MAJOR CAUSES OF THE DECLINE OF TOMATO PRODUCTION AMONG SMALL HOLD FARMERS IN BUDONDO SUBCOUNTY, BUDONDO VILLAGE IN JINJA DISTRICT, UGANDA

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(BU/UP/2021/3445)

THIS FINAL YEAR PROJECT REPOPRT IS SUIBMITTED TO THE DEPARTMENT OF AGRICULTURE IN PARTIAL FULLFILLMENT OF THE REQUIREMENT FOR THE AWARD OF THE DEGREE OF BACHELOR OF SCIENCE IN EDUCATION

SEPTEMBER, 2024

DECLARATION

I **MUKESI ROGERS** declare that this research report is my original work. It has not been submitted to any other University or higher institution for any award and where it is indebted to work for others.

Signature..... Date: 1-10-24

MUKESI ROGERS

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APPROVAL

I hereby certify that the research report entitled the major cause of the decline in tomato production among small hold farmers in Budondo sub county, budondo village in jinja district, Uganda. Submitted in partial fulfilment of the requirement for the award of the degree of Bachelor of Science education of Busitema University is an authentic record of bonafied research carried out by Mukesi Rogers [BU/UP/2021/3445] under my guidance and supervision. No part of this research has been submitted for any other degree or diploma.

Signature: ..... Date: 01/10/2024

MR. DRAMADRI GERALD AFAYO

SUPERVISOR

DEDICATION

To my beloved parent Mr. BAIDU DANIEL and Mrs. NAMWASE NORAH for their financial support and tireless efforts towards my education. I cannot risk forgetting SEERA LYDIA, my wife for the continuous support she has provided too. May God reward them abundantly?

ACKNOWLEDGEMENTS

I thank the lord almighty for keeping, protecting and giving me good health during the course of my study.

I would like to appreciate the work of my supervisor Mr. Dramadri Gerald Afayo diligently guided me during my research. May the Almighty reward him abundantly?

Special thanks go to my father, mother and all my realtives especially Mrs NAKASANGO SARAH and my friend, Wapakala Derick, for their love and support for my education.

I would like to acknowledge my friends, Kigenyi Duncan and Musana Raden for their support throughout my research.

I also wish to thank my teachers for their advice, knowledge and guidance towards my education. May God bless them.

LIST OF ACRONYMS AND ABREVIATIONS

NARO…. National Agricultural Research Organization

NAADS….National Agricultural Advisory Services

BW…… Bacterial Wilt

FAO…..Food and Agriculture Organization

NEMA… National Environment Management Authority

NEPAD….New Partnership for African Development

HO… Null Hypothesis

HA….. Alternative Hypothesis

USA... United States of America

URA…. Uganda Revenue Authority.

TYLCV…tomato yellow leaf curl virus, tomato

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ABSTRACT

Introduction

Tomato [Solanum esculentum.L], is among the most widely grown vegatables globally with an estimated annual production of 182 million tons from 4,8 million hectares. The crop is ranked sixth among the most consumed crops worldwide. Therefore, the major purpose of this research was to find out the major cause for the decline of tomato production amongst small holder farmers in budondo village specifically.

Materials and methods: The study employed a mixed-methods approach, combining both quantitative and qualitative methods. A questionnaire was developed to gather information on demographics, lifestyle factors, and existing management strategies for the under production of tomatoes.

Interviews were conducted with a subset of participants to obtain qualitative data on their experiences, perceptions, and challenges related to tomato production and their management. Data was analyzed using descriptive and thematic analysis.

Results: the study found out that there is a significant prevalence of pest and disease attacks in the area that attacked the tomato gardens and mostly the bacterial wilt disease. The study finally found out that the most commonly perceived effective management strategies were, selection of the resistant varieties, using healthy seeds, spraying with chemicals, removal of the affected crops, and others.

Conclusion: Research findings underscore the need for comprehensive intervention to address the causes for the under production of tomatoes in the area of budondo.

