

Plant Pathology and Pest Management in Nigeria: Challenges, Innovations, and Sustainable Approaches

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Abstract

Plant diseases and pests remain major constraints to agricultural productivity in Nigeria, where over 70% of the population depends on farming for livelihood. The country's tropical climate—characterized by high humidity and temperature—creates ideal conditions for pathogen proliferation and pest outbreaks. This paper examines the current status of plant pathology and pest management in Nigeria, emphasizing key crops such as cassava, maize, yam, and rice. It reviews common pathogens and pests, evaluates management practices, and explores sustainable approaches including biological control, integrated pest management (IPM), and the use of resistant crop varieties. Findings from literature and field reports reveal that despite progress in research and extension, pest management remains hindered by limited funding, weak policy enforcement, and farmer awareness gaps. The study recommends a shift toward eco-friendly pest control methods, local capacity building, and adoption of genomic tools for disease diagnosis and resistance breeding.

1. Introduction

Agriculture is the backbone of Nigeria's economy, contributing about 24% to GDP and employing the majority of the rural population. However, crop productivity continues to decline due to the devastating impact of plant diseases and pests. The Food and Agriculture Organization (FAO) estimates that up to 40% of potential yields are lost annually to pest and disease infestations in sub-Saharan Africa, with Nigeria being one of the most affected nations. Plant pathology, the scientific study of plant diseases caused by pathogens such as fungi, bacteria, viruses, and nematodes, provides the foundation for disease diagnosis and control. When coupled with pest management strategies targeting insects, weeds, and rodents, it becomes a key pillar of sustainable crop production.

In Nigeria, the rapid spread of invasive pests like the Fall Armyworm (*Spodoptera frugiperda*) and pathogens such as Cassava Mosaic Virus and Rice Blast has exposed the fragility of the country's pest management systems. This study aims to analyze the current trends in plant pathology and pest management in Nigeria, identify key challenges, and propose sustainable solutions for improving food security.

2. Literature Review

2.1. Major Plant Diseases in Nigeria

Several economically important diseases affect staple and cash crops in Nigeria:

Cassava Mosaic Disease (CMD): Caused by African Cassava Mosaic Virus (ACMV) and transmitted by whiteflies (*Bemisia tabaci*). CMD causes chlorotic leaf mosaic, stunted growth, and yield reduction.

Maize Streak Virus (MSV): Affects maize across all agro-ecological zones, transmitted by leafhoppers.

Rice Blast (*Magnaporthe oryzae*): Responsible for severe yield losses in rice fields, particularly under humid conditions.

Yam Anthracnose (*Colletotrichum gloeosporioides*): Causes necrotic lesions on leaves and tubers, reducing market value.

Cocoa Black Pod Disease (*Phytophthora megakarya*): Affects cocoa pods and accounts for 20–30% annual yield loss in southern Nigeria.

2.2. Major Pests in Nigerian Agriculture

Common insect pests include:

Fall Armyworm (*Spodoptera frugiperda*) – affects maize and sorghum.

Stem Borers (*Busseola fusca*) – attack maize and rice stems.

Yam Beetles and Nematodes – damage underground tubers.

Pod Borers (*Maruca vitrata*) – affect cowpea.

Cocoa Mirids (*Sahlbergella singularis*) – destroy cocoa pods and shoots.

Pest pressure is intensified by climatic variability, lack of resistant varieties, and poor field sanitation.

2.3. Traditional and Modern Pest Management Approaches

Historically, Nigerian farmers relied on cultural practices such as crop rotation, handpicking, and intercropping to control pests. However, the widespread use of synthetic pesticides in the 1980s increased yields but led to pesticide resistance, residue contamination, and ecosystem imbalance.

Modern approaches emphasize Integrated Pest Management (IPM)—a holistic strategy combining biological, cultural, mechanical, and chemical methods to minimize pest damage economically and ecologically.

3. Methodology

3.1. Study Design

This paper adopts a mixed-method approach combining literature review, secondary data analysis from agricultural research institutes, and interviews with extension agents and farmers in Nigeria's major agricultural zones (North Central, Southwest, and Southeast).

