ASSESSING THE EFFICACY OF CHORAX 72% FUNGICIDE IN THE MANAGEMENT OF LATE BLIGHT (PHYTOPHTHORA INFESTANS) DISEASE ON TOMATOES

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ABSTRACT

Emergency of fungal diseases can be controlled using chorax72% fungicide however, there is limited information on its effectiveness under Uganda's unique environment. This study evaluated the effectiveness of chorax72% fungicide in controlling late blight disease and its effect on yield of tomatoes. The research was conducted using a randomized complete block design with three replications. The different treatments dosages of Chorax 72% included the recommended (37.5g/10L of water), 25% higher (46.9g/10L) and 25% lower (28.1g/10L), a reference fungicide (mancozeb at 25g/10L) and untreated control. Data was collected on severity, incidence and tomato yield including fruit yield weight and marketable fruits. The results showed that there was significant difference ($p<0.001$) among the dosages of chorax72% on the disease severity and incidence. There was also significant effect of Chorax 72% on yield weight ($p=0.015$) and marketable fruits ($p=0.012$) of tomatoes. The 25% higher dosage of Chorax 72% showed the lowest disease severity and incidence (1.54 ± 0.60^a and 0.20 ± 0.12^a respectively) while the untreated control had the highest severity and incidence with 2.97 ± 0.74^d and 0.91 ± 0.11^d respectively. The recommended dosage produced the highest fruit weight (2574g) and zero treatment had the lowest fruit weight (872g), both the recommended and 25% higher doses resulted in the highest number of marketable fruits(33.0fruits) compared to zero treatment (8.0fruits). This implies that the recommended (37.5g/10L) and 25% higher dosages (46.9g/10l) of Chorax 72% inhibits the pathogen growth on tomatoes leading to increased crop yield. Therefore, the recommended dosage (37.5g/10L) of chorax72% fungicide is recommended for controlling late blight disease in tomatoes in Uganda.

DEDICATION

I dedicate this report to my beloved family and Aunt Joy Awori, their unweaving support (financially and spiritually) and encouragement have been a source of strength during my study. Your tireless generosity and love have made this endeavor possible.

DECLARATION.

I, Othieno Capher, hereby declare that this research dissertation, entitled assessing the efficacy of chorax72% fungicide in the management of late blight disease on tomatoes is an original work carried out by me under the guidance of the instructor and I affirm that all information and ideas presented in this proposal are the result of my own investigation and intellectual effort, except where otherwise acknowledged.

Furthermore, I certify that this report has not been submitted for any other degree or qualification at this or any other institution of learning.

Signature:………………..

DATE : ……………………………

OTHIENO CAPHER

APPROVAL

This dissertation, entitled assessing the efficacy of chorax72% fungicide in the management of late blight on tomatoes, has been submitted to the department of agricultural sciences for review and approval.

The dissertation has been reviewed and approved by my Academic supervisor

Signature: .... Date: 16th/04/2025

MS. NAMUTOSI WINNIE (ACADEMIC SUPERVISOR)

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ACRONYMES

FAO - Food and agriculture organization.

MAAIF - Ministry of agriculture, animal, industries and fisheries.

P.Infestans_ Phytophthora infesstans.

IDM _ **I**ntegrated disease management

CHAPTER ONE

1.0 INTRODUCTION

1.1 Back ground.

Tomato (solanum lycopersicum) is one of the most widely cultivated and consumed vegetables globally being a staple in many diets dues to its nutritional benefits(Ddamulira et al., 2021) its ranked the third vegetable worldwide (Brief, 2022), Currently the global tomato production is at 186 million tones.).The food and agriculture organization (FAO) reported that Uganda's tomato was estimated at over 800,000 metric tons IN 2020 making significant increase from previous years.(FAO,2020).

However, despite of its importance, the tomato production (farmers) in Uganda faces serious hindrances/challenges, which are particularly from biotic stress most notably the diseases which accounts for a substantial portion of yield losses. Among these, late blight caused by the pathogen *phytopthora infestans* is one of the most devastating leading to severe reductions in crop quality and quantity (Byarugaba et al., 2018). Late blight not only affects tomatoes but also crops like potatoes and its management is pivotal for maintaining productivity. The late blight disease has characteristic symptoms such as water-soaked, gray-green circular lesions on leaves, as the disease progress ,the spots darkens and a white fungal growth forms underside the leaves eventually colonizing the whole plant (Quesada-Ocampo & Meadows, 2019)). This interrupts the plant's physiological processes leading to drying off of leaves, fruits with greasy spots hence the death of the whole plant. The use of a resistant variety is the best option tin the management of this disease, despite that the pathogen is more aggressive and highly adaptive in the environment, and a breakdown of resistance is reported making measure to often fall short when faced with significant disease pressure (Haverkort et al. 2009). So, the most reliable strategy left is the use of integrated disease management (IDM) for the disease, where fungicides stands as the most effective over the disease t(DEY et al., 2024).

