

## ASSESSING THE BARRIERS TO THE ADOPTION OF IMPROVED PLANTAIN TECHNOLOGIES IN OSUN STATE, NIGERIA

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### ABSTRACT

*This study is on the barriers to the adoption of Improved Plantain Technologies (IPT) among smallholder farmers in Osun State, Nigeria. The objectives were to identify socio-economic and assess the barriers preventing adoption; and propose strategies for improving adoption. A mixed-methods approach was employed, combining a survey of 125 farmers with qualitative interviews. The study found that the main barriers to IPT adoption were inaccessibility of planting materials (92.0%), inadequate labour (91.2%), and lack of follow-up by extension agents (98.4%). Farm size was a significant determinant, with 51.2% of respondents owning farms between 1.1 and 3.0 hectares, and larger farmers more likely to adopt improved practices. The study also found that 89.4% of respondents practised mixed cropping, which affects the integration of new technologies. The study concludes that addressing these barriers, particularly improving access to planting materials and strengthening extension services, could significantly enhance IPT adoption. Key policy recommendations include providing subsidies for planting materials, expanding extension services, promoting cooperative farming to pool resources, and implementing land tenure reforms to ensure greater investment in plantain farming.*

**Keywords:** Plantain farming, adoption, farm size, planting material, labour

### INTRODUCTION

Plantain (*Musa paradisiaca*), a key staple crop in tropical and subtropical regions, is essential for food security, economic growth, and poverty reduction in Sub-Saharan Africa. Nigeria is one of the leading producers of plantains in West Africa, producing over 3.1 million metric tons annually (FAO, 2020). The crop serves as a primary source of carbohydrates and income for smallholder farmers, particularly in southern Nigeria, where it is cultivated on small plots of land for home consumption and local markets (IITA, 2014).

Improved Plantain Technologies (IPT) have been developed to address key productivity challenges, including pests, diseases, and low soil fertility. Technologies such as rapid sucker multiplication, hybrid varieties, and proper agrochemical application aim to enhance yields, reduce losses, and improve the profitability of plantain farming (Blomme et al., 2011). In micropropagation, a whole sucker, a large piece of the parent corm or a sword sucker can be used to produce planting materials (Faturoti *et al.*, 2008). The technology can be implemented in two ways and can be done either in the field (in situ) or in the nursery (ex-situ) (Singh *et al.*, 2013). Repression of apical dominance is usually done through complete/partial decapitation or by detached corm method to stimulate lateral bud development and increase the suckering rate.



FIGURE 1. Standard macro-propagation unit (A and C), tunnel structure (B and D) and mulch cover unit (E).

Fig 1: standard macro-propagation unit

Globally, barriers to the adoption of agricultural technologies are well-documented, particularly in low-income regions where farmers face a range of socio-economic and infrastructural constraints. Studies in East Africa, for instance, show that smallholder banana farmers struggle with similar challenges, including limited access to disease-free planting materials and weak extension services (Rai et al., 2020). Addressing these constraints is critical to ensuring sustainable production systems and improving livelihoods.

According to Rogers' Diffusion of Innovations theory, the rate of adoption depends on the perceived relative advantage, compatibility, complexity, trialability, and observability of the innovation (Rogers, 2003). Farmers are more likely to adopt technologies that are easy to implement, affordable, and beneficial. However, structural barriers such as limited access to inputs, inadequate extension services, and socio-economic challenges often hinder adoption in rural settings (Alhassan et al., 2018). Financial constraints are among the most significant barriers to adoption. Studies by Mgbenka and Mbah (2016) reveal that high input costs and lack of access to credit prevent many smallholder farmers in Nigeria from adopting improved practices. Similarly, labour-intensive technologies are often resisted by older farmers, who may lack the physical capacity or resources to hire additional labour (Fischer & Qaim, 2012).

Despite extensive research and development efforts, plantain yields in Nigeria remain below their potential, averaging 4–6 tons per hectare compared to the achievable 20 tons per hectare under optimal conditions (Olumba & Rahji, 2014). Conversely, an unsustainable increase in cultivated or harvested area steadily rose from 162,000 hectares in 1990 to 481,000 hectares in 2009 (Bal, 2016). If the expansion recorded in farm size over the years corresponds progressively with an increase in output, then there would be a huge turnover in productivity and this production turnover can only be achieved by investigating the barriers of these advanced technologies invented to farmers. This study addresses this gap by exploring the barriers to adoption of sustainable Improved Plantain Technologies among farmers in Osun State.

