



## Indigenous knowledge in rice pest and disease management: Drivers of farmer utilization in Ogun State, Nigeria

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### Abstract

This study investigated the factors affecting the utilization of Indigenous Knowledge (IK) techniques in controlling rice pests and diseases in Ogun State, Nigeria. Specifically, it identified the types of indigenous knowledge techniques used by the farmers, factors affecting the utilization of these techniques, benefits of utilizing these techniques, and the challenges faced by these farmers in utilizing these techniques. Data was collected from 120 randomly selected respondents from 2 communities in Ifo and Ewekoro Local Government Areas of Ogun State with the aid of a well-structured questionnaire. The data were analyzed using descriptive statistics such as frequency, percentage, and mean scores, while regression analysis was used to determine the relationship between the socio-economic characteristics and the utilization of indigenous knowledge techniques. Findings revealed that manual weeding (93.3%) and planting traditional varieties of rice (88.3%) are the most used indigenous knowledge techniques. The findings also showed that farmers perceived several benefits in adopting IK practices. The most significant advantages were the promotion of diverse, locally adapted crop varieties, ease of adoption, environmental sustainability compared to chemicals, and enhancement of farmer self-sufficiency. Other perceived benefits included cultural preservation, biodiversity conservation, and reduction in chemical pesticide use. Despite these benefits, rice farmers also faced multiple challenges. The most prominent was limited resources for pest and disease management, followed by the relatively slower action of IK compared to chemical pesticides, high cost of alternative methods, and difficulty in sourcing traditional control materials. Additional constraints included doubts about effectiveness, lack of training and documentation, and challenges in balancing IK with modern practices. The study concludes that IK remains a valuable, sustainable, and culturally relevant approach to rice pest management but requires institutional support, validation, and integration with modern pest control methods to enhance its wider adoption.

**Keywords:** Indigenous knowledge, Nigeria, Ogun state, Pest and disease management, Rice farmers.

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### **Contribution of this paper to the literature**

This study provides empirical evidence on how farmer cooperation and cultural beliefs shape the utilization of indigenous pest management practices, while revealing the influence of socio-economic factors and key constraints limiting adoption and integration with extension services among rice farmers in Ogun State, Nigeria.

## **1. Introduction**

### *1.1. Background of the Study*

Rice is a relevant staple food for specific populations in Sub-Saharan Africa, especially in West Africa. Since 1973, the regional demand for rice has been increasing at an annual rate of 6%, fueled by population growth and a shift in preference from traditional coarse grains [1]. The utilization of indigenous knowledge in pest and disease management of rice crops is crucial for sustainable agriculture. This indigenous knowledge is passed down orally from generation to generation and is deeply rooted in cultural practices and beliefs [2]. Indigenous knowledge plays a crucial role in sustainable farming practices. It encompasses traditional methods of crop cultivation, pest and disease management, soil fertility enhancement, and water conservation techniques that have been refined over time to suit local environmental conditions and resources [3]. Farmers use indigenous techniques such as natural pesticides, plant extracts, and crop diversification to control pests and diseases sustainably [4]. Using indigenous knowledge techniques to control rice pests and diseases represents a critical intersection between traditional agricultural practices and modern pest management strategies [5]. This knowledge, rooted in centuries of observation and adaptation, offers sustainable, environmentally friendly, and cost-effective solutions for rice cultivation [6]. However, the adoption and effectiveness of these indigenous techniques are influenced by a myriad of factors. These include socio-economic conditions, cultural beliefs, access to resources, educational levels, and the degree of integration with contemporary agricultural practices [7]. Understanding these factors is essential for enhancing the implementation and efficacy of indigenous pest control methods, ultimately contributing to sustainable agricultural development and food security [8].

### *1.2. Problem Statement*

Rice cultivation is a cornerstone of global food security, sustaining millions of livelihoods and serving as a dietary staple for a significant portion of the world's population. However, the persistent threat of pests and diseases poses a formidable challenge to rice production, demanding innovative approaches for mitigation [9]. Amidst modern advancements in agricultural science and technology, indigenous knowledge techniques emerge as a valuable reservoir of wisdom, offering holistic and sustainable solutions deeply rooted in local traditions and practices. Investment in agricultural research to develop high-yielding and disease-resistant rice varieties is crucial. Indigenous knowledge plays a vital role in managing rice pests and diseases in the region. Some key factors influencing the utilization of these techniques include the values placed on indigenous knowledge, the methods employed by farmers, and the effectiveness of these practices in maintaining productivity and ensuring better output for the local population. This research identifies the various factors that affect the utilization of indigenous knowledge techniques in controlling rice pests and diseases, aiming to highlight the challenges and inherent benefits of integrating traditional wisdom with modern agricultural practices.

### *1.3. Objectives of the Study*

The general objective of the study is to identify factors affecting the utilization of indigenous knowledge techniques for controlling rice pests and diseases in Ogun State, Nigeria.