The combination of cymoxanil and mancozeb has gained attention for its effectiveness against late blight. Cymoxanil is a systemic fungicide that can penetrate the plant leaves rapidly and act by preventing sporulation in fungi (Action, n.d) hindering the reproduction of spores from infected plants. While as mancozeb is a protectant fungicide that provides abroad spectrum contact action, disrupting fungal enzyme functions (Gullino et al., 2010). The dual action of the two active ingredients in chorax72% makes it a promising solution for tomato farmers in Uganda facing this threat of late blight. Though its effectiveness is not known yet. The study therefore assessed the effectiveness of chorax72% fungicide in controlling late blight disease in tomatoes for improved growth and yield.

1.2 Problem statement.

Despite the benefits of tomatoes, its production is challenged by the devastating pathogen *phytophthora infestans* (Akello L et al., 2023). The disease is reported to cause losses of about 30-70% (Akello L et al., 2023) studies showed a yield loss of upto 79.47% in susceptible under the favorable conditions for the pathogen. Management of the disease basically relies on synthetic Fungicides that stands out to be the effective strategy under intense disease pressure like Dithane (mancozeb), bravo (chlorothalinil) and indofil M-45(mancozeb) (Haveri et al., 2018). The repetitive use of the same type and formulations of the fungicide has led to development of resistance in *P. infestans* diminishing the long-term efficiency of these chemicals (Cohen et al., 2020). Studies shows that a combination of cymoxanil+mancozeb fungicides performs best in disease control and also influence the quality of tubers and fruits yield (Debanath S and P.S.Nath ,209) Kumar P et al.,2018). These exists on the Asian continent (India) where climatic conditions differ from Uganda's and this which may alter the genetic make-up of the pathogen and support the growth-patterns of crops differently hence affecting the response to the fungicide by the plant and the pathogen. However, for chorax72% fungicide formulation and field applicability, limited information is known on its effectiveness under Uganda's unique environment and the farmers behavior of applying without observing the prescribed dosages. Therefore, this study evaluated the effectiveness of chorax72% fungicide in controlling late blight disease and its effect on yield of tomatoes.

1.3 Research Objectives.

1.3.1 General objective.

To evaluate the effectiveness of Chorax72%fungicide in controlling the late blight in tomatoes for improved tomato yields.

1.3.2. Specific objectives.

1. To assess effect of chorax72% fungicide on growth of *Phytophthora infestans* in tomatoes
2. To determine the effect of altering the fungicide dosages on the yield of tomatoes.

1.4 Hypothesis.

1. Chorax 72% fungicide has no significant effect on the growth of *phytopthora infestans* in tomatoes.

2. Altering the dosages of chorax72% fungicide will significantly affect the yield of tomatoes.

1.5 Justification of the study.

Chorax 72%, a fungicide containing 8% cymoxanil and 64% mancozeb has been developed as one of the potential materials that can contribute to the management of late blight disease that causes devastating losses in the world. Based on the studies and applicability of the active ingredients contained in the fungicide, they show positive results when used as a single or mixed with other fungicides in inhibiting the growth and development of the pathogen p. infestans (Ogolla et al., 2021). This combination promises enhanced effectiveness by targeting the pathogen at different stages of its life cycle since the active ingredients in it have different and unique mode of action towards the pathogen.

However, for any new chemical introduced in a country its mandatory to go through the ministry of agriculture (MAAIF) for approval and registration under the Agricultural chemical control, Act 2006. This applies to the fungicide in study before its distribution and adoption, its important to assess its efficacy under the agro-ecological conditions of Uganda against the strains of the pathogen present.

The research evaluated the effectiveness of chorax 72% in controlling late blight and its impact tomato yield. The study would help the MAAIF stake holders in making informed decisions and recommendations of the dosage for farmers adoption in managing the late-blight disease.