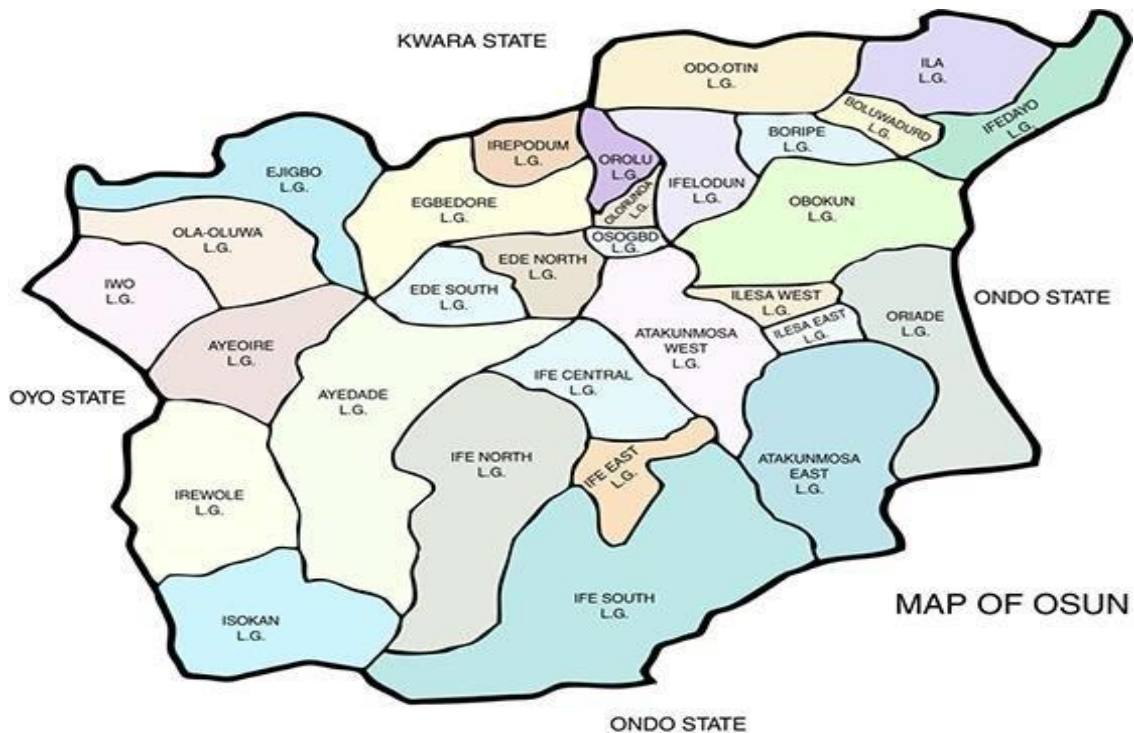
Addressing these constraints requires an in-depth understanding of the specific barriers farmers face and the factors that exacerbate them. This study aims to fill this knowledge gap by identifying and analyzing the constraints to IPT adoption among smallholder farmers in Osun State, Nigeria. The specific objectives of this study are to describe the socio-economic characteristics of the respondents, identify the key constraints affecting the adoption of improved IPT, and assess the severity of these constraints.

This study contributes to the growing body of research on agricultural technology adoption by focusing on a high value, yet underperforming, crop in Nigeria. By identifying the constraints to IPT adoption, the findings offer practical insights for policymakers, agricultural extension agencies, and development organizations. Addressing these barriers aligns with global efforts to achieve the Sustainable Development Goals (SDGs), particularly those related to zero hunger (SDG 2) and poverty alleviation (SDG 1).

## **METHODOLOGY**

The study was conducted in Osun State, Nigeria, a key agricultural region with significant plantain production. Osun State is divided into three agricultural zones: Ife-Ijesa, Osogbo, and Iwo. These zones were selected based on their prominence in plantain farming and the availability of farmers trained in improved Plantain Planting Practices (IPT). The region is characterized by a humid tropical climate, fertile soils, and a diverse cropping system where plantain is intercropped with yam, maize, and cocoyam.

