, $p < 0.01$), compared to those in Sikasso. These differences might have stemmed from regional disparities in agroecological training, land availability, or ecological conditions, as also observed by Coulibaly *et al*. [8].

Finally, access to technical advice had contrasting effects. It positively influenced the adoption of plot plowing (β = 0.572, $p < 0.01$) and hand cultivation (β = 0.387, $p < 0.05$), but negatively affected direct seeding (β = –0.331, $p < 0.1$). This might have reflected the orientation of extension services, which often promoted conventional techniques over agroecological practices, a pattern discussed by Mariano *et al*. [21] and Feder [20].

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These findings demonstrated that the gender adoption of agroecological practices could not be understood through a single lens. Instead, it resulted from the interaction of multiple structural and contextual factors. Policies aiming to promote sustainable agriculture in Mali must therefore be gender-responsive, regionally adapted, and grounded in farmers' experiences and knowledge systems.

## CONCLUSION AND RECOMMENDATIONS FOR DEVELOPMENT

Agroecology encompasses environmentally friendly farming techniques that utilize scientific research, local knowledge, and natural resource enhancement while minimizing chemical inputs. This study analyzed agro-ecological practices and their influencing socio-economic and demographic factors in the Sahel region, focusing on hand cultivation, direct seeding and plot plowing. Key factors influencing these practices include the number of years working on the plot and technical cultivation advice.

Results show that gender significantly affects agroecological practices. Therefore, the analysis showed that gender, age, education, experience, locality, and technical advice significantly influenced the adoption of agroecological practices. Men were less likely than women to adopt hand cultivation and direct seeding. Older producers were less inclined to adopt direct seeding, while formal education increased adoption of hand cultivation but reduced adoption of direct seeding. Farming experience consistently promoted all practices. Regional differences emerged, with Ségou farmers less likely to practice hand cultivation but more likely to adopt direct seeding. Technical advice had mixed effects, encouraging plot plowing and hand cultivation but discouraging direct seeding.

Based on the results of the model, the study recommends enhancing agroecological practices through increased access to cultural technical advice, which was found to have a significant and positive effect on the adoption of all three practices. Furthermore, the negative coefficient of the sex variable suggests gender disparities in practice adoption, supporting the need for greater inclusion of women in training programs. Although access to agricultural credit and land were not statistically significant, their importance in policy design remains crucial, particularly in enabling conditions for marginalized groups. Policies should thus prioritize advisory support and gender-sensitive training to improve uptake of agroecological methods.

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**Table 1: Gender**

| Gender | | | | |
|---|---|---|---|---|
| **Village name** | **Female** | **Male** | **Total** | **Percentage** |
| Kobala-couira | 97 | 55 | 152 | 34% |
| Kondogola | 100 | 49 | 149 | 33% |
| Dougoumousso | 100 | 50 | 150 | 33% |
| Total | 297 | 154 | 451 | 100% |

Source: Authors

**Table 2: Socio-economic Characteristics of Producers by Gender**

| Variables | Male | | Female | | |
|---|---|---|---|---|---|
| | Avg. | Std. Dev. | Avg. | Std. Dev. | T-test |
| Age (years) | 32 | 6.65 | 39 | 13.33 | 5.64*** |
| Cattle (number of heads) | 1.74 | 3.42 | 0.39 | 2.83 | 4.45*** |
| Sheep (number of heads) | 3.09 | 4.023 | 0.54 | 1.45 | 9.78*** |
| Goats (number of heads) | 3.09 | 5.09 | 1.08 | 2.13 | 5.88*** |
| Total cultivated area (hectares) | 0.28 | 0.76 | 0.42 | 0.47 | -2.31** |
| Agricultural experience (years) | 5.32 | 7.31 | 12.5 | 10.24 | -7.71*** |

Source: Authors

**Note**: *** Significant at the 1% level; ** significant at the 5% level; * significant at the 10% level; Average = Arithmetic mean; Std. Dev. = Standard deviation