1.6 Significance.

Tomato (Solanum lycopersicum) is one of the major horticultural crops grown extensively for its nutritious edible fruits (Akejo & Obbo, 2017). With over 20,000 small holders farmers particularly for income generation (Sonko et al, 2005), and the sector is dominated by male who do it for purposes of house hold income generation. (Ddamulira et al., 2021). Since the Late blight, caused by *Phytophthora infestans*, is a devastating disease that can result in significant yield losses to tomato growers, and the active ingredients contained in chorax72 % fungicide have been effective in controlling the *P. infestans* pathogen, it's very crucial to evaluate the efficacy of Chorax 72% fungicide compared to the widely-used Mancozeb under the Uganda agroecological zone. This study lies in its potential to enhance agricultural productivity and sustainability by providing effective solutions for managing late blight in tomatoes. This will reduce on the economic losses, increase the income of the smallholder farmers and their livelihoods through the increased productivity.

1.7. Conceptual frame work.

This conceptual frame works **serves** to summarize how the research was done bringing out the relationship among the components of my investigations (Anfara and Mertz, 2014). The independent variables, the variables that were the major key factors of the experiment study being chorax72%fungicide application the dosage (the recommended dosage,25% higher and lower than recommended dosage) and frequency of application, also the fungicide properties (chemical composition, mode of action).

The dependent variables, the assessment depended on the main dependent variables are the disease progress (severity and incidence) after the fungicide application and the yield response in different treatments.

Intervening variables, these are factors that controlled the experiment for example, the experiments were also dependent on the environmental factors like humidity and rainfall patterns affect the pathogen activity and also the susceptible tomato variety which prone to the disease.

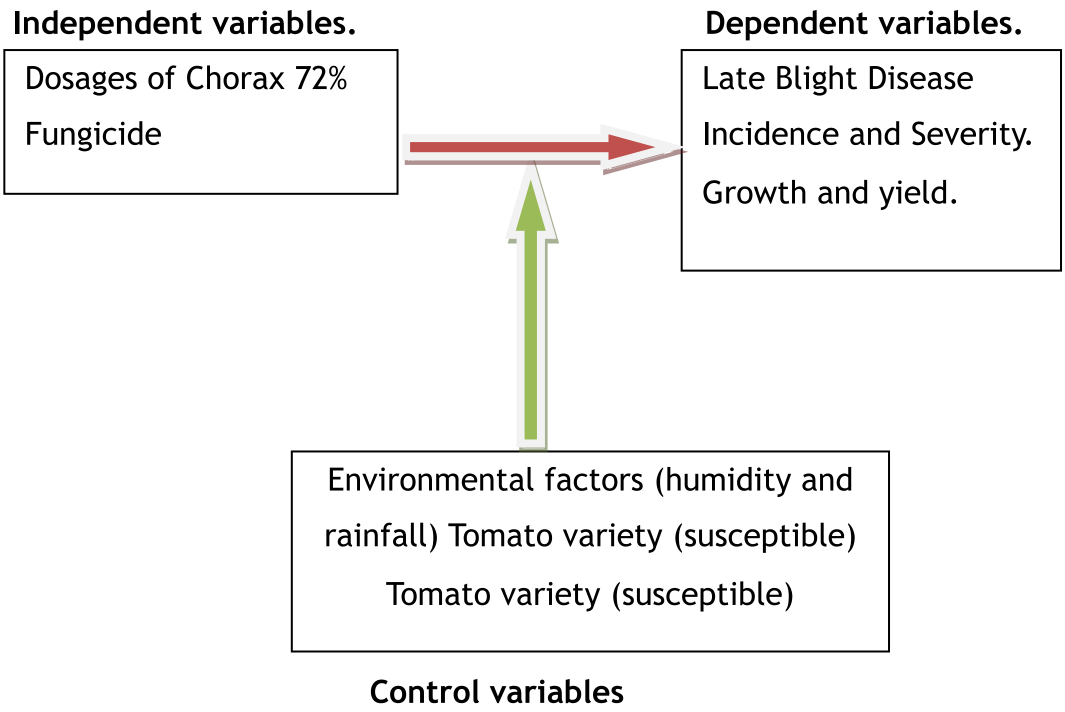

Figure 1: Illustration of conceptual framework

1.8 Scope of the study.

The experiment evaluated the effectiveness of chorax72% fungicide on the management of *P. infestans* in tomatoes and this was conducted at Makerere agricultural research institute Kabanyolo (MARIK) from December 2024 to february2025.

