ISSN (Online): 2455-3662
EPRA International Journal of Multidisciplinary Research (IJMR) - Peer Reviewed Journal
Volume: 10| Issue: 11| November 2024|| Journal DOI: 10.36713/epra2013 || SJIF Impact Factor 2024: 8.402|| ISI Value: 1.188

EFFICACY OF BIOLOGICAL CONTROL AN INSTITUTIONAL ASSESSMENT OF NON-CHEMICAL TREATMENTS FOR PLANT DISEASES IN YOLA, ADAMAWA STATE, NIGERIA

Halliru Abdu[1], Mohammed Bako Yerima[2], Ahmed Bello[3]
[1]*Ph.D Federal College of Education Yola Department of Psychology*
[2]*Federal College of Education Yola Department General Studies*
[3]*Federal College of Education Yola Department General Studies*

ABSTRACT
Biological control has emerged as a sustainable alternative to chemical treatments for managing plant diseases, reducing chemical residues, and preserving the environment. This study assesses the efficacy of biological control methods employed by institutions in Yola, Adamawa State, Nigeria. It evaluates their implementation, outcomes, and challenges. Data were collected from experimental farms on plants characters and disease incidences. The findings reveal a high potential for biological agents, such as Trichoderma harzianum and Bacillus subtilis, in controlling key pathogens affecting tomatoes and maize. Recommendations focus on capacity building and government policy support to enhance the adoption of these eco-friendly measures.

KEYWORDS: *Biological control, plant diseases, non-chemical treatments, Yola, Adamawa State, sustainable agriculture.*

INTRODUCTION
Plant diseases pose a significant threat to global food security, with annual crop losses attributed to pathogens estimated at 20–30% (Savary *et al*., 2019). The overreliance on chemical pesticides for disease control has raised concerns regarding environmental degradation, human health risks, and the development of resistant pathogen strains (Oerke, 2020). Biological control, which employs natural antagonists like beneficial microorganisms and bio pesticides, offers a sustainable alternative aligned with ecological and economic goals (FAO, 2021).Yola, Adamawa State, is an agrarian hub in North-eastern Nigeria, where crops such as tomatoes and maize are staple agricultural commodities. Despite the increasing availability of BCAs globally, their adoption in this region is minimal due to various challenges, including low awareness, inadequate funding, and a lack of technical capacity among farmers and institutions. Previous studies, such as those by Olufemi *et al*. (2020), emphasize the potential of BCAs in mitigating fungal and bacterial diseases under Nigerian agro ecological conditions. However, empirical evidence from localized studies is sparse.

This study explores the institutional implementation of biological control methods in Yola. It assesses the efficacy of BCAs in managing plant diseases and identifies the barriers to their adoption. By integrating experimental results and institutional perspectives, the research contributes to the growing discourse on sustainable agriculture in Nigeria. Chemical pesticides have been the cornerstone of plant disease management for decades, yet their overuse has led to significant environmental and health concerns. Biological control offers a promising alternative, leveraging natural enemies and microbial agents to suppress plant pathogens. This approach aligns with global trends toward sustainable agriculture and the Sustainable Development Goals (SDGs), particularly Goal 2 (Zero Hunger) and Goal 15 (Life on Land) (FAO, 2021).

Adamawa State, with its diverse agro ecological zones and reliance on agriculture, faces a dual challenge: increasing agricultural productivity and mitigating the environmental impacts of chemical inputs. Despite the availability of biological control agents (BCAs) globally, their adoption in Yola remains limited. Studies such as those by Olufemi *et al*. (2020) have highlighted the potential of *Trichoderma spp*. and *Pseudomonas fluorescens* in managing fungal diseases in Nigeria, but localized evidence is scarce. This research aims to bridge this gap by assessing the efficacy of biological control methods in combating plant diseases in Yola. It explores the institutional landscape, implementation strategies, and outcomes of non-chemical treatments, focusing on key crops such tomatoes, peppers,and maize. The study contributes to understanding how institutional frameworks and practical applications intersect to shape the adoption and effectiveness of BCAs. It further provides actionable recommendations for stakeholders, including policymakers, researchers, and farmers, to enhance the sustainable management of plant diseases in the region.

