



Factors Influencing Indigenous Pest Management Practices among Smallholder Crops Farmers in Northern Ecological Zone of Taraba State, Nigeria

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ABSTRACT

This study assessed factors influencing indigenous pest management practices among smallholder crop farmers in Northern Ecological Zone, Taraba State, Nigeria. Specifically, the study identified the indigenous pest management practices employed, evaluated the effectiveness of the practices and analyzed the influenced of socio-economic factors. A multistage sampling technique was adopted for the study. Primary data were obtained through the use of structured questionnaires and interviews. A multistage sampling procedure was used to select 120 respondents. Data were analyzed using descriptive statistics and inferential statistics. The major indigenous pest management practices identified included the use of neem (*Azadiracta indica*) extracts, wood ash, crop rotation, intercropping, smoking, local herbs, and handpicking of pests. The study revealed that age ($\beta = -0.052$; $p < 0.05$) and farming experience ($\beta = -2.510$; $p < 0.01$) negatively influenced the utilization of indigenous pest management practices, while marital status ($\beta = 1.543$; $p < 0.01$), educational status ($\beta = 0.493$; $p < 0.01$), and household size ($\beta = 0.056$; $p < 0.05$) positively influenced utilization. The study concluded that indigenous pest management practices remain important for sustainable crop production among smallholder farmers due to their affordability, accessibility, and environmental sustainability. The study recommended improved extension services, documentation of indigenous knowledge systems, and integration of indigenous and modern pest management approaches to enhance sustainable agricultural productivity and food security.

Keywords: Factors Influencing, Indigenous Pest Management, Practices, Smallholder, Crops Farmers

INTRODUCTION

Agriculture has been a cornerstone of Nigeria's economy for centuries, providing livelihoods for a significant portion of its population, especially in rural areas. Nigeria's favorable climate, fertile soil, and diverse natural resources make it conducive to various agricultural activities, including crop production, livestock farming, and fishing. The country's agricultural output includes staples such as cassava, yam, maize, rice, sorghum, millet, cocoa, and oil palm, all grown in different regions (Abubakar *et al.*, 2021; Ibrahim and Suleiman, 2022). Despite

its importance, agricultural activities in this area face several challenges, among which pest infestations stand out as a major concern. Pests can cause severe losses in both crop yields and quality, undermining agricultural productivity and posing a serious threat to food security. Therefore, implementing effective pest management strategies is crucial to maintaining farm output and improving the economic stability of farming households (Yahaya and Mohammed 2022). Pest infestation is a major constraint to agricultural productivity, especially among

smallholder farmers in sub-saharan Africa. In Nigeria, pest such as insects, rodent, fungi, and weeds causes significant yield losses, undermining food security and farmer livelihoods. Pest management practices are often shaped not just by biological factors but also by socio-economic conditions as income, education, access to extension services, and market access (FAO, 2022).

Pest management is defined as a critical component of sustainable agriculture, aimed at maintaining pest populations whether insects, weeds, fungi, or other organisms at levels that do not threaten the economic viability of crop production. Rather than relying solely on chemical pesticides, modern pest management promotes a combination of practices that are both environmentally sound and socially acceptable. These include biological control (using natural predators or parasites), cultural practices (such as crop rotation or intercropping), mechanical methods (like traps and barriers), and the judicious use of pesticides only when necessary (FAO, 2021). The goal is not to eliminate all pests, but to manage them in a way that minimizes harm to people, animals, beneficial organisms, and the environment, while ensuring stable food production and economic returns for farmers (FAO, 2021). Pest management is the practice of controlling or eliminating harmful organisms (pests) that can damage crops, structures, human health, and the environment. The goal is to manage pest populations in a way that minimizes negative impacts on ecosystems, human health, and economic resources (David 2021). Pest management involves a variety of techniques designed to control pest populations and minimize their impact on crops. Among small-scale farmers in Nigeria, the methods used for pest control differ widely, often influenced by socio-economic factors such as household income, access to modern technologies, educational levels, and the availability of agricultural resources (Obeten *et al.*, 2022). These factors greatly affect farmers' capacities to adopt and apply effective pest management practices. Research shows that a farmer's financial

standing significantly shapes the agricultural methods they use, including pest control (Abubakar *et al.*, 2021; Ibrahim and Suleiman, 2022). Farmers with limited income may be unable to afford modern pest control technologies, forcing them to rely on traditional methods, which are frequently less effective. This economic limitation highlights the importance of policy interventions aimed at supporting smallholder farmers through the provision of affordable and accessible pest management solutions (Abubakar *et al.*, 2021; Ibrahim and Suleiman, 2022). Pest management practices in Nigeria involve information about education and socio-economic factor that influences pest management in Nigeria. The knowledge that farmers possess about pest control techniques plays a significant role in how they manage pest-related issues.