A multi-stage sampling technique was used to select respondents for the study. The study covered the three zones in Osun state: Iwo, Osogbo, and Ife Ijesa zones. In the first stage, a purposive selection of three Local Government Areas (LGAs) from Ife-Ijesa (Oriade, Atakumosa and Ife North) and one LGA from Osogbo (Odo-otin) and Iwo (Iwo) zones were selected due to predominance in plantain production. In the second stage, communities and respondents were selected from the LGAs proportionate to size and they are Erin-Oke (18), Erin-Ijesa (12) and Akola (10) communities in Oriade LGA. Iperindo (15) in Atakumosa and Ipetumodu (10) in Ife North Local Government. In Odo-Otin, 23 respondents were selected in Osogbo and 17 in Iwo LGA. Twenty respondents were selected in Ile ogbo of Iwo zone making 125 respondents that form the sample size for the study.



Source: [www.osunstate.gov.ng/geography.htm](http://www.osunstate.gov.ng/geography.htm) (2011)

A list of nine possible constraints to the use of IPT was presented to the respondents for them to choose as applicable. This was measured on a 3-point Likert-type scale of “severe constraint”, “mild constraint”, and “not a constraint” assigned scores of 2, 1 and 0 respectively. The mean score of each of the constraint items was determined and used to rank the constraints in order of severity.

The dependent variable for the study is the adoption of IPT. Respondents’ adoption of IPT was measured on a 14-item question of utilization. A scale of ‘always utilized’, ‘sometimes utilized’, and ‘not utilized’ with scores of 2, 1 and 0 were assigned respectively to measure the response options. Respondents were categorized into two using a benchmarked mean score. Respondents whose scores fall below the mean were regarded as having a low level of utilization, while those that are equal or above the mean were categorized as having a high level of utilization of improved Plantain Technologies. Data were analyzed using frequencies, percentages, standard deviation and linear regression.

## **RESULTS AND DISCUSSION**

### **Socio-Economic Characteristics of Respondents**

The socioeconomic characteristics of the respondents are described in Table 1. The mean age of respondents (55.4 years) indicates that most farmers are middle-aged to elderly. This finding aligns with the work of Solomon (2020), who highlighted that older farmers often exhibit resistance to labour-intensive technologies due to diminished physical capacity and higher risk aversion. This age distribution underscores the need to design agricultural interventions that account for the physical limitations and risk concerns of older farmers, while also encouraging the involvement of younger individuals in farming.

The educational distribution reveals that 24% of respondents had tertiary education, 33.6% had secondary education, and 36.8% had primary education, suggesting a moderate literacy level among the farmers. This finding supports Orisakwe and Agomuo (2011), who argued that education plays a critical role in facilitating technology adoption, as it enhances farmers' ability to understand, interpret, and implement improved agricultural practices. The relatively high proportion of farmers with primary or secondary education highlights the importance of simplifying technical information and offering targeted extension services to improve knowledge dissemination.

The gender distribution, with 64.8% of respondents being male, reflects the typical gender disparity in agricultural labour, where men predominantly engage in production activities, while women focus on processing and marketing, as noted by Adeleke and Alanni (2020). This finding emphasizes the need for gender-sensitive policies and programs that address the unique roles and constraints faced by women in agricultural systems, ensuring equitable access to resources and opportunities.

Finally, the average monthly income of respondents (₦51,560) highlights the financial limitations of smallholder farmers. This finding is consistent with IITA (2011), which observed that income levels significantly influence farmers' ability to adopt improved practices, as financial viability determines access to inputs, tools, and technologies. To address this challenge, interventions such as subsidized inputs, credit schemes, and income diversification programs should be prioritized to enhance farmers' financial capacity and resilience.