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1 CHAPTER ONE: INTRODUCTION

1.1 Background

In Uganda, 40,124 tons of tomatoes were produced from 6,671 hectares. The crop was mainly grown by smallholder farmers who sold the fresh fruits in regional and domestic markets in their localities to generate income. It has been also a reliable source of food security and employment for on- and off-farm. A Tomato (*Solanum esculentum* .L), has been among the most widely grown vegetables global with an estimated annual production of 182 million tons from 4.8 million hectares The crop has been ranked sixth among the most consumed crops worldwide . Africa alone has produced 21 million tons from 1.3 million hectares. In East Africa, 1.9 million tons of tomato have been produced annually with Tanzania and Kenya leading as producers followed by Uganda.

As such, it has been regarded as an economic crop for rural and peri-urban farmers. In Uganda, tomato has been consumed by about 3 million households in their most meals due to their nutrition value. It has been also processed and combined in many different dishes and eaten in different ways, such as tinned paste, fresh vegetable, tomato juice, sauce, or soup. Tomato has been known for its nutritive value; it is rich in vitamin C and contains lycopene, a very vital antioxidant which prevents cancers .In the last decade, Uganda has experienced

Calvo FJ, (2012) Tomato (Solanum lycopersicum) has been a vital cash crop in many tropical and subtropical regions, including Budondo Sub-County in Jinja District, Eastern Uganda. However, the production of tomatoes has been significantly threatened by various diseases, among which Bacterial wilt disease is one of the most devastating. . Calvo FJ, (2012) Wilt has been caused by Ralstonia solanacearum (formerly pseudomonas solanacearum). The bacterium has survived in the soil for extended periods and enters the roots through wounds made by transplanting, cultivation, insect feeding damage, and natural wounds where secondary roots emerge. Adamou H, et al. (2016)

Bacterial wilt has emerged as a major constraint to tomato production in East Africa, including Uganda. The disease has affected both the quality and quantity of tomato fruits, leading to significant yield losses and economic implications for farmers. Brévault T, (2014)

Bacterial wilt primarily affected the tomato plant filling it with slime. This has resulted in rapid wilt of the plant while the leaves stay green. If an infected stem was cut crosswise, it could look brown and tiny drops yellowish ooze could be visible. . Calvo FJ, (2012)

The disease has been spreading rapidly in recent years, posing a serious threat to food security and livelihoods in the region. Adamou H, et al. (2016)

Tomatoes have been one of the most important cash crops for more than 150 million people in East and Central Africa. Human population growth rates in this sub-region have continued to be one of the highest in the world, and consequently there has been an urgent need to match this growth with concomitant increases in food production, using one of the most crops in terms of resilience to climate variability The crop was prioritized by the New Partnership for African Development (NEPAD) as one of the crops to combat poverty and food and nutrition insecurity in Africa, and has been a high priority commodity in the Uganda national research and development agenda. Brévault T, (2014)

China has been the world's largest tomato producer, followed by India, Turkey USA, among other countries. Factors influencing tomato production include rainfall, soil quality, local cuisine preferences, and access to technology and financing. Adamou H, et al. (2016)

However, tomato production in the region and in Uganda has been restricted by a diverse set of constraints. The most economically important are the two bacterial diseases: Bacterial wilt, and Late blight. Both have been recognized in the region since 1990s, but have become increasingly damaging in recent years. BACTERIAL WILT is caused by Bacterium referred to as Erwinia tracheiphila, gram negative Brévault T, (2014)

. Bacterial wilt has occured wherever tomatoes have been grown in Africa, from Senegal and Togo in the north-west to Mozambique in the south-east, as well as on the off-shore islands of Madagascar, Mauritius, Seychelles, Zanzibar and Cape Verde. The biology of the bacterial wilt has been the subject of much study since the early 1990s. Key areas of interest included:

molecular characterization, vector transmission, field and regional-level epidemiology, resistance breeding and management.

