

Pest and disease management practices among rural cashew farmers in Oyo State, Nigeria

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Abstract: Cashew production is vital to the Nigerian economy, yet it is significantly constrained by poor management of insect pests and diseases. This study assessed the pest and disease management practices (DIPM) among 125 rural cashew farmers in Oyo State, Nigeria using a three-stage sampling procedure. Data collection was through structured interviews and analysed using mean, percentage and Chi-square tests. Results revealed that the mean age of the respondents was 54.8 years, most (56.8%) had secondary education. Association was the main (55.2%) source of agricultural information. It was further revealed that termites (43.2%) and girdlers (34.4%) were prevalent pests while twig dieback (34.4%) and powdery mildew (23.2%) were the most common diseases. Only 23.2% of the respondents used treatment methods, primarily pesticide application (23.2%) while 76.8% didn't practice disease management. Likewise, knowledge of appropriate agrochemicals was limited (23.2%). A significant association was found between educational level and disease knowledge ($\chi^2 = 13.510$, $p = 0.001$). It is therefore concluded that majority of the cashew farmers in the study area had inadequate knowledge of pest and disease management practices. Hence, it was recommended that training on integrated pest and disease management, emphasising both organic and chemical approaches should be organised.

Keywords: Cashew, diseases infestation, management, pests, farmers

1. Introduction

In Nigeria, agricultural activities face numerous challenges that affect production rates and impede the country's food security efforts. One of these challenges is the plant diseases and insect-pests' management (DIPM) (Azeez & Olabanji, 2023; Ofuya et al., 2023; Amuda & Alabdulrahman, 2024; Jonathan et al., 2025). Castillo and Celiz (2022) asserted that inadequate management of pests and diseases can lead to reduced yields and lower quality of the produce, ultimately impacting farmers' earnings (Ofuya et al., 2023). Adeniyi and Asogwa (2022) stated that pests cause significant challenges in agriculture, which pose serious threats to the economic, and DIPM is complex as a result of the presence of manifolds of pathogens. Similarly, Abutu (2014) observed that agricultural activities in Nigeria are often carried-out at the mercy of pests and rodents

that eat crops to their satisfaction, which can lead to significant damage.

Plant diseases are mainly caused by abiotic and biotic factors which are both responsible for significant agricultural losses. Biotic factors include disease-causing organisms like bacteria, fungi, nematodes, mycoplasmas and viruses. Abiotic factors are environmental conditions such as temperature, soil nutrients and fertility, relative humidity and soil composition (Batista et al., 2024; Oyebamiji et al., 2024). Terna et al. (2020). reported that plant diseases can cause significant reduction and unavailability of food. Disease infestation can occur both on the field and during post-harvest handling. Globally, plant diseases cause more than 20% reduction in food and cash crop production (Thind, 2012), resulting in economic losses estimated in millions of dollars in Nigeria.

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One of the crops that is significantly affected by pests and diseases infestation is cashew. Cashew (*Anacardium occidentale*) is a perennial tree widely cultivated in Nigeria primarily for its economic value. Although originally introduced into the country as part of an erosion control strategy, the significant economic benefits associated with its production have shifted its primary purpose toward commercial cultivation (Azeez & Olabanji, 2024). The main product of interest is the raw cashew nut (RCN). In Nigeria, smallholder farmers account for the majority of RCN production; however, their limited access to improved, disease-resistant planting materials (biotypes) and modern agronomic practices increase the crop's vulnerability to diseases and insect pests. Cashew is cultivated commercially in more than twenty of Nigeria's thirty-six states, as well as in the Federal Capital Territory, with all agro-ecological zones supporting its growth (Babatunde et al., 2023; Azeez, et al., 2024)

Ezeagu (2002) identified the principal cashew-producing states, where commercial cultivation began as early as the 1950s. In the eastern region, these include Abia, Anambra, Cross River, Ebonyi, Enugu, and Imo, while in the western region, they comprise Ekiti, Ogun, Ondo, Osun, and Oyo. These states collectively account for the majority of Nigeria's cashew exports. Additional producing areas highlighted by Ezeagu (2002) include Benue, Kogi, Kwara, Nasarawa, Niger, and Taraba, along with the Federal Capital Territory in the north-central region, and Kebbi and Sokoto states in the northwest. Cashew-producing states are generally classified as either major or minor producers based on their respective production levels. Adeniyi et. al. (2022) and Azeez et al. (2024), stated that cashew production in Nigeria is greatly impaired by problems connected with pests' complexity. They further mentioned that cashew trees serve as hosts to vast majority of pests and diseases which eventually lead to infestation of various parts of the trees such as – twigs, roots, stems, branches, flowers, inflorescences and the pseudo apples. Cashew is susceptible to infestation right from seedling stage (Asogwa et al., 2008).