In Northern Taraba State, where agriculture is the primary livelihood, smallholder farmers depend largely on subsistence and low-input farming systems. Pest outbreaks have contributed to considerable crop losses, especially in staple crops such as yam, maize, millet, and rice. Ever, the effectiveness and adoption of pest control strategies appear to vary widely across munities due to differences in farmers' socio-economic characteristics (Gbegbelegbe *et al.*, 2018). Understanding how socio-economic factors influence pest management practices is essential for designing effective agricultural policies and support systems tailored to farmers realities (Madaki *et al.*, 2024).

In many rural areas, cultural practices and traditional beliefs often shape how farming activities are carried out, including pest control. While traditional methods, such as the use of local herbs and rituals, have been passed down through generations, their effectiveness may not be supported by scientific evidence (Musa *et al.*, 2021). However, these traditional practices are deeply rooted in the cultural fabric of the communities and can be resistant to change. For effective pest management strategies to be adopted, it is essential to balance traditional beliefs with modern agricultural practices in a

way that respects local customs while improving pest control outcomes.

Agriculture in many rural areas is not only an economic activity but also a cultural tradition, with farming practices passed down through generations. This cultural attachment fosters a strong connection to the land and an understanding of the natural environment (Madaki *et al.*, 2024). However, as Nigeria's population grows and urbanization accelerates, pressure on rural areas intensifies. Many people migrate to urban centers in search of better opportunities, leading to a depletion of the rural workforce that traditionally supported the agricultural sector (World Bank 2021). This migration, coupled with the adverse impacts of climate change and environmental degradation, poses a significant threat to the sustainability of smallholder farming and the agricultural sector as a whole. Despite agriculture's importance, the sector faced years of neglect, particularly during the oil boom when focus shifted to petroleum extraction. This neglect led to a decline in productivity, with many farmers lacking adequate support systems and rural infrastructure remaining underdeveloped (Parsa *et al.*, 2014). Smallholder farmers are central to these efforts, as they are the primary food producers in the country. Ensuring their growth and sustainability is essential to achieving goals of poverty reduction, job creation, and rural development. Efforts to improve the sector must focus on addressing challenges faced by smallholder farmers, such as access to credit, markets, and agricultural inputs. The importance of pest control as a logical attempt to protect crops both in field and in store is well recognized. It is driven by the need to guarantee the availability of food, a key pillar of food security, and the desire to preserve investments. Insect pest control is all the more expedient since about 70% of the farming communities are smallholders (Ofuya *et al.*, 2023). Effective pest control is essential for enhancing agricultural productivity and ensuring food security. However, many farmers continue to face significant challenges in managing pests efficiently due to various socio-economic factors (Parsa *et*

al., 2014). Despite various efforts by government and non-governmental organizations to improve pest management through extension services, training, and supply of agrochemicals, pests continue to threaten agricultural productivity in Northern Taraba State. Several farmers still rely on traditional or ineffective methods, resulting in frequent crop losses and income instability. Balancing effective pest management with sustainable farm productivity and the economic well-being of farmers requires a strategic approach that brings multiple pest control methods. The methods are diverse with farmers embracing perceived proven and effective methods that span indigenous, conventional and alternative (Owojaiye *et.al.* 2024). The study seeks to bridge this knowledge gap by systematically assessing the socio-economic factors that influences the Indigenous pest management among smallholder farmers in Northern Taraba State, Nigeria.

The broad objective of this study is to assess the socio-economic factors influencing indigenous pest management practices among smallholder farmers in Northern Taraba, while the specific objectives are to:

- i. identify and document the prominent indigenous pest management practices employed by the smallholder crops farmers in the study area?
- ii. evaluate the effectiveness of the prominent indigenous pest management practices deployed by the smallholder farmers in the study area?
- iii. analyze the influenced of socioeconomic factors on pest management practices deployed by the smallholder farmers in the study area?