1.2 Tomato Production in Jinja:

- Jinja, located in eastern Uganda, has been known for tomato cultivation especially in its suburbs of Budondo.
- Farmers in Jinja have been adopting new tomato varieties to increase yields and improve quality.
- The region's favorable climate and soil conditions has contributed to tomato production.

1.3 Statement of the research problem and justification.

Tomato growing has been one of the most sacred and traditional activity in Uganda. While commercialized in the late 19th century, it remained an important cultural pillar in making agreements, welcoming visitors, celebrating new friendships and new homes. Economically, tomatoes not only the largest foreign exchange earner for Uganda but also traditionally a sign of wealth among different communities and home holdings. Tomatoes have been one of the major crops predominantly grown by small-scale producers in Uganda. As the chief producer of food for Jinja City, the largest share of total land used to grow cash crops has been covered by various tomato varieties mostly in the low altitudes of Eastern Uganda, while the rest of the land has been predominantly in the highland area around mountain Elgon in the east, and the Rwenzori Mountains. Calvo FJ, (2012)

Tomato production has been playing a fundamental role in the agricultural land scape of Budondo Sub County, Jinja city, Eastern Uganda. However, there has been a need to understand the major cause for the decline of tomato production and address them to enhance sustainability and high productivity. This research aimed to identify and analyze the major cause for the decline in tomato production in the region. . Calvo FJ, (2012)

1.3 Purpose of the study

The primary aim of the study was to assess the Major causes of the Decline in Tomato Production among Small hold farmers in BUDONDO regions (Jinja district).

Objectives of the study.

- To identify the Major causes of the Decline in Tomato Production among Small hold farmers
- To find the impact of pests and diseases on tomato production to identify the tomato varieties grown in Budondo.
- To find out different tomato varieties and cropping systems used.

1.4 Research questions.

To what extent has pest and diseases attack affected the income generation of the farmers in jinja district.

What are the common pests and diseases that affect tomato production I Budondo Sub County in Jinja district?

1.5 Significance of the study

1. The study of tomato development in Uganda which includes the identification of significant interventions that have influenced that evolution. To include: trends in tomato production and utilization over a given time period (up to the present day), at the country level and by major tomato producing regions within the country;
2. Major interventions, both at the national and regional level, that have influenced the evolution of the tomato sector, including for example: changes in the development model adopted by the country (e.g. from a model of import substitution to a model of trade liberalization); investment in tomato research or development, including production, processing and marketing of the crop; investment in infrastructure and services to promote rural development and/or the development of the crop.
3. The analysis of the successes and failures (or limitations) of the interventions identified above in removing the constraints to and realizing the opportunities for the development

of the crop. Criteria for analyzing the relative success of each intervention might, depending on the information available, include:

- impact on equity, including gender;
- impact on the environment;
- Impact on the development of institutions and organizations associated with the cassava sector.

4. A synthesis of the implications for a future strategy for tomato development in Uganda.

1.6 Scope of the study

The study was aimed at investigating the major cause for the decline of tomato production amongst the small hold farmers in budondo village, jinja district and exploring the management strategies employed by the farmers of budondo village. The study was carried out in budondo village found in jinja district. Data was collected for some good number of weeks. The number of farmers was limited since most of them thought I was among the land grabbers and from the URA that I have come to demand for licenses.

1.7 Ethical Considerations.

Ethical guidelines were strictly adhered to throughout the research process. Informed consent was obtained from all participants, and their confidentiality and privacy were ensured. The research protocol was submitted to the relevant ethical review board for approval before data collection begins.