The specific objectives of the study are to:

1. Ascertain the socio-economic characteristics of rice farmers in the study area.
2. Identify the indigenous techniques used to control rice pests and diseases in the study area.
3. Identify the factors affecting the utilization of indigenous knowledge techniques to control pests and diseases in the study area.
4. Examine the perceived benefits of utilizing indigenous knowledge techniques to control rice pests and diseases in the study area.
5. Identify the challenges faced by rice farmers in utilizing indigenous knowledge techniques to control pests and diseases.

### *1.4. Hypothesis of the Study*

*H<sub>0</sub>. There is no significant relationship between the socio-economic characteristics of the respondents and the factors affecting the utilization of indigenous knowledge techniques to control pests and diseases in the study area.*

## **2. Research Background**

### *2.1. Rice Production in Nigeria*

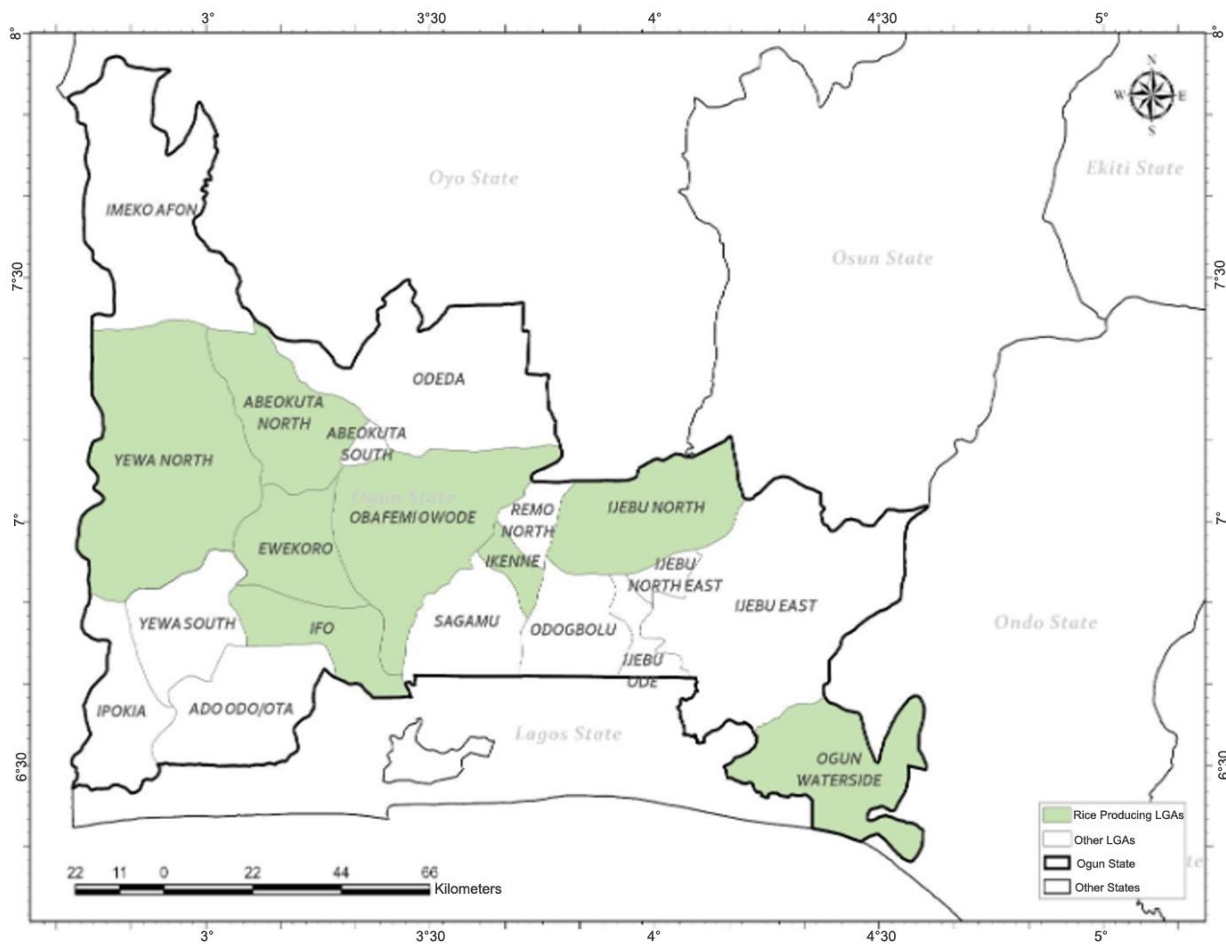
Nigeria is the largest producer of rice in Africa, producing about 8,435,000 tonnes annually, with significant growth in production over the past few years. The country's rice production has increased from 2 million metric tonnes in 2015 to 9 million metric tonnes in 2021, showcasing a substantial growth trend [10]. Despite being a major rice producer, Nigeria is also one of the highest importers of milled rice globally, importing about 2 million metric tonnes annually [11]. Historically, rice has been grown in Nigeria for centuries, primarily as a subsistence crop. Various initiatives have been structured in Nigeria to boost rice production through the provision of inputs, extension services, and infrastructure development [12].