Hammed et al. (2008), asserted that within 20 years, over 286 species of cashew pests and diseases were reported. Their primary attack parts are the foliar and fruit parts of the plants. Likewise, Adeniyi et. al. (2022), stated that numerous insects and diseases infested cashew at varying stage of growth and development, resulting to reduction in yields. The disease and pests are capable of attacking cashew plants at the same time and/or at successive manner. The economic loss due to the pests and diseases' infestation in cashew plants is

can be up to 100% depending on the pests or diseases. For instance, anthracnose, powdery mildew and black rust can cause up to 70%, 50 -70%, and 48.4% loss in production respectively. While *Fusarium oxysporum* can account for 100% production loss (Domedjui et al., 2023). These losses will directly affect the earnings of cashew farmers.

Apart from the economic implications of the pests and disease, it also leads to reduction in the quality and quantity of raw nuts of cashew being made in Nigeria. According to Domedjui et al., (2023) and Adeniyi et. al. (2022), pests and diseases were parts of factors responsible for cashew low productivities in Nigeria. Other factors mentioned include- Unimproved planting materials, overcrowding and interlocking, poor maintenance and abandonment, low plant population and low soil fertility. Likewise, Salami et al. (2024) observed that the major risks faced in cashew production in Nigeria is pest and disease infestation.

Furthermore, Adeniyi et. al. (2022) stated that diseases of cashew are categorised into major and minor. The classification is based on their economic impacts on the raw nuts in terms of quality and quantity. Some of the crucial diseases of cashew are inflorescence blight (*Lasiodiplodia theobromae*); anthracnose (*Colletotrichum gloeosporioides* Penz.); damping-off (*Sclerotium rolfsii*; *Fusarium spp.*; *Pythium spp.*); seedling dieback (*Fusarium spp.*; *Lasiodiplodia theobromae*); twig dieback (*Lasiodiplodia theobromae*). Whereas, Adeigbe et al. (2015), mentioned five major diseases of cashew caused by fungi, however, three out of the five were recognised as major diseases in Nigeria which include- floral shoot and twig die back instigated by *Lasiodiplodia theobromae*, root-rot of seedling of cashew instigated by *Pythium ultimum* and damping off caused by *Fusarium sp.* On the other hand, Adeniyi et al. (2022) listed some important insect-pest to include- longhorn beetle (*Analeptes trifasciata*). Other insect pests mentioned by Adeniyi et al. (2022) and pathogens are red banded thrips (*Selenothrips rubrocinctus*) which eat leaves and fruits, and fruit scrapper (*Pachnoda cordata* Durry). In addition, some researches have listed major fungal pathogens across West Africa to include *Colletotrichum gloeosporioides* (anthracnose), *Oidium anacardii* (powdery mildew), *Pestalotia heterocornis* (pestalotiosis), *Cryptosporiopsis sp.* (black rust), and *Lasiodiplodia theobromae* (bud dieback), among others (Domedjui et al., 2023; Adejumo, 2005; Houndahouan et al., 2018). Despite the significant damage caused by diseases and insect-pests, there is scarcity of information on the cashew farmers' knowledge and the DIPM adopted