2 CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

2.1 Cropping system and tomato varieties used by farmers within the Budondo.

According to Calvo FJ, (2012) Most farmers (78.4%) cultivated tomato as a mono-crop, 16.2% as mixed crop and 5.4% as an intercrop. The reason given by farmers practicing mono-cropping was that during tomato growth, specific operations like insecticide and fungicide spraying were done. Adamou H, et al. (2016) these operations are obstructed in mixed and intercropped systems because Different crops have been attacked by different insect pests and diseases, which required different pesticides to manage. Brévault T, (2014)

This led to waste in mixed and intercrops when non crop targets are sprayed with chemicals. However, mono-cropping if used for a long time has adverse effect on soil enzyme activities, soil microbial abundance, soil chemical practices and tomato yield , hence the need to minimize the use of mono-crop after some time. In all, the cropping systems used in tomato growing, land preparation was done using hand hoe (85.3%), tractors , herbicide application (4.6%) and ox-plough (1%). Adamou H, et al. (2016). Hand hoeing was commonly used probably because most farmers either could not afford to mechanize their operations or with their smallholding (0.68 acres), mechanization was not economically viable. The results indicated that most farmers cultivated tomato twice a year, which corresponded to two rain seasons (April to June and September to November) in a year Brévault T, (2014)

. This means that most tomato growing in the surveyed areas is rain-fed, but a few farmers who could afford irrigation facilities staggered their tomato production throughout, making four seasons a year. Other farmers utilize the wetlands during the dry period to grow tomato as water availability is assured compared to the dry land. Adamou H, et al. (2016)

The five tomato varieties mostly grown included: Asilla F1 (35.3%), Tengeru94 (21.1%),

Rambo (18.1%), Novela F1 (17.7%) and Riogrande (10.3%). The high preference of

Asilla F1, Tengeru97, Rambo and Novela F1 was due to their being hybrids with high yielding potential and long shelf-life. Farmers prefer high yielding tomato varieties (hybrids) which ensure increased production using less land [21]. However, there were other tomato varieties grown on small-scale, which included: Commando, Eden F1, Ranger F1, (hybrids) Victoria, VFN Roma, MT 56, Marglobe, "Musununu", Vikima, Omega, Opello and Sifa (open pollinated varieties) among others. Brévault T, (2014)

The choice of tomato variety to be cultivated was influenced by several factors (Figure 1), though the three high ranking factors were: high yield, pest and disease tolerance and desired market and consumer preference. . Calvo FJ, (2012) . Market preference is dependent on fruit size, shape (oval) and shelf-life. Traders preferred big size, oval shaped and hard-skinned tomato fruits which are not easily damaged during transit. On the other hand, the consumers preferred tomato with long shelf-life and they are compelled to buy small, medium or big sized tomato as long as they have long shelf-life Adamou H, et al. (2016)

2.1.2 Prevalence of Pests and disease

Farmers reported caterpillars followed by thrips (*Frankliniellspp*), worms and white flies (*Bemisia argentifolii*) as the major pests of tomato. Some of the pests like Aphids (*Aphidoidea spp*) and worms (*Lepidoptera spp*) had been earlier reported as major tomato pests in Uganda. Brévault T, (2014)

However, the study revealed that caterpillars are emerging as pests of major importance. Indeed, unlike the previous studies, caterpillars were ranked first in tomato growing areas in the current study. The other pests such as moth, spider mites (*Tetrancychus urticae*), leaf hoppers (*Epoasca fabae*), and scales were also mentioned as minor pests. Among the districts sampled, most tomato pests occurred in the central region districts followed by districts in eastern Ugandan Calvo FJ, (2012). But sampled districts within south western region had low levels of pest infestation. The variation in tomato pest-occurrence in relation to districts in different regions

was attributed to differences in weather conditions across the two regions. Tomato pests mostly occur in hotter and cool weather which is typical of central Uganda compared to

2.1.3 The major tomato diseases

Reported were bacterial wilt (*Ralstonia solanacearum*), early blight (*Alternaria linariae*) late blight (*Phytophthora infestans*), tomato leaf spots (*Xanthomonas spp*) and viral diseases (Figure 4). . Calvo FJ, (2012) .The high bacterial wilt occurrence in the study area was attributed to common use of a mono-crop system with limited crop rotation brought about by land scarcity. Since bacterial wilt is a soil-borne disease, continuous use of same fields leads to pathogen population disease pressure build up, hence escalating the occurrence of the disease in the field . Furthermore, the absence of tomato varieties that are resistant to diseases also contributed to the high occurrence of bacterial wilt, early and late blight diseases mentioned by the respondents.