Rice is one of the most consumed staple foods in Nigeria, with a per capita consumption of 32kg, slightly lower than the global average of 53.9kg per capita. Locally produced rice accounts for approximately 57% of rice consumption in Nigeria, while the remaining 43% is met through smuggled or illegally imported rice [13]. Ogun State is one of the major rice-producing states in Nigeria, with significant potential for further growth in rice

production. Ogun State's current rice output is estimated to be between 15,000 and 20,000 tons per annum [14]. The area under rice cultivation is about 12,000 hectares, accounting for 0.7% of the national area cultivated for rice. Rice has been identified as one of the six major cash crops in which Ogun State has a comparative advantage [15]. The method of rice cultivation and harvesting mostly relies on labor-intensive approaches at the subsistence level, with low mechanization. Some rice farmers form clusters to create self-assistance and boost their production levels [16]. There are some pests that pose significant threats to rice production, leading to yield losses and reduced crop quality if not effectively managed. The major pests include Rice Stem Borer (*Scirpophaga incertulas*), Green Leaf Hopper, Rice Leaf Folder (*Caphalocrocis medinalis*), Rice Gundi Bug / Earhead Bug (*Leptocorisa acuta*), etc. Managing these pests effectively requires an integrated approach that combines cultural, biological, and chemical control methods. Rice crops are susceptible to a variety of diseases that can significantly affect yield and quality. These diseases can impact rice yields and quality if not properly managed through resistant varieties, cultural practices, and judicious use of chemicals where necessary [17]. Effective disease management is crucial for maintaining healthy rice crops. Some common diseases that affect rice crops include rice blast (*Magnaporthe grisea*), brown spot (*Cochliobolus miyabeanus*), sheath blight (*Rhizoctonia solani*), sheath rot (*Sarocladium oryzae*), false smut (*Ustilaginoidea avirens*), bacterial blight (*Xanthomonas oryzae*), bacterial leaf streak (*Xanthomonas oryzicola*), rice tungro disease, rice yellow mottle virus (RYMV), etc. Indigenous methods of controlling rice pests and diseases are deeply rooted in traditional agricultural practices and local knowledge passed down through generations. These methods often emphasize sustainability, environmental harmony, and the use of locally available resources [18]. Farmers practice crop rotation, rotating rice with non-rice crops helps break the pest.

### 3. Methodology

This study was carried out in Ifo and Ewekoro Local Government Areas of Ogun State, Nigeria. Multistage random sampling procedure was used in the selection of the respondents. The first stage involved a random selection of two (2) Local Government Areas (Ifo and Ewekoro LGAs) out of the twenty (20) LGAs in the state. The second stage involved a random selection of three (3) communities from each LGA, making a total of six (6) communities. The third stage involved the random selection of twenty (20) rice farmers per community. Hence, a total of 120 respondents constituted the sample size for the study.



**Figure 1.** The map shows rice-producing local government areas in Ogun state.

Source: Research Gate [19].

Figure 1 illustrates the map of Ogun State, Nigeria, highlighting the selected rice-producing Local Government Areas (Ifo and Ewekoro) where the study was conducted.

### 4. Result and Discussion

#### 4.1. Socio-Economic Characteristics of Respondents

Table 1 reveals that 50.0% of respondents were within the age group of 41-60 years, 46.74% were within 61-80, and 3.3% were within 30-40 years. The mean age of respondents in the study area was 59. This indicates that farmers in the study area are middle-aged, aligning with previous research suggesting that individuals in these age brackets who are economically active are typically engaged in agricultural activities and possess extensive experience [20]. Table 1 shows that most respondents (59.2%) were male, married (69.0%), and had some form of education (66.6%). This suggests that over one-third of respondents lack formal education. Studies in Ogun State

indicate that farmers with limited formal education retain significant indigenous knowledge but need participatory and visual extension methods, such as Farmer Field Schools, to improve adoption of pest-control techniques [21, 22]. Table 1 also showed that the majority (75.8%) of respondents have a household size of 6-10 members, with most (71.7%) cultivating relatively small farm sizes of 4-6 hectares. This study aligns with similar evidence from studies on Ofada rice farmers in Ogun State, which highlighted that household labor availability and farm size strongly influence the preference for indigenous over chemical pest-control options [23]. Table 1 revealed that many (59.2%) of the respondents reported less than 20 years of farming. Such experience allows farmers to observe pest cycles and adapt strategies over time, making them key reservoirs of traditional pest-management practices. However, the table also revealed that extension contact is infrequent, with the majority (64.2%) of respondents interacting with extension agents only once every six months. Finally, the method of rice cultivation shown in Table 1 indicates that most (70%) of the respondents are subsistence farmers, while 30% operate commercially. Subsistence farmers are generally more inclined to use low-cost, indigenous practices to safeguard household food security, whereas commercial farmers tend to adopt chemical pesticides to protect yields and meet market standards. Similar patterns have been observed in studies across Nigeria, where subsistence farmers maintained traditional pest-control strategies, while commercial farmers were more likely to combine them with chemical applications [21].