CHAPTER TWO

2.0. LITERATURE REVIEW.

2.1.1. The importance of the Tomato production.

Tomatoes are a crucial component of global diet, with production levels reaching 180 million tones per year as of 2019, ranking them as the most important vegetable crop (Hong et al., 2022). They are rich in vitamins phytonutrients and minerals contributing to public health and nutrition (khanh et al., 2020). The economic importance of tomatoes extends beyond their nutritional value, they are an essential source of income for millions of farmers and play a key role in national income particularly in developing countries (Khanh et al., 2020).

2.1.2 Late blight.

Late blight is devastating disease caused by the oomycete pathogen pytophthora infestans. This pathogen is notorious for causing the Irish potato famine in 1840s that led to death of over million people (Quesada-Ocampo & Meadows, 2019) .it affects tomatoes and other members of the solanaceae family such as potatoes, petunias and nigh shade. With several symptoms on the tomato plant ; irregular water soaked lesions on leaves, often with a lighter halo around them, white cottony growth on the underside of leaves where sporangia forms, brown to gray lesions on the surface of leaves, blighted leaves and stems that curl, shrive and eventually die and rotted fruit with greasy spots that become leathery and chocolate brown ((Nelson, 2008)

2.1.3. Origin and distribution of *P. infestans*

Phytophthora infestans originated in America and has since spread globally (fry et al., 2016). As a hemibiotrophic pathogen, it takes nutrients from living tissues and transitions to necrotic phase, decaying its host tissues during infection (Zhang et al.,2014). The ability of *P. infestans* to thrive in various environmental conditions has facilitated its widespread distribution and emergence as a major pathogen responsible for substantial crop losses in tomatoes worldwide (fry et al., 2016).

2.2. Disease development and lifecycle.

The development of late blight disease is influenced by several environment factors including temperature, humidity and leaf wetness duration optimal temperature ranges between 15-25 degrees with relative humidity >90% or prolonged leaf wetness (Gonzalez ,et al .,2021) under these conditions the sporangia produced by *p.infestans c*an germinate rapidily and infect the host tissue. The pathogen can undergo both sexual and asexual life cycle. The asexual life cycle of *Phytophthora infestans* is characterized by alternating phases of hyphal growth, sporulation, sporangia germination (either through zoospore release or direct germination, i.e. germ tube emergence from the sporangium), and the re-establishment hypha growth.(*Nowicki,et al.,2013*).

2.3. Economic importance of late blight in the tomato production.

The economic implications of *p.infestans* outbreaks are profound, as late blight can lead to catastrophic yield losses, often exceeding 50% in severely affected areas within a short span of time (Duarte c et al., 2018). The pathogen's rapid reproduction and adaptability through genetic mutations enable it to overcome host resistance through genetic mutations enable it to overcome host resistance and fungicide application, hence this necessitates continuous management efforts (Duarte c et al., 2018). So the fear of late blight prompts farmers to apply fungicides prophylactically and multiple sprays to overcome it which affects the growers economically (Yang et al.,2023).

2.4.0 Control methods.

2.4.1 Biological control/eco-friendly management

This method is gaining importance due to the negative impacts of chemicals. A study found that leaf extracts from onions, garlic, Malus toringo revealed positive inhibition of the mycelial growth of *P. infestans*. Other antagonists such as Bacillus subtilis B5 and Trichoderma viride have also been found to be effective. (Lal et al., 2017)

2.4.3 Host resistance

The use of resistant varieties is among the most effective and environmentally safe tools for late blight management (FAO, 2008).

The host plant resistance reduces the incidence of late blight; delays the onset and development of disease and the required number of sprays. Plant resistance for late blight started with the introduction of the resistance gene (R-gene) though it has been broken by virulent strains (Binyam et al., 2014).

2.4.4. Chemical management;

Fungicides application remains the most prevalent method of managing late blight in tomatoes. There are several fungicides available for late-blight management such as; Mancozeb, Mancozeb+ Metalaxyl, Ridomil Gold, indofila, Mancolaxyl, (Mancozeb and Metalaxy-M), Fungomil, Mancolaxyl 72% among others (Haverkort, et al., 2012). Generally, the fungicide application has been the only reliable management for late blight however, the consistent use has led to the development of systemic fungicide resistance in *P. infestans*. The genetic diversity complicates management strategies as different strains may respond differently to control measures tasking for introduction of newer fungicides to divert the pathogen.

2.5. Chorax72% fungicide.

Chorax72 % fungicide contains cymoxanil8%and mancozeb64%. It has a dual mode of action as both a protective and a curative fungicide as per the properties of its active ingredients making it a valuable tool in the disease management.