**Table 3: Marital status distribution (%)**

| Marital status (%) | Kobalacoura | Dougoumousso | Kondogola |
|---|---|---|---|
| Married | 91 | 92 | 91 |
| Single | 4 | 5 | 4 |
| Divorced | 1 | 0 | 0 |
| Widowed | 5 | 3 | 5 |

Source: Authors


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**Table 4: Level of education of the respondents by gender**

| Education level | Male | Female |
|---|---|---|
| No formal education | 66.23 | 77.44 |
| Primary | 14.29 | 12.46 |
| Secondary | 15.58 | 5.72 |
| Superior | 3.90 | 2.02 |
| Literacy | 0.00 | 7.00 |

Source: Authors

**Table 5: Factors influencing agro-ecological practices**

| | Individual plot plowing | Cultivation with hands | Direct sowing seeds |
|---|---|---|---|
| variables | Coefficients (Std Err) | Coefficients (Std Err) | Coefficients (Std Err) |
| Sex | -0.150 | -0.960*** | -0.899*** |
| | (0.147) | (0.171) | (0.208) |
| Age of Producer | -0.00426 | -0.00737 | -0.0155* |
| | (0.00785) | (0.00877) | (0.00884) |
| Literacy | 0.503 | -0.530 | -0.0459 |
| | (0.634) | (0.584) | (0.525) |
| Formal education | -0.116 | 0.442** | -0.524*** |
| | (0.151) | (0.180) | (0.203) |
| Years of work on the plot | 0.0471*** | 0.0410*** | 0.0236** |
| | (0.00977) | (0.00995) | (0.0103) |
| Married | 0.133 | -0.0334 | 5.217 |
| | (0.327) | (0.369) | (2,235) |
| Widower | 0.0578 | -0.233 | 5.126 |
| | (0.504) | (0.538) | (2,235) |
| Segou | -0.0297 | -1.571*** | 0.370** |
| | (0.146) | (0.166) | (0.163) |

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| | | | |
|---|---|---|---|
| Access to land | 0.499 | 0.216 | 4.477 |
| | (0.476) | (0.536) | (124.4) |
| Access to agricultural credit | 0.154 | 0.265 | -0.240 |
| | (0.197) | (0.223) | (0.228) |
| Cultural technical advice | 0.572*** | 0.387** | -0.331* |
| | (0.142) | (0.159) | (0.171) |
| Constant | -0.783 | 0.609 | -9.865 |
| | (0.597) | (0.679) | (2,239) |
| Observations | 451 | 451 | 451 |

Source: Survey data, 2020-2021. Standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1 *** Significance at 1%, ** Significance at 5% * Significance at 10%

Number of sightings = 451 - Wald chi2(33) = 245.87² - Prob > chi2 = 0.0000 - Log likelihood = -612.9342

| | **Coefficients** | **Standard Error** | **z-test** | **P>\|z\|** |
|---|---|---|---|---|
| Atrho21 | 0.746 | 0.105 | 7.05 | 0.000 |
| Atrho31 | -0.470 | 0.095 | -4.94 | 0.000 |
| Atrho32 | -0.216 | 0.875 | -2 .47 | 0.013 |
| Atrho21 | 0.633 | 0.063 | 9.98 | 0.000 |
| Atrho31 | -0.438 | 0.076 | -5.70 | 0.000 |
| Rho32 | -0.213 | 0.083 | -2.55 | 0.011 |

Likelihood ratio test of rho21=rho31=rho32=0 - Chi2(3) = 87.2968 Prob greater than chi2 =0.0000

Source: Authors

## REFERENCES

1. **World Bank.** World Bank Report on Mali. Washington DC, 2018. http://www.worldbank.org/en/country/mal *Accessed May 2024.*

2. **Havard M and C Soudré** Sustainably develop mechanization to improve the productivity of family farming in Sub-Saharan Africa. 2013.

3. **Le Bars H, Martin S, Fournier M, Étienne F, Laborde G, Petit M and D Colliou** Risk assessment of the use of pesticides in cotton cultivation in Mali. *Cahiers Agricultures,* 2020; **29(4):** 900-918.

4. **Wezel PJ, Casagrande M, Celette F, Vian JF, Ferrer A and J Peigné** Agroecological practices for sustainable agriculture: A review. *Agronomy for Sustainable Development*, 2014; **34(1):** 1-20.