**Table 1. Socio-economic characteristics of respondents.**

Variables	Category	Frequency	Percentage (%)	Mean
Gender	Female	49	40.8	-
	Male	71	59.2	
Age (years)	30-40	4	3.3	59.2
	41-60	60	50.0	
	61-80	56	46.7	
Educational Level	No Formal Education	40	33.3	-
	Primary Education	31	25.8	
	Secondary Education	24	20.0	
	NCE/OND	19	15.8	
	HND/BSc	6	5.0	
Household Size	<5	23	19.2	6.87
	6-10	91	75.8	
	11-15	6	5.0	
Marital Status	Single	16	13.3	-
	Married	72	60.0	
	Divorced	16	13.3	
	Widowed	10	8.3	
	Separated	6	5.0	
Religion	Christian	53	44.2	-
	Islam	51	42.5	
	Traditional	8	6.7	
	Others	8	6.7	4.68
Farm Size (hectares)	4-6	86	71.7	
	7-9	20	16.7	
	10-12	14	11.7	
Farming Experience (years)	<20	71	59.2	24.12
	21-40	23	19.2	
	41-69	26	21.7	
Extension Contact	Once a month	19	15.8	-
	Once in 3 months	8	6.7	
	Once in 6 months	77	64.2	
	Once a year	16	13.3	
Method of Rice Cultivation	Commercial	36	30.0	-
	Subsistence	84	70.0	

Source: Field Survey, 2024.

### 5. Indigenous Techniques Used to Control Rice Pests and Diseases

The result in Table 2 shows the indigenous methods utilized by rice farmers to control rice pests and diseases. The most widely practiced method is manual weeding using cultural approaches, reported by 93.3% of respondents. This finding reflects the critical role of timely weeding in suppressing pest infestations, reducing host plants that harbor insects, and maintaining overall crop health. Similar results were reported by Abdulsalam-Saghir and Banmeke [21], who found that farmers in Ogun State consistently rank cultural weed management as one of the most effective and affordable practices. Another major technique is the planting of traditional rice varieties, adopted by 88.3% of farmers. The continued use of indigenous varieties reflects their resilience, as these local seeds are often more resistant to common pests and diseases than newer improved lines. Millinga et al. [24] also observed in Tanzania that farmers retain indigenous crop varieties because of their adaptability to local ecological conditions and ability to withstand pest pressures. This suggests that traditional seed systems remain vital for enhancing resilience and maintaining genetic diversity within rice farming. Other widely applied practices include crop rotation (81.7%), handpicking pests (80%), and intercropping (80%). These practices help to disrupt pest life cycles, reduce the chances of outbreaks, and promote ecological balance on farms. Their popularity among farmers indicates that, despite being labor-intensive, they are cost-effective alternatives to expensive chemical inputs. This finding is similar to Kitheka [25], who reported that smallholder farmers in Kenya integrate intercropping, crop rotation, and handpicking into their pest management strategies because they are practical and sustainable. Moderately adopted measures such as flooding rice fields (75%) and the use of natural predators (75%) highlight

farmers’ awareness of ecological approaches. Flooding helps suppress pests such as stem borers while encouraging natural enemies, which supports biological control. Likewise, botanical applications using materials like neem and chili pepper (73.3%) demonstrate farmers’ reliance on locally available biocontrol agents as substitutes for synthetic chemicals. These practices reflect the increasing global interest in eco-friendly integrated pest management [26].

**Table 2.** indigenous techniques used to control rice pests and diseases.

Indigenous techniques	Yes (%)	No (%)	Mean
Setting traps for pests	86(71.7)	34(28.3)	1.28
Applying natural biocontrol agents, e.g., neem, chili pepper	88(73.3)	32(26.7)	1.26
Use of natural predators on their farm	90(75)	30(25)	1.25
Periodic flooding of rice fields	90(75)	30(25)	1.25
Inter cropping	96(80)	24(20)	1.20
Handpicking pests	96(80)	24(20)	1.20
Crop rotation	98(81.7)	22(18.3)	1.18
Planting traditional crop varieties	106(88.3)	14(11.7)	1.12
Weeding using cultural methods	112(93.3)	8(6.7)	1.07

Source: Field Survey, 2024.