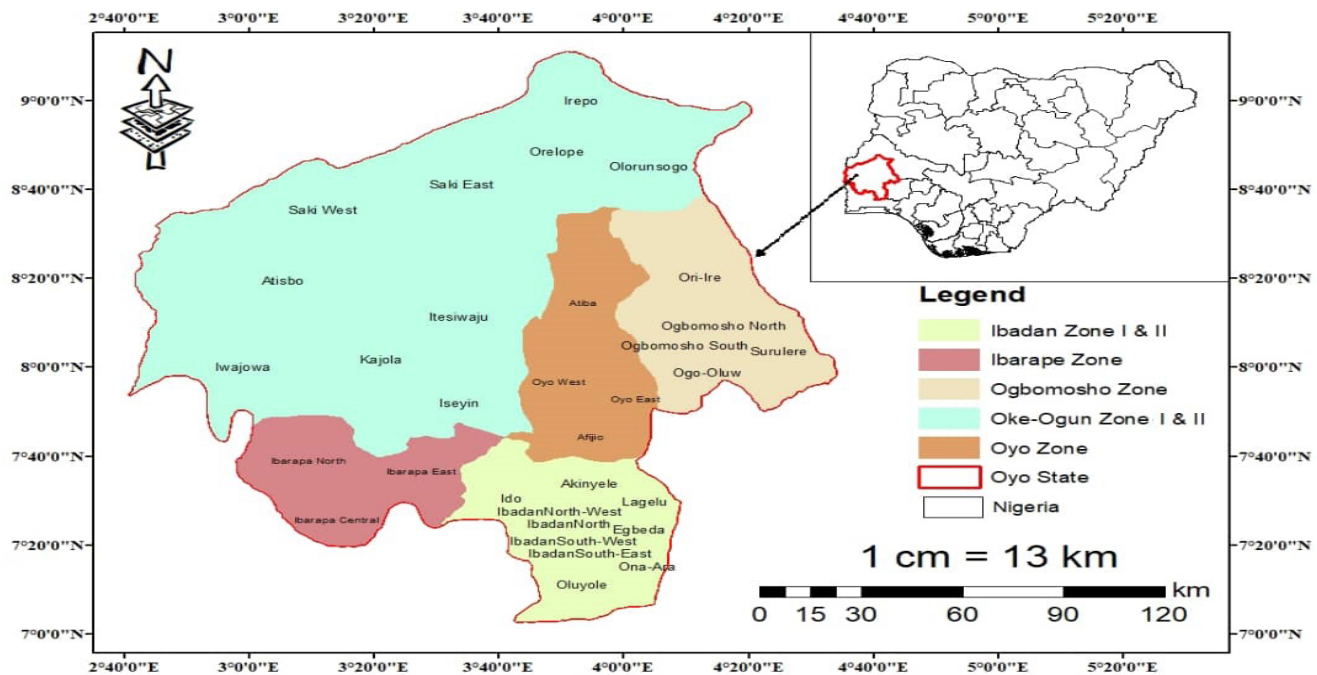


Fig. 1: Map of the study area.

Source: Designed with Arc GIS

in cashew production in Oyo State, Nigeria, hence, this research tends to bridge this gap in knowledge.

The objectives of this study were to:

- i. determine the socio-economic characteristics of the cashew farmers
- ii. identify common disease on cashew farms using diseases and pest catalogue;
- iii. identify common insect-pests on cashew farms using diseases and pest catalogue;
- iv. determine the disease management practices adopted by the farmers

Hypothesis

Ho: No significant relationship is existing amongst educational level of the farmers and their disease and insect pest knowledge.

2. Materials and methods

2.1. Study Area

The research was conducted in Oyo State, Nigeria. The State is located in the Southwest region of the country. The State is situated between latitudes 6.5° and 9° N of the equator and between longitudes 3° and 5° E of the Greenwich Meridian (Fig. 1). Oyo State is known for equal climate, that is rainy and dry periods. The rainy

period is from April to October whereas the dry period is usually between November – March. The State relative humidity favours agricultural activities include tree/cash crops cultivation. Daily average temperature of the State is usually from 25° C and 35° C with altitudes ranging from 200 – 450 m above the level of the sea. The yearly rainfall is around 1000 – 1500 mm. There is savanna vegetation in the State with trees of varying height and size in the north and the south. The State climatic condition and vegetation favour cultivation of cashew nuts trees. Similarly, the State is considered as one of the biggest raw cashew nuts producing states in the country.

2.2. Sampling procedure and sample size

Population of the study was all cashew farmers in the State. One hundred and twenty-five (125) cashew farmers were selected for the study using three-stage sampling procedures. The first stage involved purposive selection of five local government areas (LGAs) from the thirty-three (33) local government areas in the State based on their cashew cultivation and numbers of farmers involved. The selected LGAs were – Orire, Surulere, Saki East, Irepo and Iseyin LGAs. Second stage involved simple random selection of five communities from each of the selected local government Areas, making 25 communities. The third stage involved random selection of five cashew farmers from each of

the selected community. Hence, 125 farmers were used for the study.