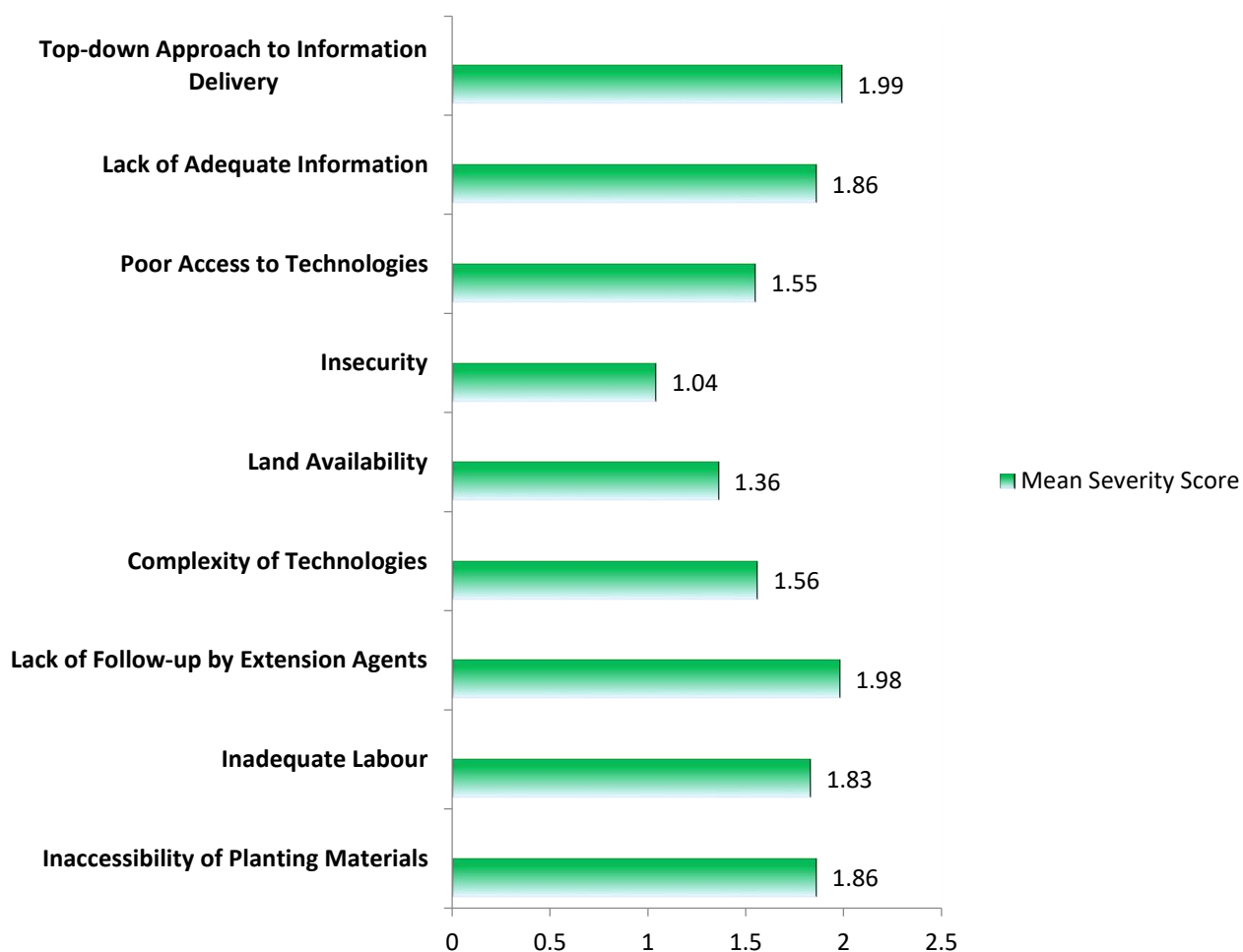
**Table 1: Distribution of respondents according to socioeconomic characteristics (n=125)**

<b>Variables</b>	<b>Frequency</b>	<b>Percentage (%)</b>	<b>Mean</b>	<b>±</b>	<b>SD</b>
<b>Age (in years)</b>			55.40	±	8.28
Less than 41	6.0	4.80			
41-55	56.0	44.8			
56-70	61.0	48.8			
<b>Sex</b>					
Male	81.0	64.8			
Female	44.0	35.2			
<b>Marital status</b>					
Married	115.0	92.0			
Single	10.0	8.00			
<b>Level of education</b>					
No formal education	7.0	5.60			
Primary education	46.0	36.8			
Secondary education	42.0	33.6			
Tertiary education	30.0	24.0			
<b>Occupation</b>					
Artisans	17.0	13.6			
Farming	64.0	51.2			
Others	6.0	4.8			
<b>Source of income</b>					
Personal savings	123.0	98.4			
Loan	2.0	1.60			
<b>Membership of association</b>					
Member	83.0	74.5			
Non-member	42.0	25.5			

**Source: field survey, 2023.**

**Constraints militating against the adoption of improved plantain technologies.**

The study identified several constraints affecting the adoption of improved plantain technologies (IPT), ranked by severity based on their mean scores. These constraints significantly limit the utilization of innovative planting practices and were consistent with findings in related studies across Nigeria and Africa.



*Figure 4: Severity of Constraints to IPT Utilization*

Source: Field survey, 2023.

### **Inaccessibility of Planting Materials**

The most critical constraint identified was the unavailability of affordable, high-quality planting materials ( $\bar{x}=1.86$ ). This aligns with Blomme et al. (2011), who highlighted the propagation of infected suckers as a major factor contributing to declining plantain yields in Africa. Farmers' inability to access disease-free planting materials reduces productivity and discourages IPT adoption. To address this issue, community-based nurseries and subsidies for hybrid suckers have been recommended as effective interventions (Adeleke & Alanni, 2020).