## 6. Factors Affecting the Utilization of Indigenous Knowledge (IK) Techniques to Control Pests and Diseases

The result in Table 3 shows the factors that affect the utilization of indigenous knowledge (IK) among farmers to control pests and diseases. The results in Table 3 indicate that the level of cooperation among farmers is the most significant factor influencing the use of indigenous knowledge (IK) techniques in rice pest and disease management in Ogun State. More than half of the respondents (56.7%) agreed that cooperation is critical ( $\bar{x}= 3.22$ ). This highlights that knowledge-sharing platforms and communal practices remain central to IK utilization. Similar studies in southwestern Nigeria emphasize that social capital, trust, and collective action enhance the adoption of indigenous farming methods [27, 28]. Cultural beliefs were ranked second, with 42.5% of farmers agreeing that beliefs shaped their IK use ( $\bar{x}= 3.09$ ). This shows that while traditions encourage the preservation of certain pest control practices, they can also act as barriers to innovation. Olatokun and Ayanbode [29] similarly note that cultural worldviews strongly determine the preservation and transfer of IK among Yoruba farmers, but may also hinder external interventions that conflict with local norms. Sixty percent of the respondents agreed that the complexity of integrating modern practices was a challenge ( $\bar{x}= 3.03$ ). This suggests that while farmers recognize the potential of combining modern and indigenous practices, practical barriers such as access to inputs, compatibility issues, and lack of training limit integration. This finding aligns with Obalum et al. [30], who argue that integration of indigenous and modern pest management requires extensive extension support and participatory approaches. For the effectiveness of the method, 41.7% of the respondents agreed that IK techniques are effective ( $\bar{x}= 2.98$ ). This perception reflects farmers’ doubts about the consistency and reliability of IK methods. Similarly, concerns about environmental impacts (51.7%) ( $\bar{x}= 2.97$ ) and health concerns (70.8%) ( $\bar{x}= 2.93$ ) reveal that farmers acknowledge the safety advantages of IK compared to synthetic pesticides. Oyekale [31] and Yusuf et al. [32] found that health and environmental concerns are significant motivators for seeking less toxic, eco-friendly pest management strategies. Cost-effectiveness, indicated by 66.7% of respondents ( $\bar{x}= 2.92$ ), and affordability (63.3%) ( $\bar{x}= 2.83$ ) were also recognized as important, reflecting the low-cost nature of IK methods. However, factors such as land ownership and rights (75%) suggest that tenure security influences farmers’ willingness to invest in time-consuming IK methods ( $\bar{x}= 2.83$ ). These findings support [33] who argue that secure land tenure encourages the adoption of sustainable indigenous practices.

**Table 3.** Factors affecting the utilization of indigenous knowledge techniques to control pests and diseases.

Factors	SD (%)	D (%)	A (%)	SA (%)	Mean	Rank
Level of cooperation amongst farmers in society	39(32.5)	13(10.8)	68(56.7)	-	3.22	1 <sup>st</sup>
Cultural beliefs	40(33.3)	29(24.2)	51(42.5)	-	3.09	2 <sup>nd</sup>
The complexity of integrating modern practices	26(21.7)	22(18.3)	72(60)	-	3.03	3 <sup>rd</sup>
Effectiveness of the method	34(28.3)	36(30)	50(41.7)	-	2.98	4 <sup>th</sup>
Concerns about environmental impacts	27(22.5)	31(25.8)	62(51.7)	-	2.97	5 <sup>th</sup>
Concerns about health	13(10.8)	22(18.3)	85(70.8)	-	2.93	6 <sup>th</sup>
Cost-effectiveness	6(5)	16(13.3)	80(66.7)	18(15)	2.92	7 <sup>th</sup>
Affordability of the method	8(6.7)	20(16.7)	76(63.3)	16(13.3)	2.83	8 <sup>th</sup>
Land ownership and rights	6(5)	16(13.3)	90(75)	8(6.7)	2.83	8 <sup>th</sup>
Adaptability of the method	26(21.7)	51(42.5)	43(35.8)	-	2.79	9 <sup>th</sup>
Engagement of other farmers	13(10.8)	37(30.8)	54(45)	16(13.3)	2.61	10 <sup>th</sup>
Farmers' level of education	16(13.3)	32(26.7)	56(46.7)	16(13.3)	2.60	11 <sup>th</sup>
Farm size	33(27.5)	21(17.5)	34(28.3)	32(26.7)	2.54	12 <sup>th</sup>
Access to resources	33(27.5)	26(21.7)	29(24.2)	32(26.7)	2.50	13 <sup>th</sup>

Note: SA=Strongly Agree, A=Agree, D=Disagree, SD=Strongly Disagree.

Source: Field Survey, 2024.