2.3. Data Collection

Data were elicited using structured interview technique with the aid of interview guide. Data on socio-economic characteristics were obtained as itemised in the questionnaire and recorded. Diseases and pests catalogue prepared by United State Department of Agriculture and Cultivating New Frontiers in Agriculture (USDA/CNFA) in 2023 were presented to farmers for diseases and pests' identification. Farmers identified diseases and pests commonly found on their farm from the catalogue. Each identified disease and pest were recorded in the interview guide. Based on this, frequency and percentage of common disease were computed.

2.4. Statistical Analysis

The data obtained were analysed using frequency count, percentage, means and chi-square. The socio-economic variables were analysed using frequency and percentages while chi-square was used to test for association between educational level and socio-economic variables at 5% significant level. Identification of pests and diseases was done by using frequency of mentioned. The extent of the pests/diseases were mentioned based on perceived extent of low, moderate and high. Meanwhile, educational level was taking as categorical variable estimated using frequency which were then classified into no formal, primary and secondary.

3. Results and discussion

The majority of the farmers were male (68.8%) whereas 31.2% were female which is an indication that cashew cultivation is mostly practiced by male in the study area (Table 1). Most of the respondents (30.4%) were between 46 – 55 years of age with mean of 54.8 ± 12.4 while 8.0% were 35 years and below. Also, 27.2% were 66 years and above. The finding is in consonant with the findings of Agada & Sule (2022), Falaye & Ojo (2020) and Adebayo et al. (2022). Related observations were made by Uwagboe et al. (2017) amongst the cashew farmers in Oyo and Osun state. This is an indication that cashew cultivation is dominated by prime age people in the State. Table 1 revealed further that most (56.8%) of the farmers had post-primary education and 88.0% were married.

The main source of information indicated by the respondents was association (55.2%), followed by radio (32.8%). It means association is the best way

of reaching most cashew farmers in the State. These findings were in consonant with the observation of Uwagboe et al. (2017), where it was noted that major sources of information utilised by farmers were friends and radio sources. Likewise, the findings indicated that majority (77.6%) of the farmers do listen to radio from different stations depending on their location. Some of the prominent stations mentioned were – Oke-Ogun FM (22.4%), Ajilete FM (32.0%), Gravity FM (33.6%) and Parrot FM (12.0%). The listening time is majorly in the morning (55.2%). This is the time for popular radio programme called “*Koko inu iwe iroyin*” [Newspapers headings]. The programme's name varies across the country; it depends on the station. The programme is majorly on newspaper review holding almost every-day across radio stations in Nigeria.

In addition, it was revealed that majority (54.4%) of the respondent had contact with private extension agents compared to government extension agents. This is more so in the study area because the State government had collapsed Agricultural Development Programme (ADP) staff into the State Ministry of Agriculture. All the respondents (100%) denied to have received training on cashew disease management from any source. This is contrary to the findings of Ahmed et al. (2023), where 22.9% of their respondents had received training on cashew disease management. It was similarly revealed that 66.4% of the respondents belonged to farmers' association. Similarly, majority (56%) had less than or equal to 10 years' experience in cashew cultivation. 65.6% had farm size of 11 acres and above.

Table 1: Socio-economic characteristics of cashew farmers

Variables	Freq- uency	Percentage	Mean
Gender			
Male	86	68.8	
Female	39	31.2	
Age			54.8 ± 12.4
≤ 35	10	8	
36 – 45	20	16	
46 – 55	38	30.4	
56 – 65	23	18.4	
≥ 66	34	27.2	
Educational Level			
No formal	41	32	
Primary	13	10.4	
Secondary	71	56.8	

Marital Status		
Married	110	88.0
Single	15	12.0
Sources of Information		
Association		
Radio	69	55.2
Newspaper	41	32.8
Textbook	15	12.0
Experience		
≤ 10	70	56
11 – 20	40	32
≥ 21	15	12
Farm Size (Acre)		
≤ 5	15	12
6 – 10	28	22.4
≥ 11	82	65.6
Listening to Radio		
Yes		
No	97	77.6
	28	22.4
Radio Station		
Oke-Ogun FM	28	22.4
Ajilata FM	34	32.0
Gravity FM	42	33.6
Parrot FM	15	12.0
Time of Listening to Radio		
Morning		
Evening	69	55.2
Not Applicable	28	22.4
	28	22.4
Contact with Extension agents		
Yes, Government	42	33.6
Yes, Private		
Organisations	68	54.4
No	15	12.0
Previous training on disease management		
No	125	100
Yes	0	0
Other Crops Planted		
Cassava	29	23.2
Maize, Cassava	15	12.0
Maize, Soybean	13	10.4
Maize, Yam, Cassava	13	10.4
Soybean	29	23.2
Soybean, Rice	13	10.4
Yam, Maize, Soybean	13	10.4
Membership of Farmers		
Association		
Yes	83	66.4
No	42	33.6