2.5.1. Mode of action.

Studies indicate that cymoxanil operates through its ability to cause cell death in pathogen its less toxic to beneficial microbial populations (NA & MS, 2016). It controls diseases during the incubation period and prevents the appearance of damage on the crop. ((Safety et al., 2024). Mancozeb, a dithiocarbonate, disrupts the pathogen's extracellular enzyme production and spore germination mechanisms (fry, 2016).

2.5.2. Field trials of cymoxanil + mancozeb combinations.

Studies have shown that a combination cymoxanil and mancozeb is highly effective in controlling late blight when applied as a prophylactic measure (before appearance of disease symptom) as well as curative. (Sharma, 2013). Based on the field study comparing different fungicides in the management of late blight in potatoes "}(NA & MS, 2016), Recent studies on the investigation of the efficacy of fungicides in controlling the late blight shows that a combination of cymoxanil and mancozeb fungicides proved to be more effective in controlling the late blight disease of tomatoes and it had a positive impact on the yield of tomatoes(Das, 2022). A study by (Debnath S., et al 2009) also recorded that there was lowest disease severity observed in the treatment with the mixture of sprays of mancozeb

64%+ cymoxanil8%-72%wp@1500g/ha as compared to other sprays like infinity 68.75% and metalaxyl8%+mancozeb 64%-72 wp when used in the management of late blight disease. This gives its potential but still this formulation is not adopted in the country by the farmers.

CHAPTER THREE.

3.0. Methodology.

3.1. Experimental site.

The experiment was conducted at Makerere University Agricultural Research Institute Kabanyolo (MUARIK) field. MUARIK is located on spatial coordinates 0˚27'60"N, 32˚36'24" E at an altitudinal range of 1250m to 1320 m above mean sea level (Yost, D et al., 1990). The study site is within in the administrative boundaries of Nangabo sub county, Wakiso district abou19 kilometers north of Kampala along the Gaya-Zirobwe road, sited on 650 hectares serving as a hub for training, research, outreaches and agricultural production.

Kabanyolo is part of the Lake Victoria basin that receives an average annual precipitation of 1218 mm and slightly drier periods in June to July and December to February. The average annual temperature is 21.5˚C making it suitable for agricultural projects (Komutunga, E.T. et al.,2001).

3.2. Materials and equipments

The Ansal f2 tomato variety was used for the study, seedlings were raised and managed using standard nursery practices at MAURIK. Transplanting was done four weeks after seedling emergence with handful of organic manure per plant. Three different concentrations of chorax72% fungicide (recommended dosage, 25% higher and 25% lower than the recommended dosage), mancozeb as a reference fungicide and the untreated were included for comparisons. The agronomic practices that are weeding, pruning and gap filling were done as recommended.

The equipment used included: knapsack sprayer, Data sheets (hard copies), long ruler, disease diagnosis manuals, tags, pencils, Weighing scale.

3.3. Experimental design.

The experimental field was laid out in a randomized complete block design with replications (Olsson, 1978) The plots size were measuring 3m×3 m with 15 plots. Covering the total area of 135 square meters. The seedlings were transplanted at a spacing of 50cm ×50 cm with a total of 36 plants per plot. The experiment relied entirely on natural infection (Gudero et al., 2018).

3.3.1. Treatment allocation.

Treatments were randomly assigned within each replication and properly tagged before fungicide application.

Rep 1	Zero treatment	25% Lower Dose	Chorax72% Recommended Dose	Reference Dose	25% Higher Dose
Rep 2	Reference Dose	Zero Treatment	25% Higher Dose	25% Lower Dose	Chorax72% Recommended Dose
Rep 3	25% Higher Dose	Chorax72% Recommended Dose	Reference Dose	25% Lower Dose	Zero Treatment

Figure 2: **Illustration of the field lay out**

3.4. Fungicide application.

The fungicide chorax72% was applied at recommended dosage of 37.5g/10 liters of water, altered the dosage 25% higher the recommended (46.9g/10l), 25% lower the recommended (28.1g/10l) and mancozeb at manufacturers dosage (25g/10l). The spray started at the appearance of the symptoms of the late blight disease at the interval of 12 days apart from the control that received zero chemical (Gudero et al., 2018).

3.5. Data collection.

Each plot had six rows but data collection was limited to the middle four rows excluding the boarder plants. Ten plants in each plot were tagged for data collection(Poudel et al., 2020).

3.5.1. Data collection For Objective One:

To assess effect of chorax72% fungicide on growth of *Phytophthora infestans* in tomatoes

Disease severity and incidence.