## 7. Perceived Benefits of Utilizing Indigenous Knowledge Techniques to Control Rice Pest and Diseases

Table 4 presents the respondents' responses to perceived benefits of utilizing Indigenous Knowledge (IK) techniques for the control of rice pests and diseases. The findings highlight that farmers attach strong value to IK practices, especially in terms of cultural preservation, environmental sustainability, and practicality. More than half of the respondents (57.5%) agreed that IK promotes cultivating diverse locally adapted crops ( $\bar{x}= 3.42$ ). This indicates that IK supports biodiversity and crop diversification, which enhances resilience to pests, diseases, and climatic variations. Similar findings were reported by Adesina and Chianu [34], who emphasized that local seed diversity and traditional farming practices are crucial for sustainable pest management in sub-Saharan Africa.

The second perceived benefit was that IK is easily adopted ( $\bar{x}= 3.31$ ). A large proportion of respondents (68.3%) agreed, showing that IK techniques are simple, practical, and require little external input. This supports the argument of Warren et al. [35] that IK thrives because it is rooted in farmers' everyday realities and does not demand advanced technical training. 59.2% of the respondents agreed that IK is environmentally sustainable compared to chemicals ( $\bar{x}= 3.27$ ). This shows that farmers recognize IK as a safer alternative to chemical pesticides, which often degrade soils and pollute water systems. Studies by Yusuf et al. [32] confirm that Nigerian farmers increasingly adopt eco-friendly pest control methods due to health and ecological risks associated with chemicals. Another strong benefit was that IK promotes farmer self-sufficiency ( $\bar{x}= 3.25$ ), with 74.2% agreeing and 25.8% strongly agreeing. This suggests that IK reduces farmers' dependency on external inputs, enabling them to rely on locally available materials. Oyekale [31] noted that farmers practicing IK enjoy greater autonomy and resilience, particularly in regions where access to agrochemicals is limited. IK was also recognized for its effectiveness in controlling rice pests and diseases ( $\bar{x}= 3.20$ ), with 80% of the respondents agreeing to this. Similarly, 81.7% of the respondents agreed that IK preserves cultural and traditional practices ( $\bar{x}= 3.18$ ). These findings underscore the dual role of IK in both enhancing agricultural productivity and safeguarding community heritage. Other perceived benefits included preservation of biodiversity (88.3%) ( $\bar{x}= 3.11$ ), sustainability (43.3%) ( $\bar{x}= 3.11$ ), and reduction in chemical use (89.2%) ( $\bar{x}= 3.02$ ). These results reveal that IK is valued not just for its practicality but also for its contribution to sustainable agricultural systems. Obalum et al. [30] stressed that integrating IK into modern integrated pest management (IPM) ensures ecological balance and long-term food security.

**Table 4.** Perceived benefits of utilizing indigenous knowledge techniques to control rice pest and diseases.

Perceived Benefits	SD (%)	D (%)	A (%)	SA (%)	Mean	Rank
It promotes cultivating diverse locally adapted crops.	-	-	69(57.5)	51(42.5)	3.42	1 <sup>st</sup>
It is easily adopted.	-	-	82(68.3)	38(31.7)	3.31	2 <sup>nd</sup>
It is environmentally sustainable, unlike the use of chemicals.	-	8(6.7)	71(59.2)	41(34.2)	3.27	3 <sup>rd</sup>
It promotes the self-sufficiency of the farmer.	-	-	89(74.2)	31(25.8)	3.25	4 <sup>th</sup>
It is very effective in the control of rice pests and diseases.	-	-	96(80)	24(20)	3.20	5 <sup>th</sup>
It preserves cultural and traditional practices.	-	-	98(81.7)	22(18.3)	3.18	6 <sup>th</sup>
It ensures the preservation of their biodiversity.	-	-	106(88.3)	14(11.7)	3.11	7 <sup>th</sup>
It is sustainable.	-	27(22.5)	52(43.3)	41(34.2)	3.11	7 <sup>th</sup>
It reduces the use of chemicals.	-	5(4.2)	107(89.2)	8(6.7)	3.02	8 <sup>th</sup>
It is easy to practice.	6(5)	13(10.8)	77(64.2)	24(20)	2.99	9 <sup>th</sup>
It does not require any form of mechanization.	5(4.2)	12(10)	89(74.2)	14(11.7)	2.93	10 <sup>th</sup>
It does not require formal education or skilled training.	20(16.7)	13(10.8)	57(47.5)	30(25)	2.80	11 <sup>th</sup>
It is cost-effective.	26(21.7)	7(5.8)	55(45.8)	32(26.7)	2.78	12 <sup>th</sup>

**Note:** SA=Strongly Agree, A=Agree, D=Disagree, SD=Strongly Disagree.

**Source:** Field Survey, 2024.

## 8. Challenges Faced by Rice Farmers in the Utilization of Indigenous Knowledge Techniques to Control Pests and Diseases