AIMS AND OBJECTIVES
1. To determine the efficacy of selected biological control agents in reducing plant disease incidence and improving crop yield

ISSN (Online): 2455-3662
EPRA International Journal of Multidisciplinary Research (IJMR) - Peer Reviewed Journal
Volume: 10| Issue: 11| November 2024|| Journal DOI: 10.36713/epra2013 || SJIF Impact Factor 2024: 8.402|| ISI Value: 1.188

2. To provide actionable recommendations for improving the adoption and effectiveness of biological control in Yola.

MATERIAL AND METHODS

The study was conducted in Yola, Adamawa State, located in Northeaster Nigeria between July 2024 to November 2024. The region has a tropical climate with distinct wet and dry seasons. The study focused on field experiments within University institutions, research farms. Yola's climate, characterized by distinct wet and dry seasons, presents conducive conditions for both crop cultivation and pathogen proliferation (Tukur 2020).The experiment was conducted on research farms at Modibbo Adama University Yola between july 2024 to November 2024 using a Randomized Complete Block Design (RCBD).Treatments included: a. Control (untreated plots) b. Chemical fungicide (standard commercial product) c. *Trichoderma harzianum* (biological agent)d. *Bacillus subtilis* (biological agent)**Crops** sown wereTomatoes (*Solanum lycopersicum*) and maize (*Zea mays*). Pathogens used were: *Fusarium oxysporum* (tomatoes) and *Pythium spp*. (maize). Diseases were monitored weekly, and data on disease incidence, severity, and plant health were recorded for eight weeks.A randomized complete block design (RCBD) was used in the field experiment. Three biological control agents Trichoderma spp., Bacillus subtilis, and neem oil—were tested against three major plant diseases: Fusarium wilt, Late Blight, and powdery mildew. The control group involved untreated plants. Biological control agents used were Trichoderma spp, Commercial formulations of Trichoderma harzianum were obtained from a local agricultural supply store and Bacillus subtilis. A liquid formulation of Bacillus subtilis was used, which is commonly marketed for its disease-suppressive properties.Neem Oil Cold-pressed neem oil was sourced from a local supplier, known for its antifungal and insecticidal properties. Field experiments were conducted on tomato plants affected by Fusarium wilt, Late Blight, and powdery mildew. Treatments were applied at the recommended dosages and intervals.Trichoderma spp. was applied as a soil drench and Bacillus subtilis was applied as a foliar spray and Neem oil was applied as a foliar spray mixed with water.

DATA ANALYSIS

Data were analysed using SPSS software (version 26). ANOVA was performed to assess significant differences in disease severity and incidence across treatments. Means were separated using the Duncan Multiple Range Test (DMRT) at a 5% significance level.

RESULTS AND DISCUSSION

Efficacy of Biological Control Agents Trichoderma spp. significantly reduced disease severity in all three diseases tested, with the highest reduction observed in Fusarium wilt (35%) followed by powdery mildew (30%) and Late Blight (25%).Bacillus subtilis was also effective, particularly against Late Blight, with a 40% reduction in disease severity, while it showed moderate effects on Fusarium wilt (28%) and powdery mildew (25%).Neem Oil had the least effectiveness but still provided a noticeable reduction in disease severity, with an overall average of 15-20% reduction in all diseases.**Diseases Incidence.***Trichoderma harzianum*: 65% reduction in tomato disease incidence compared to control.*Bacillus subtilis*: 50% reduction in maize disease incidence compared to control. **Crop yield** BCAs increased tomato yield by 30% and maize yield by 20% compared to control plots. **Cost-Effectiveness** BCAs demonstrated a 25% cost reduction compared to chemical fungicides over the growing season. The findings underscore the potential of BCAs as effective and eco-friendly alternatives to chemical pesticides. Similar studies by Akande *et al*. (2020) corroborate these results, highlighting their role in reducing pathogen load and improving crop productivity and (Olufemi 2020). s

CONCLUSION AND RECOMMENDATIONS

Conclusion

Biological control methods are effective in managing plant diseases and improving agricultural productivity in Yola. Despite their advantages, adoption is limited due to institutional and technical barriers. Strengthening institutional frameworks and enhancing farmer education are crucial for integrating BCAs into mainstream agricultural practices.

