BUSITEMA UNIVERSITY
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P.O. Box 236, Tororo, Uganda
Gen: +256 - 45 444 8838
Fax: +256 - 45 4436517
Email: info@adm.busitema.ac.ug

www.busitema.ac.ug

PREVALENCE OF TOMATO DISEASES IN BULUGANYA SUB COUNTY, BULAMBULI DISTRICT, UGANDA

By

WODAMBA CHRISTOPHER

BU/UP/2020/2885

RESEARCH REPORT SUBMITTED IN PARTIAL FULLFILMENT OF THE REQUIREMENT FOR THE AWARD OF THE DEGREE OF BACHELOR OF SCIENCE EDUCATION IN THE BIOLOGY DEPARTMENT OF BUSITEMA UNIVERSITY.

OCTOBER 2023

CONSENT FOR SUBMISSION

I have satisfactorily read through the Dissertation and consent to its submission to the department of Biology, Nangongera campus for award of Bachelor of Science and education of Busitema University.

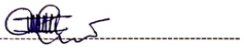
Sign ..... Date 16/01/2024

Madam Natukunda Flavia
Department of Biology
Busitema University
P.O.BOX 236, Tororo, Uganda.

DECLARATION

I, Wodamba Christopher, declare to the best of my knowledge that the study here forth is my original work, and has not been submitted to Busitema University or any other University or Institution before for the award of a degree or diploma.

Candidate

Signature  Date 16/01/2024

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I sincerely appreciate the chairperson and the whole community of Buluganya Sub county for the great cooperation they gave; Mr. Kimanya Alex who helped me greatly in interviewing the farmers and distributing questionnaires and moving to their plantations, thank you very much.

DEDICATIONS

To my relatives who stood for their self-support and beloved friends whose love and support has pushed me through.

ABSTRACT:

Tomatoes (Solanum lycopersicum) are one of the most essential vegetable crops grown all over the world because of their important nutrients. The majority of people in the world eat them on a daily basis. Tomatoes have nutrients like vitamins A, C and lycopene, which are important in human beings for reducing heart diseases and prostate cancer and other age-related diseases. Solanum lycopersicum. is prone to various diseases that can cause significant yield losses**. The aim of this study** was to determine the prevalence of tomato diseases in Buluganya Sub county, Bulambuli district and determine the most diseases affecting tomato production. Tomato diseases are significant concern to farmers, and these diseases are mostly caused by fungi, bacteria, virus and other pathogens. The diseases have resulted into significant yield loss, reducing the quality and quantity of tomato fruits. They increase the cost of production due to the need for diseases management practices to ensure sustainable quality production. Specific objectives are: to determine the most diseases affecting tomatoes, to find-out the causes of tomatoes diseases, to find out the management practices use to reduce the effects/losses due to diseases. Field survey was conducted in Buluganya Sub county, Bulambuli district, tomato plants with signs and symptoms of disease were observed and results collected using observation, interviews and questionnaire. The prevalence of tomato diseases was determined, the most common diseases affecting tomato production was identified in Buluganya Sub County, Bulambuli district. On analysis the chi-square (x^2) value (1.344) at p-value 0.05, then the null hypothesis (H0) was rejected and the alternative was accepted

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CHAPTER ONE:

INTRODUCTION

1.1 Background

Tomato (Lycopersicum esculentum.) belong to the family Solanaceae. It originated from Peru, a country in South America. It is a most common horticultural crop for the market (Pritesh and Subramanian, 2011) and essential due to the dietary nutrients, which are contributing significantly to improve health of both rural and urban populations (Waiganjo et al., 2006). Tomatoes are grown in all weather conditions. However, they give the best production in warm weather conditions where extreme temperatures are 15-30 °C (Hanaa et al., 2011). It is cultivated in both monsoon and winter Kharif and Rabi seasons (Nikhate, 2012). High humidity and temperatures decrease the produce of tomatoes. While at the ripening phase, conditions of temperatures above 30 °C reduce the fruit yield. Many factors can affect the quantity and quality of tomato, these include; diseases. Commonly known diseases of tomato are early blight, anthracnose, bacterial wilt, bacterial canker, tomato spotted wilt, and Fusarium wilt (Dodson et al., 2002), and Tomato diseases are mainly caused by fungi, bacteria, and viruses. The disease reaches an optimum level in the tomato field in periods of wet conditions that prevail on the fruit at maturity stage. Fusarium causes 20-80% losses per year worldwide (Nikhate, 2012). Characteristic symptoms of Tomato diseases are upward curling of leaves, yellow (chlorotic) leaf margines, smaller leaves than normal, plant stunting, and flower drop. Uganda increased the production of tomatoes from 5700 tonnes in 1972 to 37654.34 tonnes in 2021 growing at an average annual rate of 4.07% (Ddamulira G.et al., 2021). However, this increment didn't hit the target of 440000 tons by 2021 because of these tomato diseases. The species of tomatoes grown in Uganda; money maker, bonny best, Rio Grande, New fortune F1, Mongoro.

