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Ginger Blight Epidemic in Nigeria: Farmers' Nightmare, How Far So Far

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ABSTRACT

Ginger (*Zingiber officinale* Roscoe) is a high-value spice crop grown in several states across Nigeria, including Kano, Benue, Plateau, Bauchi, Nasarawa and Southern Kaduna State- the traditional home of ginger in Nigeria and accounts for about 85% of the country's total production. Ginger is rich in bioactive compounds and is widely utilized in several cuisines and industries. To improve Nigeria's foreign exchange profits and foster domestic trade for the populace, its production was increased. However, ginger production has been severely threatened by the outbreak and recurrence of ginger blight disease, as well as other diseases caused by other microorganisms a destructive rhizome rot primarily caused by *Fusarium* species. This review provides a thorough overview of ginger blight disease in Nigeria, combining recent economic analysis and government interventions and highlights the potential of biotechnological approaches, including spray-induced gene silencing, molecular diagnostics, tissue culture-based production of disease-free planting materials, biological control, and genetic improvement as sustainable solutions and eco-friendly alternatives for long-term disease management.

KEYWORDS

Ginger blight disease, *Zinginber officinale*, rhizome rot, biotechnology, Nigeria

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INTRODUCTION

Ginger (*Zingiber officinale* Roscoe) is an herbaceous and perennial plant that belongs to the family Zingiberaceae and has been cultivated over time based on history[1,2]. Several states in Nigeria are known to grow ginger extensively as a significant export commodity, generating revenue for the nation. States like Kaduna, Plateau, Bauchi, Benue, Gombe, Abuja, and Nasarawa are frequent ginger-producing areas. Because of its high oleoresin content and reputation for being especially powerful, Nigerian ginger is the most preferred kind internationally and is used in several dishes and medicines[2]. Recently, ginger and its products (gingerbread, ginger cake, ginger coffee, ginger drink, ginger oil, ginger spice, ginger syrup, and ginger wine) have become increasingly popular in households, pharmaceuticals, breweries, cuisines, and other related industries[3] Nigeria's principal export destinations for ginger include Dubai, where farmers mostly sell to foreign traders, and South Africa, India, and Morocco, where it is sold directly to local food processing industries.

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The ginger plant grows about three to four feet (0.9 to 1.2 meters) tall, with thin, sharp leaves that are six to twelve inches long[4]. The ginger itself is a branched, scarlet brownish/beige root or rhizome, and as it grows, it has white and pink buds that blossom into yellow flowers that grow in dense spikes. The rhizome is often fragrant and has a strong, sharp flavor. Ginger grows at a range of 50 to 100 cm in height having a rhizome that can vary in shape and size depending on the cultivar It can range in length from one to six inches[5]. The hue of ginger's flesh varies from ivory to a light greenish yellow.

Ginger contains 50% starch, 9% protein, 6-8% lipids, 2% protease, 1-3% nonvolatile oils which is responsible for its pungent smell and taste, it also contains nutrients and bioactive compounds such as proteins, carbohydrates, alkaloids, tannin, saponnin flavonoids, steriods terpenoids, phenols, anthraquinone glycosides, cardiac glycosides, glycosides and flavonoids[6] which are important for proper functioning of the body.

Consumed either fresh or dried and acts as a spice to add flavor and taste to food. Additionally, it is used in the brewery industry to produce drinks, in confectionery items, pickles, sauces and as preservatives[7]. Ginger leaf has also been utilized, particularly in China, in traditional medicine and food flavoring[8]. It has long been used in herbal medicine to treat a variety of symptoms, such as nausea, pain, and cold symptoms[9]. It contains gingerol, which has potent medicinal qualities and can be used to prevent some types of cancer. It also aids in digestion, has anti-inflammatory and antioxidant effects, and, according to research, helps with osteoarthritis, which is the degeneration of joints in the body[10]. It also lowers blood sugar and heart disease risk factors, lowers cholesterol, improves brain function, and guards against Alzheimer' disease. In addition to its anti-clotting properties, ginger can be utilized to prevent a number of heart conditions.