Other diseases of less economic importance reported included: tomato yellow leaf curl virus, tomato (TYLCV) (8.2%), Anthracnose (2.2%) and some diseases unknown to farmers, which cause burning like symptoms and yellowing of leaves during heavy rains were reported. Although some diseases were not known to farmers, the symptoms described by farmers resembled those of Fusarium wilt (*Fusarium oxysporum*) . Calvo FJ, (2012)

However, further tests are needed to confirm the disease.

In terms of disease occurrence across the study areas, tomato blights were highest among farmers in the central region. This is because late and early blight of tomato are escalated by hot and humid conditions, which often occur in central Uganda as compared to other regions [26]. On the other hand, cases of tomato late blight were low in south-west and western region due to cold conditions which do not favour. Calvo FJ, (2012)

The mixing of fungicides and insecticides could be the reason for the high frequency in spraying reported by farmers. Majority of farmers sprayed weekly (62.1%) and biweekly

(3%), respectively while 20.7% and 3% of farmers sprayed two and three times a week especially during the rainy season. Spraying three times per week is beyond what is recommended, an indication that chemicals are either wasted or not effective on the target pests

and diseases. Farmers mixed on average 32.7ml of pesticides per 20 litres of water and 112.8g of fungicide per 20 liters of water with the minimum and maximum application rate of 5ml and 200ml per 20 litters of water respectively for insecticide and 2-500g per 20 litres of water for fungicides. None of the farmers mentioned that the mixtures or dilutions they used were following the recommendations by the manufacturer, which means that injudicious use of pesticides is common. Calvo FJ, (2012)

2.2 Crop management practices used by tomato farmers

The farmers interviewed used three forms of planting materials; seed (91.8%), seedlings from fellow farmers (6.9%) and volunteer tomato crops from the previous season (1.3%). The results also established that 90.5% of the farmers planted tomato in lines, while 9.5% staggered their planting. Brévault T, (2014)

This indicated that most farmers adopted line planting practice. But several farmers still used different spacing, notably; (30 x45), (45 x 45), (60 x 60), (75 x 75), (90 x 90) and (100 x 100) cm, which could not provide them optimum yield except for the (60 x 60) cm, which provides optimum yield under field conditions . Farmers also testified that tomato performs poorly under weed infested gardens, and as a result they always endeavoured to keep their fields weed free. Brévault T, (2014)

Weeding was predominantly characterized by use of hand hoes (96.6%) and application of herbicides (4.4%) which are applied prior to planting. Majority of farmers weeded 3 times, though a few with high-weed densities in their gardens weeded up to 6 times in a season. In relation to mulching, 73.3% of respondents reported mulching their gardens, while 27.3% did not. Mulching was commonly practiced by farmers as a substitute to staking, serving as a safe haven for fruits to lie on before harvesting and also conserve moisture during the dry season. Adamou H, et al. (2016)

Irrigation using various methods was a common practice among most of the farmers

(80.6%). Tomato farmers applied at least one irrigation method in a given cropping season with a big number using hand watering (63%), water pumps and hose pipes (14%), water canals to divert water into the field (11%), drip irrigation (7%) and sprinkler irrigation (5%). Most farmers used at least one method of irrigation because tomato requires sufficient amount of water for growth as any water deficit occurring during growth, flowering and fruit formation stages reduces yield [23]. Brévault T, (2014). Tomato farmers also used a number of fertilizers to boost tomato yields; the results indicated that 90.9% of respondents used fertilizers. Foliar fertilizers (super and rapid grow) were the most applied fertilizers followed by Diammonium phosphate (DAP), cattle manure, urea and NPK. Other fertilizers applied included: goat manure, compost and single super phosphate (SSP) (Figure 2). The high use of foliar fertilizer was due to its rapid response to plant nutrient needs. This was in line with what was reported that foliar applied fertilizer becomes promptly available to tomato plant and their response is instant . Brévault T, (2014)

Nonetheless, DAP which is a soil-based fertilizer was second to foliar fertilizers.