Figure 1: Type of the tomato grown in Buluganya Sub County, Bulambuli district, Uganda

1.2 Problem statement

The tomato diseases are a significant concern for farmers, and these diseases are caused by fungi, bacteria, virus and other pathogens that transmit the disease. The diseases have resulted into significant yield loss that have reduced the quality and quantity of tomato fruits and an increase in the cost of production due to the need for diseases management practices to ensure sustainable tomato production in Buluganya Sub county, Bulambuli district.

1.3 Purpose of the study

The purpose of this research is to determine the prevalence of tomato diseases, and identify the most common disease affecting the tomatoes in Buluganya Sub County, Bulambuli District.

1.4 Objective.

1.4.1 General objective

To determine prevalence of tomato management practices in Buluganya sub county, Bulambuli district

1.4.1 Specific objectives

- To determine most diseases affecting tomatoes
- To find out the causes of tomato diseases.
- To determine the management practices used to reduce the losses due to tomato diseases.

1.5 The hypotheses

1.5.1 The null hypothesis;

There is no significance loss incurred by farmers due to tomato diseases.

1.5.1 The alternative hypothesis;

There is a significance loss incurred by farmers due to tomato diseases.

1.6 Research questions

i. What are the most common diseases affecting tomatoes.
ii. What are the causes of tomato diseases
iii. What are the management practices used by farmers during the growing of tomatoes?
iv. How are farmers benefiting from tomatoes?

1.7 Significance of the study

The significance of the study is to develop ways of reducing and preventing these tomato diseases that enable farmers to make informed decision about disease management practices such as crop rotation, fungicide application and planting resistant cultivar selection. This is essential for maintaining food security, reducing economic losses and developing effective management practices.

1.8 Scope of study

This research will be conducted on the slopes of mountain Elgon, Buluganya Sub County, Bulambuli district in eastern region 41km from Mbale city, Uganda in East Africa, Africa, in conduction of this study on the prevalence of tomato diseases, I need to information from different sources including scientific journals, government reports, agricultural organizations and academic publications. They may also need to conduct field survey to gather information on the distribution and severity of tomato diseases in different regions.

Some of the common tomato diseases to be investigate include early blight, late light, bacterial spot, powdery mild and verticillium wilt and others. These cause significant losses in tomato yields if not properly managed.

To control these diseases, researchers may explore different methods such as crop rotation, use of resistant varieties, chemical control and cultural practices such as pruning and sanitation. The effective measure may vary depending on specific diseases and environmental conditions. This research will take two months from 1st July, 2023 to 1st August, 2023

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Tomatoes (Solanum lycopersicum) are one of the most essential vegetable crops grown all over the world because of their important nutrients, which are contributing significantly to improve health of both rural and urban populations (Waiganjo *et al*., 2006).

2.2 Impotence of tomatoes

Tomatoes are essential fruits that provide that offers many health benefits and play a significant role in various aspects of human life. The following are the importance of tomato to human life.

2.2.1 Nutritional values;

Tomatoes are rich essential nutrients and bioactive compounds that contribute to their importance in health diet. They are source of vitamins A, C, and K as well as potassium, folate and antioxidants such as lycopene.

Lycopene contained in tomatoes has been extensively studied, it has been found out that it plays a potential role in reducing the risk of certain type of cancers these include prostate, lung and stomach cancer. Also act as an antioxidant hence protect the cells from damage caused by free radicles.

Potassium found in tomatoes is at a high level, this help to lower blood pressure and reduce the risk of heart diseases.

An antioxidant in the tomatoes help to prevent the oxidation of LDL cholesterol, which is the major contributor to heart diseases, and also these antioxidants protects the skin from damage caused by UV radiation and oxidative stress.

Vitamin A together with beta-carotene, both of which are essential for maintaining good eye vision and eye health.

