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ORIGINAL RESEARCH ARTICLE

Onion bulb rot disease affecting yield of women producers in rural communities of the Gambia

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ABSTRACT

The surge of onion bulb rot disease poses a significant threat to smallholder farmers who depend on onion production as source of income. This study was conducted on onion bulb rot disease affecting the onion yield of women farmers in rural communities of Gambia to determine the onion bulb rot dissemination and damage caused by the disease. The sampling procedures was purposive method with a sample size of ninety farmers were interviewed. The data was analyzed for descriptive statistics presented in frequencies and percentages using SPSS software. The result showed that 60% of respondents indicate soft rot bulbs, 30% of leaf drops while 10% of the respondents indicate slime flux discharge from the root basal. The results indicated that majority 65% of the onion growers prepared their own nurseries for seedlings production and 30% of producers nursed their own seedlings and purchased others, respectively. The results show that significant ($p \geq 0.026$) relationship between time of planting and percentage damage cause by the disease. In addition, correlation analysis was done showing a strong positive ($r = 0.97$) relationship between time of transplanting onions and disease incidence. In conclusion farmers demonstrate awareness of symptoms and spread of diseases, showing a significant gap in knowledge regarding effective control and prevention measures. This research further recommends the use of best agronomic practices for control measure such as soil health management, seedling management, water management and integrated pest management practices for the control of onion bulb rot disease.

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INTRODUCTION

Onion (*Allium cepa* L.) is the most important vegetable grown in different parts of world for its efficient consumption locally and has high economic export value. The surge of onion bulb rot disease in the rural communities of the Gambia represents a critical challenge to the agricultural sector, particularly for smallholder farmers who heavily rely on onion production as a source of income. The exact cause of the destruction by the disease remains elusive (El Nahal *et al*., 2022). This uncertainty has compounded the difficulties faced by onion farmers in handling and mitigating the spread and prevention of the disease. Importantly, recognizing the severity, the government had taken proactive measures to address the issue of onion bulb rot disease imparting on the yields and income of women producers. Primarily, onion have been directed towards understanding the underlying causes of onion bulb rot and devising a pathway strategy for its control (Konjengbam *et al*., 2021). Moreover, through capacity-building initiatives and awareness campaigns among farmers and extension workers, efforts are designed to empower local communities with the knowledge and tools needed to tackle the challenges onion bulb rot disease in the

future. This research initiative aims to determine the prevalence and distribution of onion bulb rot disease in the vegetable gardens. However, the agricultural sector faces numerous challenges of poor yields, low quality seeds, inadequate knowledge which has implications to food insecurity, poverty reduction and overall economic growth (Adnan & Waleed, 2025).

Onion production emerged as an integral part of diversifying agricultural output and enhancing food and nutritional security in the rural communities, as 80% of the people consumed onion on a daily basis (Joshi & Dama, 2024). Onion bulb rot is a disease caused by various bacterial and fungi such as *Botrytis*, *Pseudomonas* and *Fusarium* resulting to discolored, and decaying of bulbs with foul odour. Onion diseases infection begins in the field and continue to develop on the bulbs during production activities while symptoms are clearly manifested on the onion. Importantly, effective control of post-harvest diseases begins with common understanding that, the disease emanates from field operations especially in the vegetable gardens. Ideally, appropriate cultural practices, including crop rotations, removal of infected onion debris and proper selection of cultivars are essential for controlling onion bulb diseases (Belo *et al*., 2023). Onion production in particular is importance in rural communities exceeding mere economic value rather has nutritional benefits for rural women and youths. Primarily, onion production serves as income generation, for women and youth farmers strengthening their financial muscles in solving family engagement at household level. In addition, onion as a commodity enriches the diets of local consumers of different age categories at the rural communities of the Gambia. According to (Ambomsa & Seyoum, 2020) onion consumption was estimated at 17,000 metric tons/ year while 6,000 metrics/ year was produced locally. Annual production and storage losses in onion as result of diseases can range from 10 to 50% or higher depending on the location, environment, and the causal agent involved (Chakraborty *et al*., 2022).