Farmers confirmed that DAP is used for planting as a starter fertilizer which is applied once during the entire cropping cycle. By doing this, labour is saved on fertilizer application when compared to Urea and NPK which are applied in splits requiring twice more labour than cattle manure. Nonetheless, SSP, compost and goat manure are least used because they are not readily available in the study area. But depending on the availability of manure, whether cow or goat, some tomato farmers applied both organic and inorganic fertilizers within the same cycle. . Calvo FJ, (2012)

3 CHAPTER THREE: METHODOLOGY

3.1 Research Design

The study was to employ a cross-sectional survey design since it will examine data for a short time; it also involved the use descriptive-correlation since it was interested in

examining the major causes that lead to under productivity of tomatoes. Analysis of variance (ANOVA) will be performed to assess the effect of any of the categorical variables on the household tomato production.

3.2 Study location

The study was conducted in BUDONDO Sub-County, near Bujjagali falls, Eastern Uganda. Its geographical coordinates are 1º 3' 52" North, 34º 10' 46" East **N**

3.3 Study Population

Target population is defined as a set of components that contain observable features which are employed for generalization of findings of the study (Russell, 2015). Bryman and Cramer (2014) viewed population as collection of individuals, items, cases, substances, articles with common features. Here the targeted population were the tomato growing farmers of the selected villages in Budondo Sub County.ie 20 in number

3.4 Sample Selection

Sampling selection involved the use of probability sampling technique especially simple random sampling and a purposive sampling .simple random sampling was used because the study intended to select a representative without bias from accessible population. This ensured that each population member of the target population had an equal and independent chance of being included in the sample

3.5 Sample size

Sample is fraction of entire population that is involved in data collection process (Sahu, 2017). Sample size depicts the number of the total samples that are observed, measured or surveyed. A sample size of 20 farmers was used.

3.6 Data collection methods

3.7 Questionnaire

Questionnaires and surveys have long played a role in research as a means of gathering (typically quantitative) background information in order to examine the connection of particular variables to outcomes Babbie and Mouton (2014, p. 74). The questionnaire was designed by the researcher and it was distributed to the farmers. The Questionnaires enabled the researcher to quantify the information from the respondents

3.8 Interviews

Face to face interviews were carried out with the farmers designed in a way that more specific and truthful answers were got. These helped to capture information, not provided by the questionnaires. This method was preferred because of its flexibility and ability to provide new ideas on the subject (Kothri, 1990).

3.9 Document Analysis

Secondary data from materials such as textbooks, newspapers, journals and internet were used to back up primary information and relate the findings to other approaches already in existence. The method used document checklists and guides to get views from other writers which are instrumental especially in comparison analysis and literature review.

3.10 Observation

The study used observation method to find out for himself what's exactly on the ground

3.11 Data Sources

The method of data collection were questionnaires and interview guides.

3.12 Primary Data

The study used primary data sources. Primary data was obtained by use of questionnaires and interview guides.

3.13 Secondary Data

The researcher used Secondary data sources with an aim of comparing secondary data with responses to primary data that is going to be gathered in order to get a meaningful and objective interpretation of findings. Secondary, it involved review of the existing literature such as internal report, research dissertation, text books and internet.

3.14 Preparing and taking recordings

Demographics such as names, age, and others were taken through having interactions with several different farmers and they were filling the spaces by themselves under my guidance. Even those who did not know how to write, I beared the responsibility to write for them.

The objective part was taken through explaining to the farmers to choose the alternative that best suits their experiences and the current situation of their farming operations in the tomato fields.