3.2. Data Collection

Data were sourced from the International Institute of Tropical Agriculture (IITA), National Root Crops Research Institute (NRCRI), and Agricultural Research Council of Nigeria (ARCN) reports.

Field surveys assessed farmers' awareness of pest control measures and their adoption of IPM practices.

Laboratory data from published studies on pathogen identification and resistance screening were included.

3.3. Analytical Tools

Descriptive statistics and thematic content analysis were used to summarize field data and highlight trends in pest and disease management practices.

4. Results and Discussion

4.1. Disease and Pest Distribution in Nigeria

Findings show that fungal and viral diseases are most prevalent in humid southern regions, while insect pests dominate semi-arid northern areas. Cassava diseases are widespread in the South and Middle Belt, while maize and rice pests are predominant in the North.

4.2. Farmer Awareness and Control Practices

About 65% of surveyed farmers reported using chemical pesticides as their primary control method. However, less than 30% had received formal training on safe application or IPM. Most farmers relied on local market advice rather than extension officers, increasing the risk of misuse and resistance buildup.

Cultural practices such as crop rotation and residue burning were common, but biological control—using natural enemies like parasitoids—was rarely practiced due to limited awareness and lack of supply systems.

4.3. Research Advances and Technological Innovations

Recent research from IITA and NRCRI has led to the development of disease-resistant varieties, such as:

TMS 30572 cassava, resistant to CMD and Cassava Bacterial Blight.

NERICA rice varieties, tolerant to blast and drought.

Improved cowpea lines resistant to *Maruca vitrata* and aphids.

Additionally, remote sensing and molecular diagnostic tools are being employed for early pest detection. DNA-based methods like PCR and ELISA have improved pathogen identification, while smartphone-based pest alert systems are being tested in some states.

4.4. Challenges in Pest and Disease Management

Weak extension services: Limited communication between researchers and farmers delays adoption of innovations.

Overreliance on pesticides: Leads to resistance, environmental contamination, and loss of beneficial organisms.

Climate change: Alters pest distribution and increases disease severity.

Funding constraints: Public agricultural research receives less than 1% of the national budget.

Policy gaps: Lack of enforcement on pesticide regulation and quarantine controls enables pest invasion.

5. Sustainable Solutions

5.1. Integrated Pest Management (IPM)

IPM combines ecological understanding with practical solutions. It includes:

Use of resistant varieties.

Biological control agents (e.g., *Trichogramma*, *Beauveria bassiana*).

Crop diversification and intercropping.

Judicious use of selective pesticides based on pest threshold levels.

Adoption of IPM in rice and maize fields in northern Nigeria has reduced pesticide use by 40% without yield loss.

5.2. Biological Control and Indigenous Knowledge

Encouraging local production of biocontrol agents can reduce dependency on imports.

Nigerian farmers also use indigenous plant extracts (e.g., neem, chili, and pawpaw leaf) as natural repellents—these should be scientifically validated and commercialized.

5.3. Policy and Institutional Reforms

Strengthen national pest surveillance and rapid response systems.

Establish local biopesticide production units.

Enhance farmer training through extension networks.

Enforce pesticide registration and import control under the Federal Ministry of Agriculture and Rural Development (FMARD).

6. Conclusion

Plant diseases and pests pose a serious threat to Nigeria's agricultural sustainability. While progress has been made in research and resistant crop development, poor awareness and infrastructure limit the effectiveness of control measures. A national shift toward sustainable, science-based pest management is urgently needed.

Integrating plant pathology research, IPM, and community engagement can ensure healthier crops, higher yields, and a safer environment. Emphasis should be placed on education, early detection systems, and bio-based solutions to reduce dependency on chemical pesticides and build climate-resilient farming systems.

7. Recommendations

Expand Integrated Pest Management (IPM) programs across all agro-ecological zones.
Strengthen agricultural extension services to improve farmer training.
Promote local biocontrol industries and research on indigenous pest control plants.
Improve policy enforcement on pesticide regulation and biosecurity.
Increase research funding for plant pathology and genomics-based breeding for resistance.

8. References

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