Recommendations

1. **Training and Capacity Building**: Conduct workshops and field demonstrations for farmers and extension workers on the use of BCAs.
2. **Policy Support**: Develop government policies to subsidize and promote the production and distribution of BCAs.
3. **Research and Development**: Encourage localized research on BCA efficacy and production to adapt to regional agroecological conditions.
4. **Awareness Campaigns**: Launch campaigns to educate stakeholders about the environmental and economic benefits of biological control.

Acknowledgment

This research was funded by the Tertiary Education Trust Fund (TET Fund) through an Institution Based Research (IBR) grant that enabled the successful completion of these research appreciations goes to the (TETFUNDS). The authors also acknowledge the support of the Federal College of Education Yola for the opportunity also appreciation goes to the Department of plant Science Modibbo Adamawa University Yola.

REFERENCES

1. *Akande, A. O., & Bello, K. M. (2020). "The Role of Biological Control in Sustainable Agriculture." African Journal of Agricultural Research, 15(3), 120–130.*
2. *Akande, A. O., & Bello, K. M. (2019). "Biological Control of Plant Diseases in Nigeria: A Review." Journal of Sustainable Agriculture, 12(3), 45–60.*

ISSN (Online): 2455-3662
EPRA International Journal of Multidisciplinary Research (IJMR) - Peer Reviewed Journal
Volume: 10| Issue: 11| November 2024|| Journal DOI: 10.36713/epra2013 || SJIF Impact Factor 2024: 8.402|| ISI Value: 1.188

3. *Alemu, T., & Bekele, T. (2020). "Comparative Analysis of Biological and Chemical Disease Management Strategies." African Journal of Plant Science, 14(2), 150–162.*
4. *Akinbode, O. A., & Olaniyi, O. S. (2018). Efficacy of biological control agents against soil-borne plant pathogens. International Journal of Pest Management, 64(3), 245-252.*
5. *Dada, O. O., & Ibrahim, M. (2020). Biological control of Late Blight in tomato using Bacillus subtilis and Trichoderma harzianum. Plant Pathology Journal, 36(4), 349-358.*
6. *FAO. (2021). "The State of the World's Biodiversity for Food and Agriculture." Rome: FAO.*
7. *FAO. (2021). "The State of the World's Biodiversity for Food and Agriculture." Rome: Food and Agriculture Organization.*
8. *Ibrahim, A. R., & Adedayo, M. A. (2021). Challenges in adopting sustainable plant disease management practices in Nigerian agriculture. Journal of Agricultural and Food Research, 2(1), 33-*
9. *Oerke, E.-C. (2020). "Crop Losses to Pests." Journal of Agricultural Science, 158(2), 1–10.*
10. *Olufemi, A. A., & Musa, K. A. (2020). "Efficacy of Trichoderma in Plant Disease Management." Journal of Plant Pathology Research, 22(4), 250–270.*
11. *Olufemi, A. A., & Musa, A. K. (2020). "Effectiveness of Trichoderma spp. in Managing Fungal Pathogens." Nigerian Journal of Plant Pathology, 18(1), 89–97.*
12. *Olaniyan, A. O., & Olubiyo, I. A. (2019). Neem oil as an alternative to synthetic pesticides in the control of crop diseases in Nigeria. African Journal of Agricultural Science and Technology, 7(2), 90-96.*
13. *Savary, S., et al. (2019). "The Global Burden of Crop Losses." Nature Sustainability, 2(7), 529–538.*