To achieve objective one, the whole plant was assessed for severity and incidence. The severity of the disease was scored at the scale of 1-4 (Maerere et al.,2010 and incidence as percentage by formula (n/N)*100 as by Meya et al.,2015 for three times during the experiment. Also, the number of infested leaves, branches and fruits were recorded.

3.5.2 Data collection for Objective Two:

To determine the effect of altering the fungicide dosages on the yield of tomatoes.

Yield performance

At maturity the red tomato fruits were harvested, taken to the lab for yield assessment. The tomatoes from each plot were weighed using a weighing scale and recorded in grams, calculated the yield increase(gm) and graded into marketable and unmarketable fruits (Gudero et al., 2018).

3.6.0. Data analysis.

Data for both objectives was analyzed using Genstat-12th edition to get the means, standard deviations and standard errors. The p-values and the LSD were got by running the Analysis of variance (A NOVA). A post-hoc test was done using the Bonferroni for the significant difference among the treatments.

CHAPTER FOUR

4.0. RESULTS.

4.1 Objective one: To assess the effect of chorax72% fungicide on the progress of phytophthora infestans in tomatoes.

4.1.1 Effect of chorax72% fungicide on *P. infestans* progress in tomatoes.

The results in (table:1) presents the mean incidence and severity of late blight caused by phytopthora infestans under different treatments using chorax72% fungicide. The treatments included varying dosages of chorax72% (25% higher, recommended& 25%lower), a reference and zero treatment. Both the severity and incidence were significantly affected by the treatments ($p<0.001$). The treatment with no fungicide application (zero) showed the highest severity of 2.97 ± 0.74^{d}, while the treatment with 25% higher than the recommended dosage of chorax72% fungicide showed the lowest severity of 1.54 ± 0.60^{a}. The results also show the treatment with Zero fungicide application had the highest disease incidence of 0.91 ± 0.11^{d}, while the treatment with 25%higher dosage showed the lowest incidence with 0.20 ± 0.12^{a}.

In table 2, showed that there was highest number of leaf infection in the treatment with zero fungicide that is $9.91{\pm}5.83^{c}$ and the treatment with the 25%higher showed the lowest number of leaves infected ($2.4{\pm}2.77^{a}$). The highest number of fruits infected was recorded from the treatment with no fungicide application ($1.33{\pm}1.71^{c}$) while the lowest number of fruit infection was recorded from the treatment with 25% higher dosage of chorax72%($0.1{\pm}0.31^{a}$).

Table 1: The incidence and severity of late blight disease in tomatoes treated with different doses of chorax72%.

Treatment	Severity (Mean ± SD)	Incidence (Mean ± SD)
25% Higher	**1.54 ± 0.60^{a}**	**0.2018 ± 0.118^{a}**
Recommended	1.78 ± 0.72^{ab}	0.2144 ± 0.10^{a}
25% Lower	2.00 ± 0.7495^{bc}	0.2650 ± 0.05^{b}
Reference	2.08 ± 0.84^{c}	0.3370 ± 0.099^{c}
Zero	**2.97 ± 0.74^{d}**	**0.91 ± 0.11^{d}**
p-value	< 0.001	< 0.001
LSD (0.05)	0.198	0.076

$P < 0.001$ shows the significantly different among treatments. $^{a,\ ab,\ bc,\ c,\ d,}$ show the differences between the treatments (dosages of chorax72%) use to control late blight in tomatoes.

Table 2: The tomato leaves, branches and fruits infected by p. infestans treated by different dosages of chorax72%).

Treatment	Infected leaves	Infected branches	Infected fruits
25% higher	2.4 ± 2.77^{a}	1.100 ± 0.37^{a}	0.1 ± 0.31^{a}
25% lower	4.96 ± 3.88^{b}	1.19 ± 0.47^{b}	0.63 ± 1.16^{b}
Recommended	4.09 ± 4.13^{ab}	1.27 ± 0.67^{b}	0.37 ± 0.67^{ab}
Reference	4.34 ± 3.46^{ab}	1.44 ± 0.51^{b}	0.4 ± 1.00^{ab}
Zero	9.91 ± 5.83^{c}	1.78 ± 0.93^{c}	1.33 ± 1.71^{c}
P-value	<0.001	<0.001	<0.001
L.s.d	0.2148	1.215	0.5501

P< 0.001 shows the significantly different among treatments. [a, ab, bc, c, d,] show the differences between the treatments (dosages of chorax72%) use to control late blight in tomatoes

4.2. Objective two: To determine the effect of chorax72% fungicide on the yield of tomatoes.

4.2.1. To determine the effect of altering the fungicide dosages on the yield of tomatoes.

The application of chorax72% fungicide caused statistically significant effect on the yield of tomatoes both on the yield weight (p=0.015) and marketable fruits (p=0.012).