Over the year's producers have witnessed daunting challenges of onion bulb rot diseases locally known as "Jabaa tolo" widely spread across the regions. This disease is characterized by rotten onion bulb causing havoc to women producers across the country, posing a significant threat to better yields for livelihoods maintenance (Anjum *et al*., 2023). The economic importance of onion diseases begins to unfold and continue to develop during reproductive stages, while transiting to storage and marketing. Importantly, best cultural practices, including crop rotations, removal of infected onion debris, and selection of proper cultivars are essential for controlling onion diseases (El-Ashry *et al*., 2022). Keeping above in view, this research was conducted to address the existing gap of inadequate knowledge of the causes and spread of onion bulb rot diseases in the rural communities of the Gambia.

MATERIALS AND METHODS

Study area

The surveillance on onion bulb-rot disease was conducted in six Agricultural Regions from April to June 2024. The study was conducted in the six agricultural regions of West Coast Region (WCR), North Bank Region (NBR), Lower River Region (LRR), Central River Region/south (CRR/S), Central River Region/north (CRR/N) and Upper River Region (URR), where onion is massively cultivated, respectively. Ethical approval was obtained from the National Agriculture Research Institute under the Ministry of Agriculture, Livestock and Food Security before administering the questionnaire of the research.

Sampling and data collection

The sampling method was purposive where five vegetable gardens were selected in each region. In each garden site, three omen onion growers were selected to serve as respondents, thus a total of 90 onion growers were interviewed in the six agricultural regions. Table 1 shows the sampling frame of agricultural regions where onion is widely grown in the rural communities. The onion bulb-rot disease was assessed through observation of incidence and the level of damage during the time of production. Global Positioning System (GPS) was used to map out the coordinates of the various gardens to be able to identify the affected and non-affected areas of onion bulb-rot disease in the country. The interview method used was focus on individual and focus group discussion dilating on damage, control measures, and knowledge gap of women producers at field level. Onion production was clearly prominent in the rural communities particularly among the women and youths of the Gambia. In the process of collecting data, the consents of the respondents/participants were verbally agreed before the questionnaire was administered by women onion producers in the six agricultural regions while maintaining the confidentiality.

Table 1. Selected gardens across the agricultural regions.

S. No.	Agricultural regions	No. of gardens	No. of respondents	Total respondents	Actual respondents
1.	West coast Region	5	3	15	90
2.	North Bank Region	5	3	15	
3.	Central River Region/N	5	3	15	
4.	Central River Region/S	5	3	15	
5.	Upper River Region	5	3	15	
6.	Lower River Region	5	3	15	

Data analysis

The collected data was analyzed using SPSS software in a form descriptive statistic and presented in tables, figures and graphs. Data analysis, and interpretation of results was key in social research work. The data analysis guides the policy makers to take coherent decisions on matters related to good governance.

RESULTS AND DISCUSSION

The issue of land is sensitive and critical in the agricultural production and productivity. In terms of economic principles land is a factor of production for effective socio-economic activities. However, meaningful production activities cannot kick-start without access to arable land and high soil fertility (Ambomsa & Seyoum, 2020). The distribution of onion bulb rot disease in various regions of the country is presented in Figure 1. The result shows that onion bulb rot disease prevails in all the locations except Jahuru Mandinka located in Central River Region/ North as spotted in green colour. In addition, the results in Figure 2 presents the land area under onion production in each region. The findings show that North Bank Region had the highest land area under onion production than all the other regions followed by Upper River Region, Lower River Region, and Central River Region North. The West Coast Region was observed to have the lowest land area under onion production. However, arable land for onion production decreases as a result of salt intrusion in the low and upland fields which as negative impact on yields. Onion bulb rot diseases had significant threat to the agricultural sector, especially for smallholder farmers whose livelihood depends on onion production for income generation and livelihood substance. The exact cause of the disease remains unknown, making it difficult for farmers to manage, prevent and controlled the disease. The disease affects the roots base of onion that negative effects on yield, quality, quantity, and storage due to the spread of pathogens in the soil, (Zandamela *et al.*, 2024). The reveals that study that, quite a number of producers mentioned that the disease is difficult to handle as different mitigating measures like application of agrochemicals daunting to eradicate the disease. The pathogen invades the plant roots where symptoms are manifested on the leaves resulting to reduction in water from the soils to the leaves (Tariq *et al.*, 2022).