Source: Field Survey n=125

3.1. Common Cashew Disease Identification

Based on the diseases/pests' catalogue presented, twig dieback was mostly (34.4%) identified by the respondents as common disease noticed on their farms, this is followed by powdery mildew (23.2%) and anthracnose (20.8%). Asogwa et al. (2008), classified dieback disease (*Lasiodiplodia theobromae*) as a major disease of cashew. Similarly, the respondents identified the following diseases as part of common diseases on their farms – inflorescence (10.4%), Bacteriosis (11.2%) and Anthracnose (20.8%). Furthermore, the extent of infestation was revealed to be moderate by the majority (56.0%) of the respondents while 32.8% observed that the infestations were great. The findings indicated that twig dieback is the most commonly identified disease in the study area. According to Azeez et al. (2024), this disease is responsible for over 50% of young vegetative shoot death in cashew plants. Although it was opined that extent of damage was moderate.

Table 2: Identification of common disease by the respondents

Variables	Frequency	Percentage
Identification of disease		
Anthracnose	26	20.8
Inflorescence	13	10.4
Twig dieback	43	34.4
Bacteriosis	14	11.2
Powdery mildew	29	23.2

Source: Field Survey

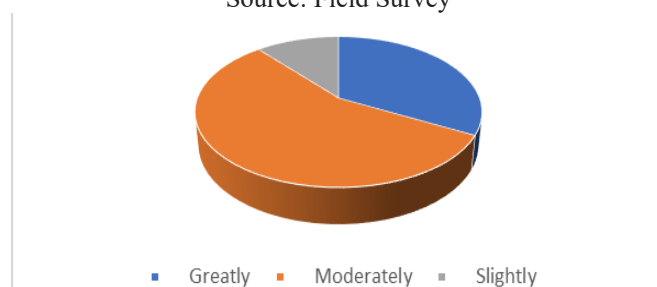


Fig.: 2: Extent of infestation

3.2. Common cashew pests' identification

Table 3: Identification of common cashew pests by the respondents

Variables	Frequency	Percentage
Identification of insect pests		
Girdler	43	34.4
Fruit Scraper	15	12.0
Termites	54	43.2
Stem and Root-borer	13	10.4

Source: Field Survey (2023).

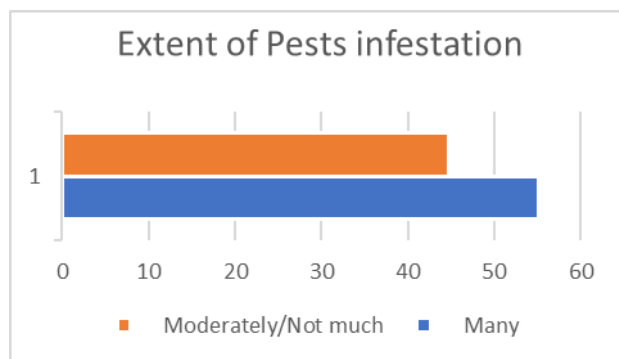


Fig. 3: Extent of infestation

From the Table, the most commonly identified insect-pests were termites (43.2%) and girdler (34.4%). Table 3 also showed that 55.2% of the farmers opined that many insect pests were noticed on their farms. Asogwa et al. (2008) classified termite as minor pest while stem girdler (*Analeptes trifasciata* Fabricius) was classified as a major pest affecting cashew production. Hence, both the minor and major cashew pests were present on the cashew plantations in the State. The results are in consonant with the observation of Uwagboe et al., (2017) where dieback and termites were highly noticed on cashew farms. However, it is in contrary to the observation of Ahmed et al. (2023) where tea mosquito bug was highly observed by the farmers. Other identified pests by farmers include fruit scraper (12.0%) and stem and root borer (10.4%).