### **Inadequate Labor**

Labour shortages were identified as a severe challenge ( $\bar{x}=1.83$ ), particularly during critical periods such as planting and harvesting. This issue is exacerbated by an ageing farmer population, as noted by Solomon (2020), making it difficult to implement labour-intensive practices like pruning and weeding. Mechanization and cooperative labour-sharing models are viable solutions that can reduce the labour burden on smallholder farmers (Rai et al., 2020).

### **Complexity of Technologies**

Farmers perceived certain technologies, such as rapid sucker multiplication, as complex and challenging to adopt ( $\bar{x}=1.56$ ). According to Rogers' Diffusion of Innovations theory (2003), perceived complexity negatively impacts adoption rates. Simplifying training programs and providing step-by-step implementation guides could help overcome this barrier and encourage wider adoption.

### **Poor Extension Support**

A lack of follow-up visits and technical support from extension agents was also rated as a significant constraint ( $\bar{x}=1.86$ ). Similar findings by Mgbenka and Mbah (2016) emphasized that the low extension worker-to-farmer ratio in Nigeria limits the dissemination of agricultural innovations. Strengthening extension services through recruitment, digital platforms, and demonstration plots could improve knowledge transfer and technology adoption rates.

### **Land Fragmentation**

Although rated as a mild constraint ( $\bar{x}=1.36$ ), land fragmentation resulting from inheritance practices restricts the scalability of plantain farming. Feyisa (2020) observed that policies addressing land consolidation and tenure security are essential for increasing productivity.

### **Insights from Related Studies**

The findings of this study align with existing research across different regions. In East Africa, limited access to planting materials and extension services has similarly been identified as a major barrier to banana and plantain production (Tumuhimbise et al., 2016; Blomme et al., 2011). Studies in Ghana and Kenya emphasized that labour shortages and financial constraints hinder the adoption of labour-intensive agricultural technologies (Fischer & Qaim, 2012; Rai et al., 2020).

### ***Implications for Policy and Practice***

The constraints identified in this study—such as inadequate labour, poor extension support, and inaccessibility of planting materials—underscore the urgent need for targeted interventions. Addressing these challenges through mechanisms such as subsidized inputs, mechanization, strengthened extension systems, and policies promoting land tenure security could significantly improve the adoption of IPT. These efforts would not only enhance plantain production but also increase farmers' incomes and improve food security.

## **CONCLUSION AND RECOMMENDATIONS**

The study highlights the significant constraints limiting the utilization of improved Plantain Planting Practices (IPT) among smallholder plantain farmers in Osun State, Nigeria. Among the barriers identified, poor follow-up by extension agents, inaccessibility of planting materials, and inadequate labour emerged as the most critical. These constraints collectively account for 41% of the variation in IPT adoption, reinforcing their impact on farmers' decisions to adopt improved practices. While land availability was identified as a less severe constraint, it still poses challenges to scaling up plantain production.



The findings emphasize the need for a multifaceted approach that addresses technical, socio-economic, and institutional barriers to promote the sustainable adoption of improved IPT.

The study recommends the following.

1. The government should increase the recruitment and training of extension agents to improve the agent-to-farmer ratio and enhance knowledge dissemination. Digital platforms should also be introduced to deliver remote extension services and ensure ongoing support. Demonstration plots can be established in rural areas to showcase improved farming techniques and encourage adoption.
2. Decentralized nurseries should be developed for producing and distributing disease-free plantain suckers to farmers. Subsidies or low-interest loans should be introduced to make planting materials affordable. Partnerships with research institutions such as IITA and NIHORT must be fostered to ensure timely dissemination of improved planting innovations.
3. Mechanization should be promoted through the introduction of affordable tools and machinery suitable for smallholder farmers. Cooperative farming systems should be encouraged to pool labour resources, particularly during planting and harvesting seasons. Additionally, youth-focused agricultural programs must be developed to attract younger labour into plantain farming, addressing the sector's ageing workforce.
4. Advocacy for land tenure reforms is critical to address land fragmentation and provide access to larger plots for commercial plantain farming. Increased public and private investment in rural infrastructure, such as roads and irrigation, will support agricultural productivity. Strengthening farmer associations will also serve as a platform for resource sharing, capacity building, and advocacy, benefiting smallholder farmers

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