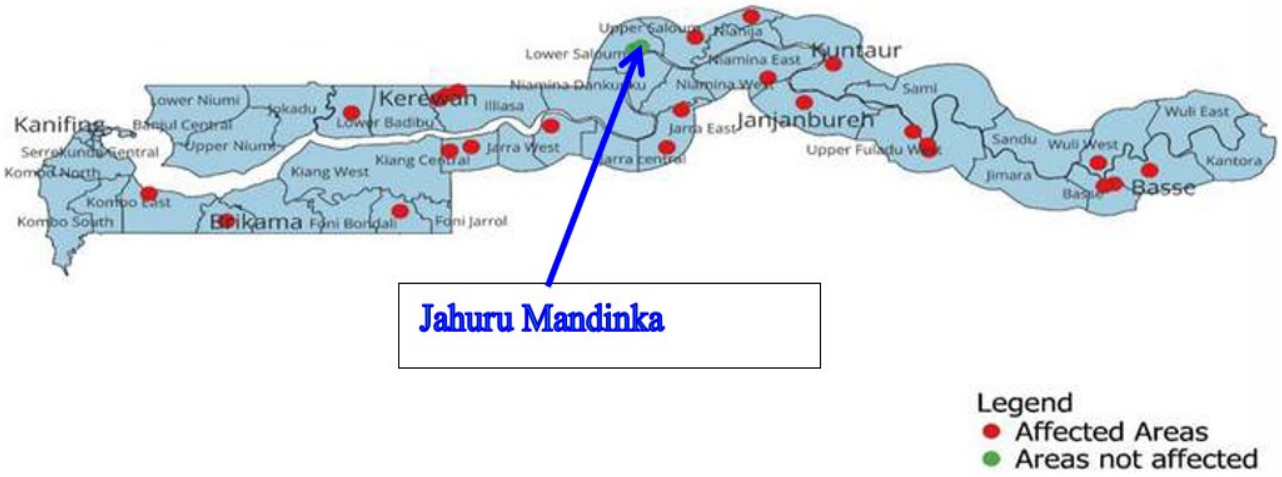

Figure 1. *Distribution of onion bulb rot disease in agricultural regions during 2024 vegetable season.*

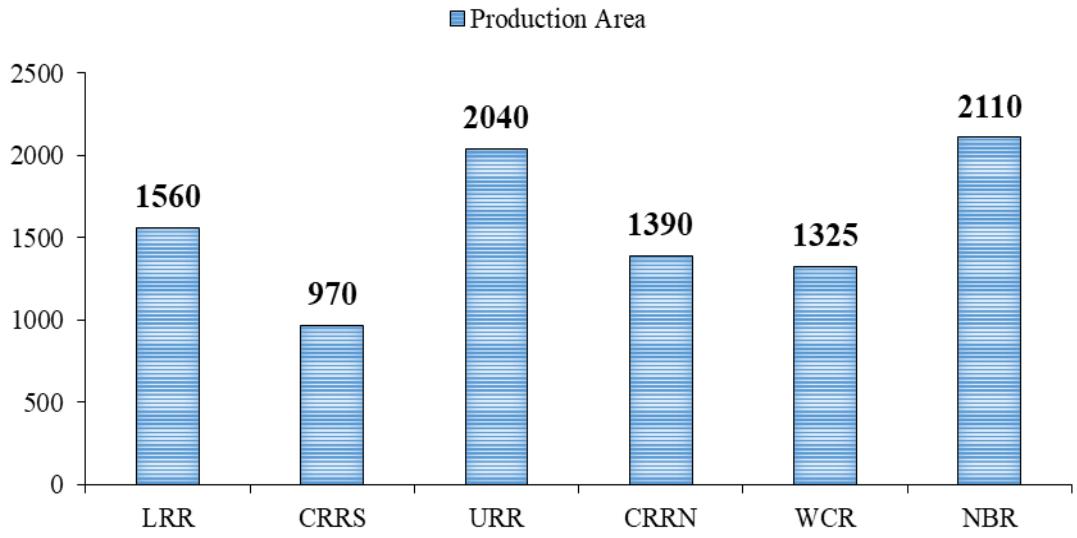

Figure 2. *Production area/ha of onion in different regions.*

Table 2. Shows symptoms of onion bulb rot disease in the regions.