METHODOLOGY

The Study Area

The research was conducted in the Northern Ecological Zone of Taraba State. Taraba State is made up of sixteen local government areas (LGAs) and two Special Development Areas (SDAs). The Taraba State Agricultural Development Program (TADP) is divided into four agricultural zones: Zone I, Zone II, Zone

III, and Zone IV (TADP, 2016). Zone I include Ardo-kola, Jalingo, Lau, Karim-Lamido, Yorro, and Zing, with its headquarters in Zing. Zone II consists of Wukari, Ibi, Gassol, and part of Bali (Garba-Chede/Dakka), with Wukari as its headquarters. Zone III encompasses Takum, Donga, Ussa, Kurmi, part of Bali (Bali/Suntai), and the Yangtu and Ngada SDAs, with Takum as the headquarters. Zone IV includes only Sardauna LGA due to its challenging terrain, with headquarters in Gembu (Orunye, et.al, 2021).

The State has a land mass covering of 59,400 km². It is situated between Latitudes 6°30' and 8°30' North of the equator and Longitudes 9°00' and 12°00' East of the Greenwich Meridian, with a population of approximately 2,294,800 according to the 2006 census (National Population Commission, NPC). By 2024, the State's estimated population, with an annual growth rate of 3.5%, was 4.272,400 persons. The State shares borders with Adamawa State to the north, Nassarawa and Plateau States to the northwest, Benue State to the southwest, and the Republic of Cameroon to the southeast. Taraba has a tropical climate with distinct wet and dry seasons, with the dry season lasting four months (December to March) and the wet season from early March to late November in the south. The mean annual rainfall is around 1800 mm. The principal ethnic groups in Taraba State include the Kuteb, Wapan, Mumuye, Jukun Kona, Ichen Kaka, Mambila, Kambu, Yandang, Karinjo, Fulani, Bandawa, Ndola, Chamba, Wurkum, Munga, and Jenjo. The majority of the population engages in subsistence farming, cultivating crops such as yam, maize, sorghum, rice, beans, soybeans, cassava, and groundnuts (Orunye, et al 2021). Agricultural activities in this area include fishing and the cultivation of maize, rice, guinea corn, beans, and melon. The major occupations in Jalingo LGA include agriculture, trade, and civil service. Agriculture is the primary livelihood, with staple crops such as yams, cassava, millet, and sorghum.

Sampling Design and Data Collection

Multi-stage sampling technique was adopted to determine respondents for the study. Three (3) blocks were purposively selected from the Zone because of their prominence in small-scale farming system. Similarly, four (4) circles were further selected from each block through simple random sampling technique to give a total of Twelve (12) circles. Hence, from the list of registered smallholder crops farmers in the selected circles, a total of 120 respondents were randomly selected and questionnaire will be administered. The data for this study were mainly primaries; sourced with the aid of structured questionnaires and key informant interviews. The five-point Likert rating scale of strongly agree (SA =5), agree (A=4), neutral (N=3), disagree (D=2) and strongly disagree (SD=1) was employed to categorized information elicited from respondents.

Data Analysis

Descriptive statistics such as frequency, mean and percentage was utilized to address Objectives I and II. While inferential statistic in form of binary logistic regression model was used to address objective III. The functional form of a logit model is specified as follows:

The implicit form of the Logit model is specified as:

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7) \quad 1$$

The Logit model in its explicit form is expressed as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + e \quad 2$$

Where; Y = Indigenous practices

X₁ = Age (years);

X₂ = Sex (male = 1, female = 0)

X₃ = Educational level (formal and informal education)

X₄ = Farming experience (years)

X₅ = Income (in Naira)

X₆ = Extension Contact (Numbers of visit)

X₇ = Farm size (in hectare)

X₈ = Membership of organization

X₉ = Household size (number of persons)

X₁₀ = Access to credit

β_0 = constant: $\beta_1 - \beta_{10}$ = coefficients of the independent variables: e = error term

RESULTS AND DISCUSSION

Indigenous Pest Management Practices Employed by Farmers

The findings indicate that a substantial proportion of farmers (71.7%) utilize synthetic chemical pesticides, making it the most widely adopted pest control method. This dominance suggests a strong reliance on modern agricultural inputs, likely due to their perceived effectiveness and rapid action in controlling pests. This observation is consistent with findings that chemical pesticides remain widely used among smallholder farmers despite increasing awareness of sustainable alternatives (Faborode and Alao, 2022). The study also found that indigenous or traditional pest control methods are still widely practiced, with 56.7% of farmers reporting their use. This indicates that indigenous knowledge systems remain relevant and are integrated into farmers' pest management strategies. Similarly, 60.0% of respondents reported the use of improved pest-resistant seed varieties, implying a complementary approach that combines both traditional and modern practices. Studies have shown that indigenous pest management practices, such as the use of plant-based materials, intercropping, and cultural techniques, continue to play a significant role in sustainable agriculture due to their accessibility and environmental friendliness (Melash *et al.*, 2023).