5. **African Development Bank Group**. Agricultural water management: Evaluation of the African Development Bank's Assistance in Ghana and Mali, 1990-2010. AfDB, Tunis, 2011.

6. **Parvin M and M Akter** Factors affecting farm and non-farm income of Haor inhabitants of Bangladesh. *Progressive Agriculture*, 2012; **23(1and2):** 143-150.

7. **D'Annolfo R, Gemmill-Herren B, Balázs B and S Gliessman** A review of social and economic performance of agroecology. *International Journal of Agricultural Sustainability*, 2017; **15(6):** 632-644.

8. **Coulibaly AM-H and HE Hamadoun** Determinants of agroecological practices adoption in the Sudano-Sahelian zone. *Journal of Environmental Protection,* 2019; **7(10):** 900-918.

9. **Tchibaka CT, Tchégnia YB and YJ Kpadenou** Socio-economic determinants of the adoption of agro-ecological practices in vegetable production in the Niger Valley in Benin. *International Journal of Biological and Chemical Sciences,* 2020; **7(13):** 3103-3118.

10. **Madukwe IK, Chianu MN and OI Agbugba** Economic analysis of smallholder maize farmers: implications for public extension services in Eastern Cape. *South African Journal of Agricultural Extension,* 2020; **48(2):** 50-63.

11. **Jokebed SC and YJ Adekambi** Factors determining the adoption of integrated soil fertility management (ISFM) measures in northern Benin: An application of the multivariate probit model to the case of maize producers. *International Journal of Biological and Chemical Sciences*, 2021; **15(2):** 664-678.

12. **Milheiras PM and S Sanchez-Gonzalez** Agroecological practices increase farmers' well-being in an agricultural growth corridor in Tanzania. *Agronomy for Sustainable Development,* 2022; **42(4):** 56.

13. **Sunday SE, Akinbode AM and OI Edewor** Gender analysis of land ownership influence on climate smart agriculture adoption among farming households in Nigeria. International *Journal of Sustainable Agricultural Management and Informatics,* 2023; **9(2):** 159-181.

14. **Le VD, Le BL and LD Le** Sustainable green tea production through agroecological management and land conversion practices for restoring soil health, crop productivity and economic efficiency: Evidence from Northern Vietnam. *Soil Use and Management,* 2023; **39(3):** 1185–1204.

15. **Dassoundo-Assogba CJFJ and RP Kadoké** Determinants of fish feed choice by fish farmers in the Ouémé Valley in Southern Benin. *International Journal of Progressive Sciences and Technologies*, 2019; **15(1):** 30-44.

16. **Manda K, Alene A and S Graw** Adoption and impacts of sustainable agricultural practices on maize yields and incomes: Evidence from rural Zambia. *Journal of Agricultural Economics,* 2016; **67(1):** 130-153.

17. **Langyintuo A and C Mwangi** The effect of household wealth on the adoption of improved maize varieties in Zambia. *Food Policy,* 2008; **36(6):** 550-559.

18. **Bizimana CN, Wang LY and F Sumberg** Factors influencing adoption of recommended farm practices by coffee farmers in Butare, Southern Rwanda. *Agrekon,* 2002; **41(3):** 237-248.

19. **Tey BY and SO Loke** Factors influencing the adoption of sustainable agricultural practices in developing countries: A review. *Environmental Sustainability,* 2014; **6(4):** 22-32.

20. **Feder G** Agricultural extension and adoption of innovations: Evidence from some developing countries. *Journal of Agricultural Economics,* 1992; **42(3):** 224-239.

21. **Mariano MJ, Villano R and E Fleming** Factors influencing farmers' adoption of modern rice technologies and good management practices in the Philippines. *Agricultural Systems*, 2012; **110:** 41-53.

22. **Adechian BM, Sohounhloué N, Adandédjan AJP and B Sinsin** Socio-economic and environmental determinants of compliance with mineral fertilization recommendations for selected traditional leafy vegetables in Benin. *African Agronomy,* 2020; **32(1):** 25-36.