Ginger production is constrained by a range of environmental (abiotic) conditions as well as biological (biotic) constraints. The principal biological threats include; bacteria, fungi, viruses and plant-parasitic nematodes. Many microbial species cause agriculturally related infections including fungal infections such as soft rot[11]. Fungal infections also pose a significant threat in ginger, causing rhizome rot, soft rot, Sclerotium rot, and yellows disorder. Futhermore, nematodes cause root knot disease in ginger plants,, whereas viruses create mosaic and chlorotic fleck. Ultimately, these disease factors significantly lower rhizome development and yield[12]. The objective of this review is to summarize the current status of the ginger blight epidemic in Nigeria, examine its causes, epidemiology, and socioeconomic impacts on ginger production, evaluate existing disease management strategies, and identify knowledge gaps and future directions for sustainable control and recovery of the ginger industry.

GINGER PRODUCTION IN NIGERIA

According to Ewuziem *et al.*[13], Nigeria is one of the world's top producers of ginger after China, Thailand among other countries. The large arable land makes it suitable for the crop's cultivation in Kaduna, with so much links within the value chain from the producers to the processors[14]. Despite these natural benefits, the nation may lose its position as a global leader in ginger production due to a variety of problems, such as poor pest control, seed scarcity, unpredictable weather patterns brought on by climate change.

Nigeria has continued to face negative effects of ginger production as a result of diseases of which some of the causative agents have been identified[15]. This outbreak affected more than 30,000 hectares of farmland leading to a significant decline in production. Many farmers, unable to cope with rising production costs and repeated crop failures, are abandoning ginger cultivation altogether, switching to crops like maize, beans, cassava, or turmeric. This abandonment threatens to prolong the crisis into future growing seasons.

Additionally, a significant portion of the scarce ginger produced is still exported due to weak control regulations, further restricting local supply. Despite a 74% decline in Nigeria's ginger exports in 2024, local markets are still underserved because of continuous demand from outside sources. Farmers frequently find it difficult to obtain high-quality seedlings, fertilizer, and equipment during the input supply stage, and the high cost and subpar quality of these inputs continue to limit ginger farmers' productivity and earnings.

Smallholder farmers are mostly responsible for primary post-harvest operations which include washing, slicing, and drying after harvest. While the secondary processing stage, which entails converting ginger into goods like powder, essential oils, and confectionery items, is often handled by big businesses outside of Nigeria due the absence of industrial processing in the country. This lack results in a loss of value and income for the nation.

DISEASE OVERVIEW

The abrupt yellowing and drying of ginger leaves is a defining feature of ginger blight disease (Fig. 1), sometimes referred to as tuber rot disease. This epidemic causes the rhizomes of the plant to decompose in the soil (Fig. 2). The infection mostly damages underground tubers, causing them to turn brown and rot, while the afflicted area discharges a clear liquid. As the disease advances, white mycelium causes the infected plant's aerial parts to wither. Contaminated seed rhizomes and inadequately decomposed manure also serve as major inoculum sources. Damp environments favors the pathogens growth, which are favorable for blight disease, particularly in low-lying areas, thick soil, and poor drainage. Spores (conidia) formed on infected tissues are readily dispersed by splashing rain or irrigation water, facilitating secondary spread. Disease is a risk when unmatured manure is applied or crops are grown continuously. The symptoms of ginger blight and ginger soft rot, two significant fungal infections that harm ginger tubers, are comparable. These diseases obviously causes ginger to soften and develops into soft rot disease which is caused by an array of microorganisms[16]. Under humid conditions, some white mycelia similar to wet cotton may appear on infected tissues.

EPIDEMIOLOGY IN NIGERIA

Emergence and spread: An outbreak of ginger blight occurred in May and June of 2023, since then research has been conducted on the cause of the disease especially in the main hub of production; Kaduna, reports have shown that many fungal species were associated with this devastating disease associated with Nigerian ginger, ginger diseases can lead to huge losses because of lower quality and yield[17,18]. Reports indicate that the disease spread swiftly in eight local government areas in southern Kaduna as indicated by yellowing and drying of ginger leaves leaves (Fig. 1), there has been reports of visible discolouration of the rhizome[19] which can also be seen in the tissue damage in the cut rhizome from the farms as indicated in (Fig. 2). Fig. 1, causing production . Beyond field losses, this outbreak created a significant shortage of viable planting materials due to a narrow gene pool, making it challenging for farmers to replant and maintain agriculture because of reliance on very few varieties of ginger[20]. Due to the scarcity, demand has reached an all-time high, driving seed prices upward. Production costs of ginger have also increased as a result of rising seed, fertilizer, and fungicide prices which has also been reported in a study[21]. Additionally, insecurity that has been exacerbated by threats from kidnappers and bandits in key farming communities has further constrained agricultural activities and has also discouraged farming activities, disrupting the entire agricultural supply chain including ginger[22].