Tomatoes are an incredibly versatile ingredient used in various cuisines around the world the world. They can be consumed raw, cooked, or processed into different forms such as sauces, salsas, and pizzas. Their color, flavor and juicy texture makes them a popular choice in many culinary preparations.

2.2.2 Economic importance;

Tomatoes have significance economic impotence globally. They are one of the most widely cultivated and consumed fruits worldwide. Globally tomato production reached 182 million tons in 2019. Processed tomato products such as sauce, ketchup, canned tomatoes and tomatoes pest have substantial market demand. The tomatoes processing industries provide employment opportunities to people hence contributing to their economy

Heathy effects of chemical used to control the diseases

Milthane super vitra, with the active ingredient Mancozeb causes several healthy problems mainly hepatic, renal and genotoxic, demonstrating an increase in ETU dosages as well as liver enzymes in most studies, coraborating the idea that deliberate use of the product can induce potential systemic complications becoming a healthy problem (J.C. Dallagnol et al., 2021).

Nemasol is being used to control Fasurium wilt causes severe burns, headache, nausea, Respiratory disorders and eye irritations

2.3 Tomato diseases

Tomato diseases are caused by fungi, bacteria and viruses these diseases have caused a significant yield loss. The diseases caused by bacteria are bacterial spots, bacterial speck, and bacterial canker. Those caused Fungi are Anthracnose fruit rot, Leaf mold, powdery mold, Verticillium, early blight, septorial leaf spot, Late blight and Fusarium wilt and the ones caused by viruses are Tomato yellow leaf curl virus (TYLCV), Tomato mosaic virus. Tomato spot wilt virus (TSWV), Tomato leaf curl disease (Jones, J.P. et al, 1991). These diseases affect plants in different ways that is to say

Septorial leaf spot; a fungus causes septorial leaf spot, creating small, circular patches with greyish-white center and dark edges. Tiny black spot may show up in the center of each blemish affected leaves turn yellow, with and fall off. (Jones. P. et al, 1991).

Anthracnose fruit rot; this is caused by collect Anthracnose, caused by the fungus colletorichum coccodes, probably the most common fruit-attacking disease of tomato in Iowa.

Symptoms first become visible on ripe or ripening fruit as small, circular, indented spots in the skin. As these spots expand, they develop dark centers or concentric rings of dark specks, which are the spore-producing bodies of the fungus.

Fusarium wilt; it caused by Fusarium oxysporum, attacker only certain tomato cultivars. Plants affected by the disease, show leaf yellowing and wilting that progress upward from the base of the stem, initially on one side of the midrib, one branch, or one side of the plant will be affected

Verticillium wilt; Verticillium albo-atrum and Verticillium dahlia, the fungi that causes this disease, this diseases also appear first on the lower leaf,HY progresses upward. Yellow blotches develop on lower leaves, the leaves rapidly turn completely yellow, wither, and drop off **Late blight**, caused by the fungus phytophthora infestansrarely occurs in Iowa but can devastate tomato plantings during periods of cool, rainy weather. Late blight may infect either young (upper) or old (lower) leaves. It first appears as water-soaked areas that enlarge rapidly, forming irregular, greenish black blotches, giving the plant a frost-damaged appearance. The undersides of the leaves often show a downy white growth in most weather. Infection of green or ripe fruit produces large, irregularly shaped brown blotches.

2.4 Management practices outside Uganda.

Fusarium oxysporum has been managed in Ethiopia by uses of resistant cultivars/hybrid as a key practice for controlling these diseases, uses of clean seeds, then intercropping has been used as management practice to reduce the incidence of the pathogens that cause Fusarium wilt. Because this intercropping system reduces the population of the pathogen and root to root transmission. (Worku. A, 2018).

The farmers also do crop rotation, the purpose of this method is to break tomato diseases cycle. Crop rotation take about three year for effectiveness of tomato diseases and other crops (Sally et al. 2006).

Pesticides are also used basing on the proper understanding of the type the diseases basin on the symptoms and other related signs.

2.5 Management practices in Uganda.

Pesticides are also used to manage theses. However, Farmers do not have knowledge on application and their target pathogens that causes diseases and do not have thoroughly understanding of diseases type. This was observed in Kamuli district (Tinyami, et al. 2014).