3.3. Diseases/pests Management Practice of Farmers

The Table 4 revealed that 76.8% of the respondents do not apply any form of treatment to their infested cashew trees/farms while 23.2% made treatment efforts. Also, 23.2% applied pesticides to treat their farms and believed they knew appropriate chemical required for the treatment. Uwagboe et al. (2017) noted a similar trend. They observed that 28.9% of their respondent's applied agrochemical for disease treatment and management. The results contradicted the view of Ahmed et al. (2023) where it was stated that farmers used different techniques to management infestations on their farms and majority utilised agrochemical technique. This is an indication that most farmers in Nigeria practice organic cashew farming – which entails non-application of agrochemical.

The Table revealed that 88.8% of the farmers noticed disease infestations on their farms while 11.2% were not aware or didn't notice the infestations. Uwagboe et al. (2017), noted that farmers were oblivious of the infestations on their farms which were observed on

the farms during (their) field survey. More so, 88.0% did not know the name of the observed disease while only 12.0% assumed to know the name. However, all the respondents (100%) believed that the diseases were capable of affecting the yields of the cashew which will lower the returns on their investment. This is in consonant to the finding of Adeniyi et al. (2022). The Table further revealed that the disease infestations were observed at different months in the year. 33.6% of the respondents observed the infestation by July which coincided with post harvesting period and rainy season. Also, 42.4% of the respondents observed that infestation is high during November and December which coincided with the flowering time. This agrees with the observation of Ahmed et al. (2023), where 60% of the farmers stated that infestation was higher during the flowering period. This is an indication that the farmers were aware of the infestation implication. However, they know little about the diseases that affect cashew farm and how to treat the infestations.

Table 4: Diseases/pests management practice of farmers

Variables	Frequency	Percent
Treatment of the disease/pests		
Yes	29	23.2
No	96	76.8
Treatment methods		
Pesticide Application	29	23.2
Do nothing	96	76.8
Insecticides knowledge		
Known	29	23.2
Unknown	96	76.8
Presence of diseases		
Yes	111	88.8
I don't know	14	11.2
Disease Name		
Known	15	12.0
Unknown	110	88.0
Plant's part affected		
Leaves	28	22.4
Stems	13	10.4
Flower/Inflorescence	42	33.6
Fruits	42	33.6
Month of infestation		
November	27	21.6
December	26	20.8
July	42	33.6
August	15	12.0
September	15	12.0
Symptoms of the diseases		
Brownish	15	12.0
Dryness of the leaves	13	10.4
Drying of flower	30	24.0

Drying of inflorescence	13	10.4
Dryness of twigs	13	10.4
Rotten Fruit	14	11.2
Yellowish of Leaves	27	21.6

Source: Field Survey

Hypothesis testing

Ho1: There is no significant association between level of education of the farmers and their knowledge of disease/pests.

Table 6: Chi-square tests

	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	12.964 ^a	2	.002	.002		
Likelihood Ratio	18.512	2	.000	.000		
Fisher's Exact Test	13.510			.001		
Linear-by-Linear Association	10.691 ^b	1	.001	.001	.000	.000
N of Valid Cases	125					

a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is 1.56.

b. The standardized statistic is -3.270.

Chi-Square analysis was used to evaluate the association between categorical variables (Level of Education and Knowledge of disease). There was less than five count in the observation, hence, Fisher's Exact Test was used for the analysis. The Table indicated that there is a significant relationship between the variables at 5% significance level. That is an indication that level of education of the respondents determines their knowledge of disease ($X^2 = 13.510$, $df = 2$, $p = 0.001$). The findings are in line with the observation of Ebewore & Isiorhovoja (2019) where it was observed that respondents' disease control practices are determined by their educational level.

4. Conclusion and recommendations

The study concluded that the majority of cashew farmers in the study area do not adequately practice pest and disease management due to limited knowledge and a significant relationship exists between farmers' educational attainment and their disease knowledge. Given these findings, there is a need for coordinated training and extension support focused on integrated pest management (IPM), involving both organic and inorganic methods. Policymakers should also ensure increased access to reliable extension agents and subsidized agrochemicals to sustain cashew productivity.

Conflict of interest

No conflict of interest was declared by the authors.

Table 5: Educational level and Disease knowledge cross tabulation

Educational level	Count	Disease		Total
		Known	Unknown	
No formal		0	41	41
Primary		0	13	13
Secondary		15	56	71
Total		15	110	125

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