Reocurrence and resurgence: In 2025, ginger farmers expressed concerns over the re-emergence of ginger blight disease that devastated their farms in 2023, leading to a loss estimated at 12 billion naira[18,23].

For more two decades, after each harvest, a significant proportion of seeds often replanted by farmers in the country are seeds that are susceptible to infection. This continuous recycling of disease-prone seeds likely contributes to the persistent and recurrent outbreaks of diseases faced in ginger production systems.



Fig. 1: Ginger blight outbreak in a farmland in Kaduna State Nigeria, showing yellowing and drying of ginger leaves
Source: Onsite



Fig. 2: Ginger blight disease in the farm, showing diseased ginger rhizome and inside the rhizome
Source: Onsite

Some farmers who failed to apply any form of chemical on their farms due to unavailability or the high cost of the chemicals faced severe loss of their ginger crops. However, in another report by Ezima *et al.*[23], it was also noted that some farmers who used chemicals continued to suffer losses as a result of the disease. The main constraint in ginger cultivation and other root vegetables and production are as a result of poor processing and fungal infestation[24] which will significantly affect Nigeria's position as a leading global ginger producer among other crops.

SOCIOECONOMIC IMPACT

According to foreign trade data from the National Bureau of Statistics (NBS), Nigeria's ginger exports fell 74% from N23.76 billion in the same time in 2023 to N6.28 billion in the first nine months of 2024. The current outlook remains highly concerning, and without decisive intervention, further deterioration is likely. According to reports by Tanko *et al.*[25] the cost of agricultural produce including ginger increased significantly.

The effect of the the dwindling performance of agricultural produce, including ginger, Nigeria's agricultural sector fails to capitalize on high-demand international markets, leading to underutilized trade potential and reduced economic potential[26]. Ginger is an important cash crop and a substantial source of revenue for smallholder farmers in Nigeria, making the country one of the world's top producers of the vegetables[27]. The president of the Ginger Growers, Processors and Marketers

Association of Nigeria (GGPMAN) stated that the disease outbreak devastating farms is the reason why exports of the commodity are decreasing. Reports have indicated that the disease caused by ginger which is monitored by human visualization is not reliable and can still not tackle the future outbreaks, the use of new technology models such as machine learning could be of help[28].

CURRENT MANAGEMENT AND GOVERNMENT RESPONSE

The National Ginger Blight Epidemic Control Taskforce was created by the Federal Government of Nigeria in reaction to the outbreak with the goal of coordinating integral ted efforts to limit the disease, assist impacted farmers, and prevent future outbreaks. sIn order to revitalize the ginger farming industry in Nigeria, the Federal Government of Nigeria launched the Ginger Recovery Advancement and Transformation for Economic Empowerment (GRATE) initiative in October 2023 under the auspices of the National Agricultural Development Fund (NADFund). Government funding since not adequate to support ginger farmers across the country, a study suggested the strengthening of market access, youths' inclusion through better market linkages, entrepreneurship development, skills training, and youth-friendly funding opportunities[29]. In an effort to provide some reprieve, farmers in a number of important ginger-growing states have also received agrochemicals such as pesticides and fungicides. Despite these measures to curb the infection, many farmers, especially in Kaduna and Kano, the two main ginger growers, continue to experience substantial production setbacks due to rising insecurities[22] and continues occurrence of diseases. According to agricultural experts, sustainable recovery will depend more on the development and distribution of disease-resistant planting materials rather than on increased reliance on chemical control measures.

KNOWLEDGE GAPS AND RESEARCH NEEDS

One key research gap is the ability to promptly identify and combat the causative agents of ginger blight disease using biotechnology and associated epidemiological dynamics in Nigeria's distinct agroecological zones. There is limited in depth scientific research on long term solutions to the fungal strains. A large amount of information available is focused on the losses caused by the disease since its emergence in Nigeria, where it wiped out about 90 per cent of ginger crops in affected areas in 2023. Researchers and other institutions need to be strategic in solving the menace of ginger diseases to avert future occurrences and ensure a steady contribution to the agricultural value chain. Several reports from farmers indicate that chemicals used to combat ginger blight disease merely suppress the disease rather than completely eradicating it. Furthermore, some fungal strains have shown resistance to fungicides or combined treatments leading to negative effects in the agricultural space, even though combined treatments has shown some level of success which is not adequate[11].