Region	Disease	Causes	Causative agent	Symptoms	Percentage (%)
All the six onion producers	Onion bulb rot	Bacterial and fungal pathogens	*Fusarium oxysporum*	Yellow leaves	30
			Botrytis allii	Bulb rot and bad odour	60
			Sclerotinia cepivorum		
			Enterobacter cloacae	Leaf drops and watery discharge	10

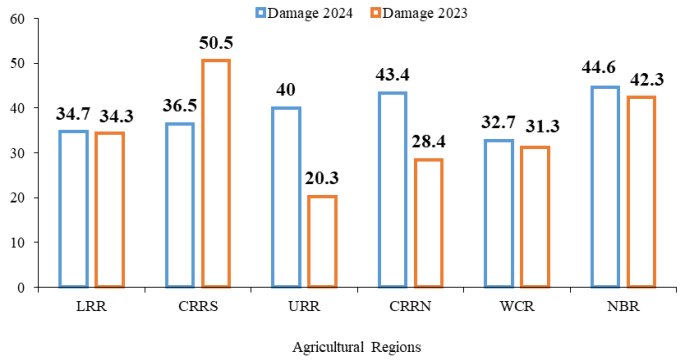

Figure 3. *Percent damage caused by onion bulb rot disease in different regions.*

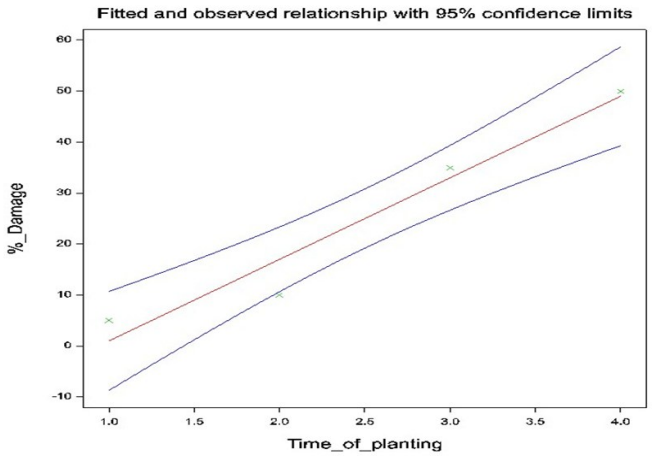

Figure 4. *Relationship between percent damage and time of planting.*

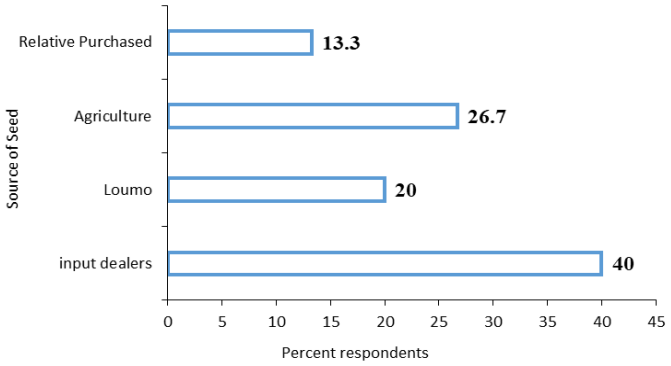

Figure 5. *Source of vegetable seeds.*

The results in Table 2 shows that, 60% of respondents indicate disease symptom of bad dour to leaf drop of 30% while 10% of the respondents indicate exudation of slime discharge from the root basal. According to (Hegazy *et al.*, 2025) onion basal rot is prevalent in the rainy season, while the incidence of the disease is higher during the dry season which has negative impact on the yield. The issue of onion bulb rot disease seriously affects the yield potential of onion while retarding the income of onion producers in the rural communities (El Nahal *et al.*, 2022; Hegazy *et al.*, 2024). The results in Figure 3 shows the number of farmers affected by onion bulb rot disease in 2023/2024 production season. In 2024 production season the percentage of respondents affected by the onion rot disease was highest in North Bank Region and West Coast Region of 100% while lowest percentage of onion farmers affected by the onion bulb rot was found in Central River Region of 67%, respectively. For last year 2023 onion production season, the highest percentage of farmers affected by the disease was observed in North Bank Region of 87%, Lower River Region 73% and Upper River Region 70%, respectively. On other hand, the incidence and severity of the disease was significantly manifested under rain-fed onion production conditions. Furthermore, the usually disease highly prevails in the rainy season as a result of favorable environmental conditions especially high humidity and soil moisture condition (Jaffar *et al.*, 2023). In comparison the percentage of farmers affected by onion bulb rot disease in the two seasons, significantly increases to 15% was observed in 2024 as compared to 2023 production season. The of farmers affected by the disease was attributed to cultural practices by onion growers that potentially favors the dissemination of the disease (Sharma *et al.*, 2024). The onion rot disease is highly contagious and easily disperse through splash water, soil pathogens and contaminated onion seedlings (Malik *et al.*, 2024).