A relatively high proportion of farmers (60.8%) reported "doing nothing" as a pest management strategy. This act may reflect constraints such as lack of access to inputs, limited knowledge, or perceived low severity of pest infestation. It may also indicate risk tolerance or resource limitations among farmers, which influence their decision-making. Similar patterns have been observed in developing agricultural systems where resource-poor farmers adopt passive strategies due to financial and institutional constraints (Akanmu *et al.*, 2023). A vast majority of respondents (82.5%) reported acquiring pest management knowledge from parents and elders within the family. This revealed the intergenerational transfer of indigenous knowledge, which remains a cornerstone of rural agricultural systems. Indigenous knowledge is often deeply embedded in local culture and is transmitted through observation, practice, and oral communication across generations (Olaniyan and Govender, 2023).

Equally, only a small percentage of farmers obtained knowledge from neighbors or other farmers (10.0%), extension agents (4.2%), and personal experimentation (3.3%). The low contribution of extension agents indicates a gap in formal agricultural advisory services in disseminating indigenous or integrated pest management practices. This aligns with existing literature which indicates that extension systems in many developing regions often have limited reach and effectiveness in promoting locally adapted practices (Davis and Sulaiman, 2022).

Table 1: Indigenous Pest Management Practices Identified by Crops Farmers

Pest Management Practices	Freq.	Percentage (%)
Synthetic Chemical Pesticides	86	71.7
Indigenous/Traditional methods	68	56.7
Improved seed varieties (resistant)	72	60.0
Do nothing	73	60.8
Knowledge		
Parents/ Elders in the family	99	82.5
Neighbors/ Other farmers	12	10.0
Personal experimentation	4	3.3
Extension agent (taught traditional method)	5	4.2

Source: Field Survey (2026)

Crop Farmers Responses on the Effectiveness of IPM Practices

The result in Table 2 revealed a mixed perception among respondents. Specifically, 30.8% of the farmers reported that indigenous pest control methods are not effective, while 26.7% remained neutral. In contrast, another 26.7% perceived the methods as effective, and 15.8% considered them highly effective. This indicates that although a substantial proportion of farmers still question the effectiveness of indigenous pest management practices, a considerable number (42.5% combining “effective” and “highly effective”) acknowledge their usefulness in crop protection. The relatively high neutral response further suggests uncertainty or inconsistent performance outcomes of IPM practices across different farming conditions. This aligns with earlier observations that farmers’ perceptions of traditional pest control methods are often influenced by variability in effectiveness, availability of alternatives, and access to extension information (Kogan, 1998; Pretty & Bharucha, 2015). In terms of comparative effectiveness, 26.7% of respondents indicated

that indigenous pest control methods perform about the same as other methods, 26.7% perceived them as slightly higher in effectiveness. While 15.8% believed they are much higher in effectiveness, suggesting a strong positive perception among a subset of farmers. On the other hand, 23.3% and 7.5% reported that indigenous methods are slightly lower and much lower respectively when compared to other pest control options.

The implication of these findings is that indigenous pest management practices remain relevant within the farming systems of the respondents, particularly where access to modern agrochemicals or extension services may be limited. However, the presence of a significant proportion of farmers who view these methods as ineffective highlights the need for improved integration of indigenous knowledge with scientific pest management approaches. Integrated Pest Management (IPM) frameworks emphasize the combination of local ecological knowledge with modern pest control technologies to enhance sustainability, reduce environmental risks, and improve yield stability (Dhawan, 2009; FAO, 2021).

Table 2: Crop Farmers Responses on the Effectiveness of IPM Practices

Effectiveness	Frequency	Percentage (%)
Overall Effectiveness of your Indigenous Pest Control Methods		
Not effective	37	30.8
Neutral	32	26.7
Effective	32	26.7
Highly effective	19	15.8
Compared		
Much lower	9	7.5
Slightly lower	28	23.3
About the same	32	26.7
Slightly higher	32	26.7
Much higher	19	15.8

Source: Field Survey (2026)

Socio-Economic Factors influence on Indigenous Pest Management Practices

The results of analysis in Table 3 revealed that Age was found to have a negative coefficient (-0.052) but statistically significant at the 5% level, indicating that an increase in farmers’ age is associated with a decrease in his adoption of Indigenous Pest Management Practices. This suggests that older farmers may be less inclined toward adopting

innovations or engaging in practices that enhance performance, possibly due to risk aversion or lower adaptability to new technologies. This finding is consistent with recent studies which indicate that younger farmers tend to be more receptive to innovation and technological change (Ogundari and Bolarinwa, 2023).