NOTE. Farmers were involved in the research basing on their willingness to participate and not by forceful means, that is to say the participation was voluntary.

3.15 Data Analysis

The collected data was analyzed using appropriate descriptive methods that were used to determine the major cause for the decline of tomato production amongst small hold farmers in Budondo village, jinja district . The qualitative data from interviews underwent thematic analysis to identify common themes and patterns.

4 CHAPTER FOUR: RESULTS

4.1 Demographic information of respondents

The results indicated male dominance in tomato production within the surveyed areas. Majority (84.1%) of the respondents were male with an average household size of 6 persons. Among the smallholder farmers involved in tomato production, 38.4% were between 18 to 35 years, 57.3% between 36 to 60 years, while the rest (4.3%) were above 60 years to.]. In terms of education, levels attained by respondents, 52.2% of the farmers stopped in primary, 29.7% in secondary (Ordinary level), 13.0% in secondary (Advanced level) and 5.1% in tertiary (Diploma and degree level). The area under tomato production ranged from 0.1 to 3.5 acres with the average acreage of 0.68.

4.2 Cropping system and tomato varieties used by farmers

Most farmers (78.4%) cultivated tomato as a mono-crop, 16.2% as mixed crop and 5.4% as an intercrop. The reason given by farmers practicing mono-cropping was that during tomato growth, specific operations like insecticide and fungicide spraying is done. These operations are obstructed in mixed and intercropped systems because different crops are attacked by different insect pests and diseases, which require different pesticides to manage. This leads to waste in mixed and intercrops when non crop targets are sprayed with chemicals. However, mono-cropping if used for a long time has adverse effect on soil enzyme activities, soil microbial

abundance, soil chemical practices and tomato yield , hence the need to minimize the use of mono-crop after some time. In all, the cropping systems used in tomato growing, land preparation was done using hand hoe (85.3%), tractors, herbicide application (4.6%) and ox-plough (1%). Hand hoeing was commonly used probably because most farmers either could not afford to mechanize their operations or with their small holding (0.68 acres), mechanization was not economically viable. The results indicated that most farmers cultivated tomato twice a year, which corresponded to two rain seasons (April to June and September to November) in a year. This means that most tomato growing in the surveyed areas is rain-fed, but a few farmers who could afford irrigation facilities staggered their tomato production throughout, making four seasons a year. Other farmers utilize the wetlands during the dry period to grow tomato as water availability is assured compared to the dry land. The five tomato varieties mostly grown included: Asilla F1 (35.3%), Tengeru94 (21.1%), Rambo (18.1%), Novela F1 (17.7%) and Riogrande (10.3%). The high preference of Asilla F1, Tengeru97, Rambo and Novela F1 was due to their being hybrids with high yielding potential and long shelf-life. Farmers prefer high yielding tomato varieties (hybrids) which ensure increased production using less land. However, there were other tomato varieties grown on small-scale, which included: Commando, Eden F1, and Ranger F1, (hybrids) Victoria, VFN Roma, MT 56, Marglobe, “Musununu”, Vikima, Omega, Opello and Sifa (open pollinated varieties) among others. The choice of tomato variety to be cultivated was influenced by several factors , though the three high ranking factors were: high yield, pest and disease tolerance and desired market and consumer preference. Market preference is dependent on fruit size, shape (oval) and shelf-life. Traders preferred big size, oval shaped and hard-skinned tomato fruits which are not easily damaged during transit. On the other hand, the consumers preferred tomato with long shelf-life and they are compelled to buy small, medium or big sized tomato as long as they have long shelf-life.