The recommended dose produced the highest fruit weight (2574g) which was significantly higher than the zero treatment with (872g). Both the recommended dosage and 25% higher dose produced the highest number of marketable fruits (33.0 and 33.0 fruits) respectively, all of which were significantly higher than the zero treatment (8.0 fruits) as shown in figure 2. The error bars that do not overlap one another shows a significant difference among the treatments .

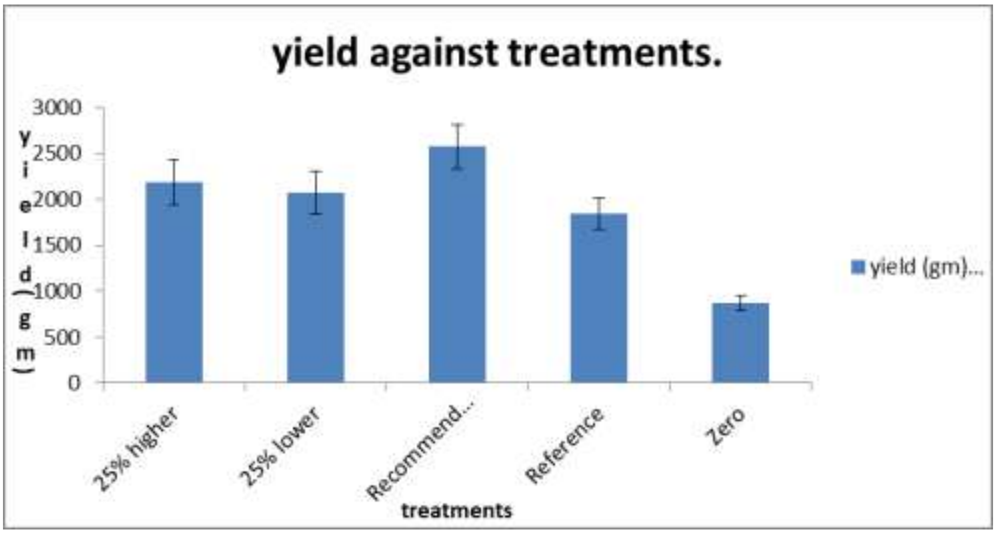

Table 3: The yield (g) of tomatoes among the dosages of chorax72% .

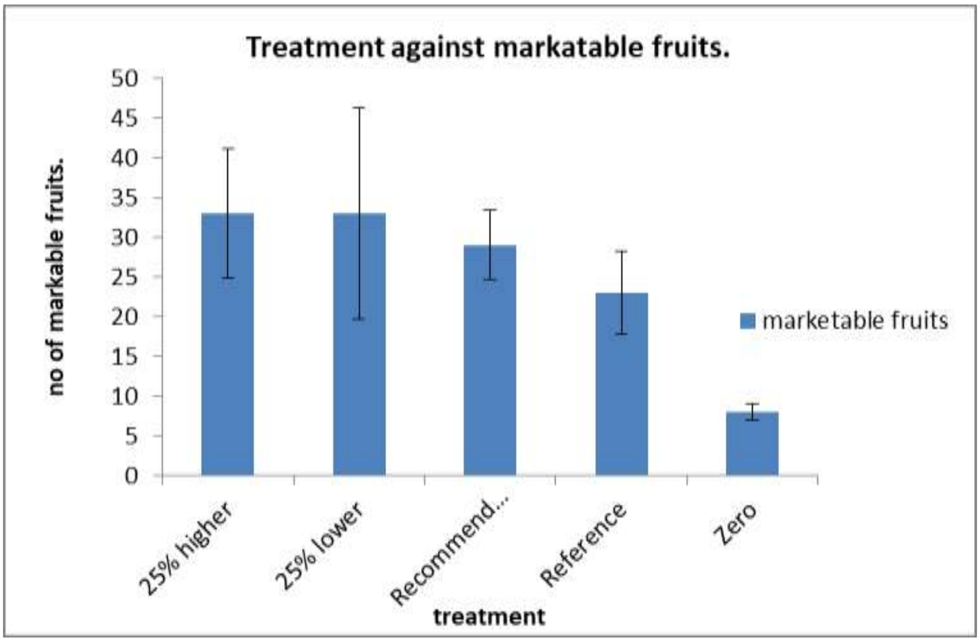

Table 4: The number of marketable fruits among the different dosages of chorax72%

CHAPTER FIVE.