Table 5 outlines the challenges faced by rice farmers in the use of Indigenous Knowledge (IK) techniques to manage pests and diseases. The results show that while IK is valued for sustainability and cultural preservation, farmers also experience significant constraints that hinder its full utilization. The major challenge identified by the majority (77.5%) of the respondents was limited resources for controlling rice pests and diseases ( $\bar{x}= 4.31$ ). This indicates that farmers lack sufficient local materials, labor, or institutional support to effectively use IK practices. This finding aligns with Mogue and Olofinbiyi [36], who emphasized that resource scarcity remains a critical barrier to adopting traditional and modern pest control methods in Nigeria. The second challenge identified by more than half (58.3%) of the respondents was that indigenous methods are slower than chemicals ( $\bar{x}= 3.15$ ). This suggests that, although IK is effective, its time-demanding nature makes it less attractive compared to fast-acting chemical pesticides. Similar observations were made by Oyekale [31], who reported that many farmers prefer chemicals due to their quick visible results despite associated risks. Closely tied to this was the high cost of alternative techniques (47.5%) ( $\bar{x}= 3.15$ ). This reflects the fact that while IK itself is often low-cost, sourcing certain traditional materials or combining them with modern techniques can be financially demanding. According to Adebisi et al. [33], even low-input systems may become costly for smallholders when the availability of local resources is limited. Another critical challenge noted by 54.2% of the respondents was difficulty in obtaining materials for traditional pest control ( $\bar{x}= 3.02$ ). This implies that some indigenous materials are seasonal or scarce, limiting consistency in practice. This mirrors findings by Ajayi et al. [37] who noted that the availability of medicinal plants and organic pest-control inputs varies by location and season, thus constraining adoption.

Similarly, difficulty in consistently achieving the desired pest control outcome was identified by 43.3% of the respondents ( $\bar{x}= 3.00$ ). This uncertainty may explain why some farmers combine IK with modern methods. Uncertainty about the effectiveness of IK methods was also identified by 45.8% of the respondents ( $\bar{x}= 2.97$ ). Limited access to training and extension services focused on indigenous techniques had a mean of 2.90, with 55.8% agreeing; lack of proper documentation of indigenous methods ( $\bar{x}= 2.67$ ) was also identified, with only 33.3% agreeing and 30% strongly agreeing. These findings point to gaps in knowledge transfer and institutional recognition of IK. Warren et al. [35] stressed that formalizing IK through documentation and extension programs is key to preventing knowledge erosion. Other socio-economic challenges included doubt about the efficacy of IK techniques ( $\bar{x}= 2.82$ ), limited education and financial constraints ( $\bar{x}= 2.80$ ), and balancing traditional and modern techniques ( $\bar{x}=2.77$ ). These highlight structural barriers such as low literacy levels, limited capital, and confusion about how to effectively integrate IK with chemical approaches. These concerns resonate with Yusuf et al. [32], who reported that Nigerian farmers face trade-offs between cultural practices and modern pest management due to financial and educational limitations.

**Table 5.** Challenges faced by rice farmers in the utilization of indigenous knowledge techniques to control pests and diseases.

Challenges	SD (%)	D(%)	A(%)	SA (%)	Mean	Rank
Limited resources for controlling rice pests and diseases	16(13.3)	6(5)	47(39.2)	46(38.3)	4.31	1 <sup>st</sup>
Indigenous methods are slower than chemicals	-	16(13.3)	70(58.3)	34(28.3)	3.15	2 <sup>nd</sup>
High cost of alternative techniques	8(6.7)	22(18.3)	33(27.5)	57(47.5)	3.15	2 <sup>nd</sup>
Difficulty in obtaining materials for traditional pest control	8(6.7)	14(11.7)	65(54.2)	33(27.5)	3.02	3 <sup>rd</sup>
Difficulty in consistently achieving the desired pest control outcome	8(6.7)	22(18.3)	52(43.3)	38(31.7)	3.00	4 <sup>th</sup>
Uncertainty about the effectiveness of the indigenous methods	8(6.7)	22(18.3)	55(45.8)	35(29.2)	2.97	5 <sup>th</sup>
Limited access to training and extension services focused on indigenous techniques	16(13.3)	8(6.7)	67(55.8)	29(24.2)	2.90	6 <sup>th</sup>
Doubt about the efficacy of indigenous techniques	8(6.7)	42(35)	33(27.5)	37(30.8)	2.82	7 <sup>th</sup>
Limited education and financial constraints	24(20)	8(6.7)	56(46.7)	32(26.7)	2.80	8 <sup>th</sup>
Balancing traditional and modern techniques	24(20)	12(10)	48(40)	31(25.8)	2.77	9 <sup>th</sup>
Lack of proper documentation of indigenous methods	32(26.7)	12(10)	40(33.3)	36(30)	2.67	10 <sup>th</sup>

Note: SA=Strongly Agree, A=Agree, D=Disagree, SD=Strongly Disagree.

Source: Field Survey, 2024.

### 9. Test for Hypothesis

Relationship between the socio-economic characteristics of respondents and the utilization of indigenous knowledge techniques for pest and disease control in the study area.