Crop rotation is also used in Uganda but the farmers have a very small farm size and therefore they do not long rotational cycles of three (3) years hence reducing the effectiveness of the management practice (Sally et al. 2006).
The farmers are trying to embrace the system of new cultivars of tomatoes however they do not have knowledge about theses which are resistant to diseases to increases on production like Rio-Grand.

2.4 Gaps in literature

The tomato diseases are still a serious concern this because most of the farmers are still using informal knowledge to management the diseases though they are trying to use most of the practices which are on international level so through this research farmers in Buluganya sub county will be informed on how to use the existing practices like uses of the pesticides only when well understood the disease he/she is trying to managing.

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CHAPTER THREE:

MATERIALS AND METHODS

3.1 The Study Site

Buluganya Sub County is 11km east west of Bulambuli district on the slopes of Mount Elgon, located in Bulambuli district in Eastern Uganda. About 41km from Mbale town. The sub county composes of four parishes that is Nataba, Namunane, Masaka and Buluganya parish, with 10, 24, 20, 25 villages in each parish respectively. The population of the sub county is about 1500 people according the report from the sub county headquarters. People of this area speak Gishu as a language.

The major economic activity is farming, they main grow coffee and Tomato. Other crops are grown on small scale like banana, beans, maize onion, and Irish potato.

3.2 Material.

Questionnaire, observation, interviews, notebook, camera/phone

3.3 Procedures of data collection.

Busitema University, department of biology granted me permission for collecting data from these villages of Buluganya Sub County which was an introductory letter. This letter was then presented to the local chairperson of the sub county Mr Namukono Richard, I obtained permission from him to interact with the people of the target population. Before data collection, I informed the respondent that, this research is for academics and the benefit of the research I conducted to them So they were able to aid me by allowing me into their tomato plantations

A cross sectional field survey was conducted in the major tomato growing Parishes of Buluganya sub County, Bulambuli district. Two parishes; Namunane, and Buluganya parish was covered during the survey and three different villages was selected and Questionnaires was given to the farmers of these plots of land followed by interview. In each village visited, one plots of tomato were randomly selected. The prevalence was calculated based on the observed symptoms.


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Figure 2: Tomatoes affected by diseases

CHAPTER FOUR:

RESULTS

A field survey was conducted in two different parishes (where tomatoes are grown in large scale) to collect data on the prevalence on different diseases and the control measures used by farmers to control tomato disease in their farms, data was collected in early-September for five days on these diseases commonly affecting the tomato. The education levels of the participants were presented as shown in the pie chart below data.

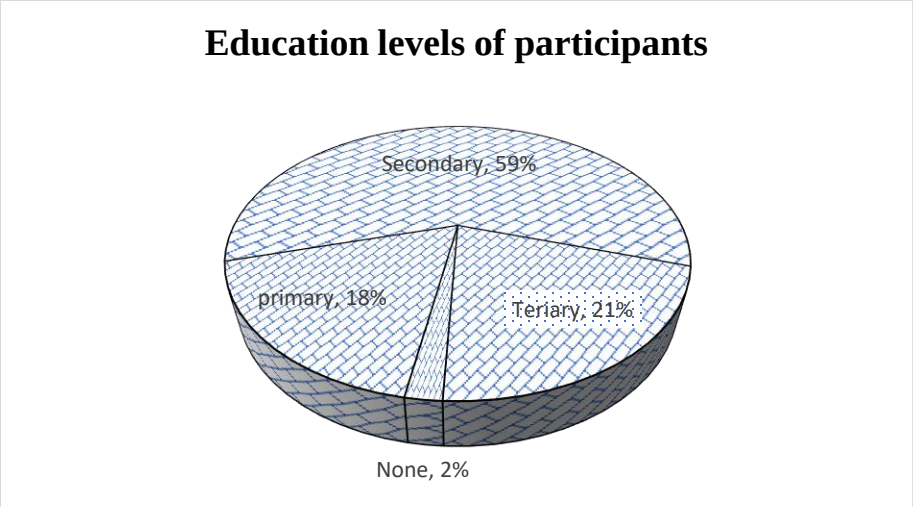


Figure 3: pie chart of education level of participants

Gender.

Most of the participants that were involved in this study were males with of 90% and the other 10% were females (only 4 participants)

Disease prevalence.

Generally, the diseases which showed was Fusarium wilt, its prevalence was (49.6%) in Namunane parish and (58.8%) in Buluganya parish giving average of (54.2%) of the total sample size with maximum prevalence of tomato diseases and the least registered was Late Bright with average of (1%). The following table shows the data collected in regards to disease prevalence per variety.