5.0 DISCUSSION AND CONCLUSION.

5.1 For Objective 1: To assess the effect of chorax72% fungicide on the progress of phytophthora infestans in tomatoes

Results presented in table1, from the experimental trials revealed that all the treatments reduced the disease incidence and severity of late blight disease over the control (zero treatment). The maximum disease severity (2.967±0.7412) was recorded in the control. Among the treatments, lowest was recorded in the 25% higher dosage of chorax72%@46.9/10litre of water (1.778±0.71). The maximum disease incidence (**0.91 ± 0.11**[d]) was recorded in the control (zero treatment) whereas the minimal disease incidence (**0.2018 ± 0.118** [a]) recorded from the 25% higher dosage. This implies that increasing the dosage above the recommended slightly improves the control of disease severity and incidence, untreated plants are most vulnerable to the infestation pathogen. Similarly, the findings reinforce that using chorax72 fungicide reduced the disease progress as it was when moximate (cymoxanil8+mancozeb 64%) had the lowest disease intensity among other fungicides (Kumar .P et al., 2018).

5.2 For objective Two: To determine the effect of altering the fungicide dosages on the yield of tomatoes.

Chorax72% fungicide had a positive effect on the tomato yield of tomatoes which is similarly to the study by (R. Das et al.,2022) (figure 2); where the treatment with combination of cymoxanil8+mancozeb 64% fungicide had the maximum yield of tomatoes as compared to other chemicals. The significant difference in yield weights with chorax72% fungicide especially at recommended dose of suggests that the fungicide effectively controlled the pathogen impact on the crop that might otherwise limit fruit development and weight gain. This is supported by previous research findings that the fungal infection can significantly reduce the photosynthetic capacity and nutrient allocation with tomato plants for fruit development (Smith et al.,2018).

In the present study, the minimum *p. infestans* progress and maximum fruit yield was found in the treatment with chorax72% fungicide that is 25%higher dosage and recommended dosage. This could be explained by the fact that higher dosages were efficient enough to inhibit the diseases producing activity of the pathogen in the plant, which resulted into a better overall growth and health of the tomato plants treated as compared to the other treatments ((Sharma, 2013). However, this research did not look at the infestation levels of pathogen at different growth stages of tomato yet its also important to know which the pathogen is most effective for efficient control.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion.

For objective one, the hypothesis stated that Chorax72% fungicide has no significant effect on the growth of p. infestans in tomatoes. According to the results, chorax72% had a significant difference ($p<0.001$) in late blight disease incidence and severity in tomatoes treated with different dosages of chorax72%. With low severity and incidence shown in25%higher dosage (**1.54± 0.60**and**0.20 ± 0.12**respectively**)** and high severity and incidence was observed when no chorax72% was applied with (2.97±0.74&0.91 ± 0.11) respectively, therefore with these results, I fail to accept the hypothesis.

For objective two, the hypothesis stated that altering the fungicide dosages will have significant effect on the yield of tomatoes and based on the results, there was a significant positive effect on the yield($p=0.012$). Therefore, there I fail to reject the hypothesis

6.2 Recommendations

One season evaluation of the chorax72% fungicide cannot give a conclusive information about its effectiveness thus a need for further assessment. Therefore, further study should be done for over three seasons and on what stage the disease effects on the crop are more severe.

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APPENDICES

Appendix 1. Time line

Activities	Sept	Oct	Nov	Dec	Jan	Feb	March	April	Cost(ugx)
proposal development									25000
experimental setup									50000
Data collection									100000
Data analysis									
Report writing.									50000
Total cost(ugx)									225000

Appendix 2 .Data sheet

ASSESSING THE EFFICACY OF CHORAX72% FUNGICIDE IN CONTROL OF LATE BLIGHT IN TOMATOES.

Researcher Name: ________________________

Site : ______________________________

Week of data collection

Date: ____________________________________ Replication Number:

Treatment code	Plant number.	Height	Stem	No of h	Infected leaves	No , branches	Infected branches	Severity(1-4)	Incidence.(%)	Yield (gm)t	Marketable fruits.
	1										
	2										
	3										
	4										
	5										
	6										
	7										
	8										
	9										
	10										
	1										
	2										
	3										
	4										
	5										
	6										

Appendix 3. Field Data collection