The results in Figure 4 showed the relationships of planting times undertaken by the women farmers as a result of onion bulb rot disease. The result shows that there was significant relationship of ($p \geq 0.02$) between time of planting and percentage damage cause by the disease. There was clear indication that, the time of transplanting of onion seedlings in the field delayed from October to January, results to high incidence of soft bulb rot disease (Mukanga *et al.*, 2024). Importantly, proper irrigation management and cultural practices can limit the damage caused by onion bulb root disease (Sami *et al.*, 2021). However, improper fertilizer application or mechanical damage during field operations also predisposes plants to pathogens infection. In addition, correlation analysis was done and the result showed a strong positive relationship ($r = 0.97$) between time of planting onions and disease incidence (Hegazy *et al.*, 2025). In vegetable production reliable and quality source of assorted seeds or seedling is an integral part of obtaining better yields of onion. The sources of onion seeds by the respondents in the various agricultural regions were presented in Figure 5. The different sources of onion seeds outlined by the women producers were input dealers, and weekly markets, or otherwise relatives, respectively. Furthermore, it indicates that most of the women producers sourced their onion seeds from registered input dealers of 40 % followed by seeds supplied by the vendors at the "Lumo" of 20% and the lowest seed source was as a gift of 13.3%, respectively.

Conclusion and recommendations

The research findings on onion bulb rot disease in the different agricultural regions showed that, land under cultivation of onion production was high in the North Bank Region and the lowest was in Central River Region/South. The percentage of the women producers affected by the onion disease and the level of damage were also observed to be highest in the North Bank Region. The results revealed that the disease prevailed in all the agricultural regions except one location which is *Jahuru Mandinka* in Central River Region/North. The respondents were able to describe the symptoms of onion rot disease ranges from yellow leaves to leaf dropping and rotten bulbs respectively. However, majority of the onion producers did not receive any training on the control and prevention of onion bulb rot disease. Primarily, respondents were practicing various methods of control to help mitigate the damages caused by the onion bulb rot disease in their respective vegetable gardens. The majority of women producers grow their own onion seedlings in their gardens while few farmers purchased seedling from weekly markets and other farmers, respectively. The research findings observed that proper irrigation method at the susceptible stages of bacterial infection during production period. Interestingly, production planning and careful timing of irrigation interval after the last leaf has emerged from the neck of onion plants was recommended to limit losses without sacrificing the matured bulb. The correlation analysis showed a strong positive relationship between time of planting and disease incidence in the field. This indicates that the time of planting onion transit to January as rot disease increases in the field. In conclusion all the vegetable gardens visited were infected by onion bulb rot disease except one location in *Jahuru Mandinka* in Central River Region/North. The farmers in North Bank Region were found to be severely affected by the disease than the rest of the region and West Coast Region was less affected compared to the other regions. The disease incidence increased in 2024 as compared to 2023 vegetable season. Therefore, early transplanting of onions, effective water management, proper soil health condition and appropriate curing will significantly mitigate the incidence of onion bulb rot disease. The research findings recommend further research on the tolerance of different varieties of onion bulb rot diseases and other related infections associated to onion production and productivity.

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DECLARATIONS

Authorship contribution statement: Conception and Methodology: S.E.S., F.J.M., and I.M.; Software and Validation: I.M. and S.E.S.; Investigation: S.E.S. and F.J.M.; Data Curation: F.J.M. and S.E.S.; Writing original draft: S.E.S. and F.J.M.; Writing-review and editing: S.E.S. and F.J.M.; Supervision: S.E.S. and I.M. All authors have reviewed and approved the final version of the manuscript before submission.

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