Table 1. A table showing the prevalence of tomato diseases disease

Parishes	Disease	Total average No. of plants sampled	Average No. of plants diseased	prevalence
Namunane	Bacterial spot	403	50	12.0
	Bacterial speck	403	31	7.7
	Bacterial canker	403	00	0.0
	Anthracnose	403	46	11.4

	Verticillium	403	00	0.0
	Early bright	403	10	2.5
	Late bright	403	02	0.5
	Fusarium wilt	403	200	49.6
	Tomato yellow leaf curl	403	00	0.0
	Tomato moisaic virus	403	50	13.4
	Tomato spot wilt	403	00	0.0
Bulunganya	Bacterial sport	425	20	4.7
	Bacterial speck	425	35	8.2
	Bacterial canker	425	00	0.0
	Anthracnose	425	40	9.4
	Verticillium	425	00	0.0
	Early bright	425	15	3.5
	Late bright	425	06	1.4
	Fusarium wilt	425	250	58.8
	Tomato yellow leaf curl	425	00	0.0
	Tomato moisaic virus	425	70	16.4
	Tomato spot wilt	425	00	0.0

Table 4.1.2. Table showing the losses incurred by farmers due to tomato diseases

villages	Amount of money invested in tomato growing	Amount of money received from the tomato produce	Loss incurred	Percentage loss
Birinda	450000	400000	50000	11.1%
Bumbole	300000	200000	100000	33.3%
Namagugu	150000	100000	50000	33.15
Masola	75000	50000	25000	33.25%
Bwakuye	250000	190000	60000	24.0%
Masabasi	`100000	20000	80000	80%

Table 4.1.3. Data analysis

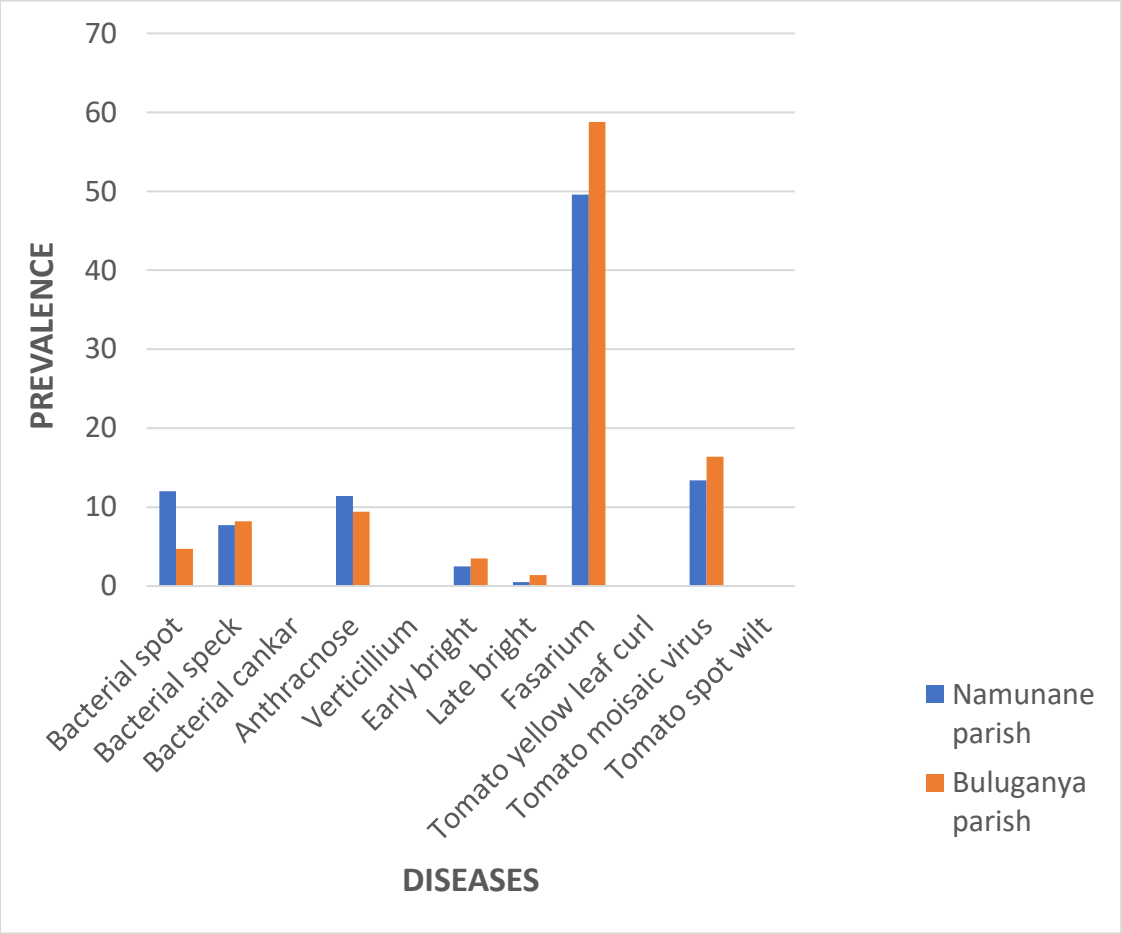
loses	Observed	Expected	O-E	(O-E)^2	(O-E)^2/E
	11.1	15.0	-3.9	15.21	1.014
	33.3	35.0	-1.7	2.89	0.08
	33.15	34.2	-1.05	1.11	0.03
	33.25	32.3	0.9	0.81	0.02
	24.0	20	2	4	0.2
	80	80.1	0.1	0.01	0.00023