An alternative for synthetic fungicides will be the use of several biological control, including *T. harzianum* and plant isolates, which are thought to be environmentally friendly and sustainable. Also, biotechnological techniques such as tissue culture and genetic engineering can be utilized to develop disease resistant varieties and high value cultivars[30]. More research will need to be carried out to understand the root cause and find a permanent solution.

BIOTECHNOLOGICAL APPROACHES FOR THE MANAGEMENT OF GINGER BLIGHT DISEASE IN NIGERIA

Biotechnology provides strong and sustainable solutions to address the current ginger blight epidemic in Nigeria by combating the disease at molecular, genetic, microbial, and diagnostic levels[30]. Biotechnological tools such as micropropagation have utilized in improving plant species. In vitro generation of haploids, somatic embryogenesis, somatic hybridization, germplasm preservation and storage, recombinant DNA technology, RNAi Biofungicides produced using dsRNA, Spray-Induced Gene Silencing and transgenics offer promising solution to managing disease infestation in crops[31]. Integrating modern plant biotechnology into ginger production systems can greatly lower the diseases incidences, increase productivity, and restore farmers' confidence.

One major obstacle to managing ginger blight disease in Nigeria is the late diagnosis of infection, frequently after significant rhizome damage has occurred. Molecular diagnosis and early disease detection, the creation of disease-resistant ginger varieties, the creation of disease-free planting material using tissue culture methods, and genetic transformation are all possible with biotechnology[32]. Biotechnology can also facilitate whole-genome sequencing of pathogenic fungi to identify virulence factors. Continuous recycling of infected rhizomes has contributed significantly to the spread of ginger blight in Nigeria; exploring these biotechnological techniques will reduce reliance on contaminated farm-saved seeds and boost ginger production.

For biotechnology to be effective, institutional support is critical:

- Establishment of plant biotechnology laboratories in ginger-producing regions
- Training of researchers, extension agents, and farmers in biotechnological applications
- Integration of biotechnology into national ginger recovery and biosecurity policies
- Promotion of public-private partnerships to scale innovations
- Until these issues are addressed, ginger prices will likely remain high, affecting not just home cooks and herbal vendors, but also businesses in the food, wellness, and export sectors
- Without widespread access to disease-resistant seeds, affordable inputs, and institutional support, the situation remains bleak

To stabilize ginger availability and prices, Nigeria must:

- Establish and fund biotechnology laboratories to rapidly produce disease-resistant seeds, which will be distributed to farmers
- Provide financial support and training in disease management
- Invest in long-term agricultural infrastructure and research

CONCLUSION

The ginger blight epidemic in Nigeria stands as a strong reminder of the vulnerabilities that exist within informal seed systems, weak plant health infrastructure, and insufficient disease management practices. A holistic, integrated approach to addressing these interconnected challenges is essential for unlocking the full potential of the ginger industry. Although government responses and recovery interventions have provided short-term relief, long-term success will depend on coordinated research efforts, reinforced biosecurity measures, and the development of disease-resistant ginger varieties. The application of biotechnology offers a potential sustainable, and a long-lasting solution to ginger blight disease in Nigeria. Strategic investments in diagnostics, resistant varieties, tissue culture, and microbial control will not only mitigate current outbreaks but also safeguard Nigeria's ginger industry against future epidemics. Strengthening Nigeria's ginger value chain is not only essential for farmer livelihoods but also for preserving the country's position in international spice markets.

SIGNIFICANCE STATEMENT

Ginger is one of Nigeria's most important spice crops and a major source of income for thousands of farming households, particularly in Southern Kaduna. In recent years, ginger production has been severely threatened by a devastating plant disease known as ginger blight, which has destroyed farms, reduced exports, and increased food prices. This review explains the causes and consequences of the ginger blight epidemic in Nigeria in simple terms, highlighting how it affects farmers, consumers, and the national economy. It also discusses current government responses and outlines how modern biotechnology, such as improved disease detection, clean planting materials, and resistant varieties, can help protect ginger production in the long term. Understanding and addressing this crisis is essential for food security, farmer livelihoods, and Nigeria's position in the global spice market.

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