The study revealed that Marital status has a coefficient of 1.543 exhibits a positive and

highly significant relationship at the 1% level, implying that married farmers are more likely to perform better or utilize available opportunities compared to their unmarried counterparts. This result aligns with the findings of Adeyemo *et al.* (2022), who reported that marital stability enhances commitment to agricultural production and decision-making efficiency.

Furthermore, Educational status ($\beta = 0.493$, $p = 0.0037$) is also positive and statistically significant at the 1% level, indicating that higher levels of education increase the likelihood of farmers' adoption of IPM or utilization. Education enhances farmers' ability to access, process, and apply relevant information effectively. This corroborates the findings of Sennuga *et al.* (2023), who emphasized that education significantly improves farmers' capacity to adopt innovations and utilize modern agricultural technologies. The study found out that, Farmers' years of experience has a negative coefficient ($\beta = -2.510$) but highly significant (0.0006) at the 1% level. This counterintuitive result suggests that more experienced farmers may be less likely to engage in IPM practices. This could be due to entrenched traditional

practices and resistance to change among more experienced farmers. Similar findings have been reported by AbdulKareem and Oladimeji (2024), who observed that long years of farming experience may sometimes hinder innovation adoption due to habitual practices.

The result presented in Table 3 shows that, Household size bears a positive coefficient of 0.056 and significant at 5% level, implying that larger households may contribute positively to the farmers' engagement in IPM practices, possibly through the availability of family labour and shared responsibilities. This finding is in line with the study by Issa *et al.* (2022), which highlighted that household labour availability can enhance farm productivity and decision-making. Ultimately, the study indicated that Sources of credit was found to be statistically significant at 1% level though with a negative coefficient, indicating that access to credit, in this context, may adversely affected farmer utilization of IPM practices. This finding supports the observations of World Bank (2023), which noted that poorly structured rural credit systems can negatively impact smallholder farmers' performance.

Table 3: Socio-Economic Factors Influenced on Indigenous Pest Management Practices

Variable	Coefficient	Std. Error	z-Statistic	Prob.
Age	-0.052	0.024	-2.143	0.0321**
Marital Status	1.543	0.450	3.431	0.0006*
Educational Status	0.493	0.169	2.906	0.0037*
Farm size (hectre)	0.151	0.193	0.782	0.4337
Years of farming experience	-2.510	0.725	-3.447	0.0006*
Household Size	0.056	0.0278	2.004	0.0450**
Access to extension services	0.295	0.550	0.537	0.5911
Membership of cooperative	-0.012	0.020	-0.610	0.5415
Sources of credit	-0.732	0.184	-3.974	0.0001*
R-squared	0.67			

Source: Field Survey Data, (2026)

Key: Level of Significance, * = 1% ** = 5%.

CONCLUSION

The study assessed factors influencing utilization of Indigenous Pest Management (IPM) Practices among Smallholder Farmers in Northern Ecological Zone of Taraba State, which are traditional, environmentally friendly, and culturally embedded methods used by farmers. Specifically, the study concludes that indigenous pest management

practices remain relevant among smallholder farmers but are limited by socio-economic and institutional constraints. Enhancing farmers' access to extension services, training, credit facilities, and improved inputs is essential to promote effective and sustainable pest management. Integrating indigenous knowledge with modern techniques offers a viable pathway for

improving agricultural productivity and food security in the study area.

RECOMMENDATIONS

Based on the major findings, the study recommends that:

There is a need to encourage the integration of indigenous practices with modern pest control methods. Combining traditional knowledge with scientific innovations will enhance effectiveness, reduce reliance on harmful chemicals, and promote sustainable agriculture. Government and research institutions should document indigenous pest management knowledge to prevent its extinction. This knowledge should be preserved, improved, and incorporated into formal agricultural extension programs. Policies should be formulated to support sustainable pest management practices, including subsidies for eco-friendly pest control inputs and support for extension services. Institutional collaboration between government, NGOs, and research bodies should also be strengthened.

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