Chi square X^2 = 1.014+0. 08+O.O3+0.O2+0.2 +0.00023

= 1.34423

Since the chi-square (x^2) value (1.344) is greater than the critical value (0.05), then the null hypothesis (H0) is rejected and the alternative is accepted.

Figure 4.1.1. A graph showing the prevalence of tomato diseases in Buluganya Sub County



4.2 Discussion of results.

4.2.1 Introduction.

In this study, the researcher attempted to find out the prevalence per each disease affecting tomatoes and the control measures for different disease affecting tomato farmers in Buluganya

sub-county, also other factors like crops grown on the farm other than tomatoes, land size, quantity of harvest among others were also recorded. The study found out the prevalence of tomato diseases, the diseases influenced by several factors some may have been identified in the study.

4.2.2 Size of the Land.

Most farmers that were approached are doing tomato farming on a small scale primarily because they do not have enough land to invest in tomato growing but because of the gains seen on this enterprise they get themselves in it with the little land they have, Some few farmers have large pieces of land but still continue to grow tomatoes on small scale because they also want to produce other crops like coffee, maize, banana, onions among others which may not yield well if mixed on the tomato farm, therefore they always leave separate land for such enterprises.

4.2.3 Spacing of tomatoes.

The recommended spacing for tomatoes is 2 feet depending on various factors such as the type of tomato, the climate, and the desired yield. Proper spacing is crucial for optimal growth, fruit production, and overall health of the tomato crop. In general, for standard-sized, a spacing of 2 to 3 feet (1 meter) between crops is recommended. This allows enough room for the crop to grow and spread their branches without overcrowding(Condon, 2012). It also ensures adequate sunlight penetration and air circulation, which are essential for healthy fruit development and disease prevention. This results into high infection since distance between two successive plants is small and diseases can easily spread.

4.2.4 Disease prevalence.

From the study it was found that the Fusarium wilt diseases had the more prevalent in Namunane parish and Buluganya parish. Late Bright was less prevalent in the very parishes of Namunane and and Buluganya . This was possibly due to the high susceptibility of tomato variety in combination with environmental factors which are prevailing disease spread.(Sharif et al., 2021) The general registered high disease prevalence was due to factors as improper spacing of plants which eases spread of disease. Also, irregularities in application of chemicals for spraying, late spraying and identification due to poor monitoring, some farmers report that the effective

chemicals are not readily available and even when accessed they are expensive, some farmers are just reluctant to do effective control of the disease because of the poor market available for the oranges and under some cases poor climate also hinders production or growth of Tomatoes.

4.2.5 Loses incurred by tomato diseases

Generally, it was found that farmers are experiencing losses due tomato diseases with Masasola village display a greatest loss due to these diseases with (80%) loss incurred and Birinda displaying the least with (11.1%)

4.2.6 Disease control.

Generally, the diseases are managed by field hygiene and spraying with chemicals, the diseases are best controlled by using resistant/hybrid, copper-based and bactericides and chemicals on regular intervals(Gottwald et al., 2002). The bactericides reduce inoculum build up on younger leaves and protect expanding fruits from further infection where b the effectiveness disease control by copper spray depends on susceptibility of the tomato, environmental conditions and incorporation of other control measures however, the study found out that a majority of the farmers though they spray their tomatoes just use commonly available chemicals without consultation from the experts, such chemical as and Rocket were found to be most used. The recommended and effective chemicals were Agri-Mycin, Nordox which are not easily accessed by farmers besides being expensive and this has made most farmers calling the disease uncontrollable simply because they cannot access the effective chemicals.