The hypothesis tested the relationship between the socio-economic characteristics of respondents and their utilization of indigenous knowledge (IK) for pest and disease control. The regression analysis in Table 6 revealed that age, gender, marital status, education level, occupation, income, household size, farm size, and farming experience have significant effects on the utilization of indigenous knowledge techniques for rice pest and disease control. These factors explained that 65.6% of the level of utilization of IK and techniques ( $R^2= 0.656$ ) is based on these socio-economic characteristics. 81% of the dependent variables were analyzed ( $R = 0.810$ ). After adjusting for the number of factors, about 62.8% of the variation in IK utilization is in rice pests and disease control. The results indicate that several variables influence the use of IK, with age, religion, level of education, and farming experience emerging as significant predictors. Age ( $B = -0.419, p = 0.001$ ) and farming experience ( $B = -0.023, p = 0.000$ ) have negative and significant relationships with IK utilization, indicating that older respondents are more likely to utilize IK, reflecting a potential preference for traditional methods based on their level of experience over the years and their subsistent scale of production. Conversely, both levels of education ( $B = 0.443, p = 0.001$ ) and religion ( $B = -0.591, p = 0.001$ ) have positive and significant effects, implying that educated farmers easily comprehend and adopt modern techniques or utilize combined measures for controlling pests and diseases on their rice farms. This finding aligns with recent research by Ngxabi et al. [38], which emphasizes that education enhances farmers' ability to implement effective pest management strategies based on indigenous practices.

**Table 6.** Linear regression analysis of the relationship between the socio-economic characteristics of the respondents against utilization of indigenous knowledge for pest and disease control.

R	R <sup>2</sup>	Adjusted R <sup>2</sup>	t-value	p-value	Significance
0.810	0.656	0.628			
Variables	B	Std Error			
Age	-0.419	0.127	-3.287	0.001	Significant
Gender	-0.078	0.142	-0.545	0.587	Not significant
Educational level	0.443	0.070	6.370	0.000	Significant
Household Size	-0.064	0.046	-1.368	0.174	Not significant
Marital Status	0.069	0.083	0.832	0.407	Not significant
Religion	0.591	0.091	6.512	0.000	Significant
Farm size	0.004	0.023	0.166	0.869	Not significant
Farm experience	-0.023	0.006	-3.831	0.000	Significant
Extension Contact	0.077	0.092	0.838	0.404	Not significant

Note: Significant at  $\leq 0.05$  (DF=Degree of freedom).

Source: Field survey, 2024.

Adebisi et al. [39] found that higher educational attainment among farmers significantly correlated with increased technical efficiency when utilizing indigenous knowledge systems for pest management in Osun State, Nigeria. Similarly, research conducted by Ngxabi et al. [38] in South Africa found that farmers relying on indigenous knowledge for pest control reported better crop yields compared to those using only synthetic pesticides. Moreover, the negative correlation between age and IK utilization suggests that younger farmers may be more adaptable to traditional methods compared to older generations, who might prefer modern techniques due to familiarity or perceived effectiveness. This observation is consistent with findings from various studies indicating that younger farmers often embrace innovative practices more readily than their older counterparts [40].

## 10. Summary, Conclusion, and Recommendation

This study aimed to identify the factors affecting the utilization of indigenous knowledge techniques to control rice pests and diseases in Ogun State. A well-structured questionnaire was used to gather responses from 120 farmers in six communities in Ifo and Ewekoro Local Government Areas, and their responses were analyzed using statistical tools, which include descriptive statistics. The socio-demographic analysis showed that the farmers are mostly men with average education. They have an average family size of 6-10 members and cultivate an average of 4-6 hectares of land. A higher percentage of the farmers engage in manual weeding and planting traditional varieties of rice to control pests and diseases in their rice farms. Level of cooperation amongst farmers in society and cultural beliefs were identified as some of the factors affecting their utilization of IK to control rice pests and diseases. The most well-known benefits of IK to the respondents are that it promotes cultivating diverse locally adapted crops, and it is easily adopted. The findings also revealed that limited resources for controlling rice pests and diseases, and indigenous methods being slower than chemicals are some of the challenges that the farmers face in utilizing IK. The findings of this study have several important implications on the utilization of IK to control rice pests and diseases by farmers in Ogun State. Firstly, the reliance on indigenous pest management techniques, such as manual weeding and planting traditional varieties of rice, highlights a commitment to sustainable farming. However, there is a need for frequent extension contact for more regular support to enhance knowledge and technology adoption, ultimately improving agricultural efficiency and productivity in the region. Furthermore, the adoption of cultural practices for pest and disease management in rice cultivation is influenced by factors such as farm size, resource availability, and education. While most of the farmers use traditional methods, health risks and effectiveness persist. Indigenous knowledge offers cost-effective solutions. However, barriers like limited resources, financial constraints, and low education levels hinder broader adoption. Addressing these challenges through improved education and support services is crucial for enhancing sustainable pest management practices in rice farming.

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