Other control measures have also been highlighted on table 4 above and of all the control measures at least all farmers control the disease by spraying with chemicals irrespective of their effectiveness and field hygiene and resistant cultivars was also seen being used through all the farmers who grow tomato.

CHAPTER FIVE:

CONCLUSIONS & RECOMMENDATIONS

5.1 CONCLUSION

From the study and in general the prevalence for tomato diseases in Buluganya sub-county was highest in Buluganya parish with (Fasarium wilt 58.8%) and least in Namunane parish (Late brig 0.5%), this therefore agrees with the first, objective of determining the prevalence of tomato. it was found that farmers are experiencing losses due tomato diseases with Masasola village display the greatest percentage of (80%) loss due to these diseases and Birinda village displaying the least percentage loss of (11.1%), which according to chi-square gave value 1.344 greater than the critical value Alpha 0.056, this disagree with null hypothesis which states that there is no significance loss incurred by farmers due to tomato diseases. and accepted the alternative hypothesis there is a significance loss incurred by farmers due to tomato diseases

5.2 RECOMMENDATIONS

Due to the high rate of infection of the Tomato disease in the sub- County due to the less effective control measures used,

- Farmers should plant resist cultivars/Varieties which are resistant to these diseases
- The farmers should also ensure proper spacing to avoid disease spread by wind due to improper spacing
- Also, Farmers should use chemicals to control the diseases and before using these chemicals, identification of the disease should be done fully before spraying with chemicals to reduce their effect
- Form should form groups with an aim of joint control of these diseases and marketing.
- Always seek for help or guidance from the extension workers on the best ways of control of these tomato diseases.

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APPENDIX 1: QUESTIONAIRE

Dear farmers,

In Buluganya Sub County, tomato diseases have become a serious issue. Am wodamba Christopher, registration number ***BU/UP/2020/2885***, a student from Busitema University, currently doing a study to assess the losses incurred by farmers due these tomato diseases that attacker tomato plants as a way of developing suitable management practices to reduce these losses caused by tomato diseases.

Section A: Bio information

1. Gender: a). Female ☐ b). Male ☐
2. Age: a). 18 to 25 ☐ b). 25 to 39 ☐ c). 40 and Above ☐

Section B: farm details

1. Village ……..
2. What is the size of the farm …….
3. How many tomato plant do you always plant in the size of land mentioned above …….

Section C: Tomato diseases information

1. Have you experienced any tomato diseases in the past?
   Yes ☐ No ☐
2. Did you use any preventive measure to reduce the effect of the diseases in the farm?
   Yes ☐ No ☐
3. Were those preventive measures effective for you?
   Yes ☐ No ☐
4. Which preventive measure did you use
   ☐ ☐

Chemicals other methods

If chemicals how much did you spend on buying these chemicals.

……

5. Are you currently facing any tomato diseases?

   Yes ☐ No ☐

   If yes how did it affect your tomato plants?

   ……

6. How frequently do you encounter these diseases

   Rarely ☐ Occasionally ☐ Frequently ☐

Section D: Assessment of diseases impact

1. Have you ever incurred any loss in terms of money due to these diseases in you tomato project?

   Yes ☐ No ☐

   If yes, how much money did you invest in the tomato project from the planting stage to harvesting stage and how much did you earn from the project all together.

   Total amount of money invested in the project ……Total amount of money earned ……

villages	Amount of money invested in tomato growing	Amount of money received from the tomato produce	Loss incurred	Percentage loss
Birinda				
Bumbole				
Namagugu				
Masola				
Bwakuye				
Masabasi				

APPENDIX 2 BUDGET

S/NO		ITEMS &TIME/PERIOD	AMOUNT
1	Field work for date collection	1 Research assistant 5000x 4 days	20,000
2	Printing, photocopying and binding		40,000
3	Stationary	1 Ream	22,000
4	Transport		100,000
5	Others		18,000
6	Total		200,000