Table 1 ***Showing the cropping systems used in tomato growing and the percentage of farmers that adopted it.***

Cropping system	**Percentage of farmers using it**
mono-cropping	78.4

mixed cropping	16.2
Intercropping	5.4

Table 2 ***Showing the tomato varieties and the corresponding percentage of farmers that have been growing them.***

Tomato varieties grown	**Percentage of farmers**
Asilla F1	35.3
Tengeru94	21.1
Rambo	18.1
Novela F1	17.7
Riogrande	10.3

4.3 Crop management practices used by tomato farmers

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not. Mulching was commonly practiced by farmers as a substitute to staking, serving as a safe haven for fruits to lie on before harvesting and also conserve moisture during the dry season. Adamou H, et al. (2016)

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Table 3 ***Showing the planting materials source for tomatoes in budondo***

Source of planting materials	Percentage of farmers adoption
Seeds	91.8
Seedlings from fellow farmers	6.9
Volunteer tomato crops from previous season	1.3

Table 4 ***Showing irrigation patterns used by farmers in budondo***

Irrigation pattern	Percentage of farmers using it
Hand watering	63
Water pumps and hose pipes	14
Water canals to divert water in the field	11
Drip irrigation	7
Sprinkler irrigation	5

4.4 Pests and disease

Farmers reported caterpillars followed by thrips (*Frankliniellspp*), worms and white flies (*Bemisia argentifolii*) as the major pests of tomatoes. Some of the pests like Aphids (*Aphidoidea spp*) and worms (*Lepidoptera spp*) had been earlier reported as major tomato pests in Uganda . Brévault T, (2014)

However, the study revealed that caterpillars are emerging as pests of major importance. Indeed, unlike the previous studies, caterpillars were ranked first in tomato growing areas in the current study. The other pests such as moth, spider mites (*Tetrancychus urticae*), leaf hoppers (*Epoasca fabae*), and scales were also mentioned as minor pests. Among the districts sampled, most tomato pests occurred in the central region districts followed by districts in eastern Ugandan Calvo FJ, (2012). But sampled districts within south western region had low levels of pest infestation. The variation in tomato pest-occurrence in relation to districts in different regions

was attributed to differences in weather conditions across the two regions. Tomato pests mostly occur in hotter and cool weather which is typical of central Uganda compared to

4.5 The major tomato diseases

Reported were bacterial wilt (*Ralstonia solanacearum*), early blight (*Alternaria linariae*) late blight (*Phytophthora infestans*), tomato leaf spots (*Xanthomonas spp*) and viral diseases (Figure 4). . Calvo FJ, (2012) .The high bacterial wilt occurrence in the study area was attributed to common use of a mono-crop system with limited crop rotation brought about by land scarcity. Since bacterial wilt is a soil-borne disease, continuous use of same fields leads to pathogen population disease pressure build up, hence escalating the occurrence of the disease in the field. Furthermore, the absence of tomato varieties that are resistant to diseases also contributes to the high occurrence of bacterial wilt, early and late blight diseases mentioned by the respondents.

Other diseases of less economic importance reported included: tomato yellow leaf curl virus, tomato (TYLCV) (8.2%), Anthracnose (2.2%) and some diseases unknown to farmers, which cause burning like symptoms and yellowing of leaves during heavy rains were reported. Although some diseases were not known to farmers, the symptoms described by farmers resembled those of Fusarium wilt (*Fusarium oxysporum*). . Calvo FJ, (2012)

However, further tests are needed to confirm the disease.

In terms of disease occurrence across the study areas, tomato blights were highest among farmers in the central region. This is because late and early blight of tomato are escalated by hot and humid conditions, which often occur in central Uganda as compared to other regions. On the other hand, cases of tomato late blight were low in south-west and western region due to cold conditions which do not favour. Calvo FJ, (2012)

The mixing of fungicides and insecticides could be the reason for the high frequency in spraying reported by farmers. Majority of farmers sprayed weekly (62.1%) and biweekly

(3%), respectively while 20.7% and 3% of farmers sprayed two and three times a week especially during the rainy season. Spraying three times per week is beyond what is recommended, an indication that chemicals are either wasted or not effective on the target pests

and diseases. Farmers mixed on average 32.7ml of pesticides per 20 litres of water and 112.8g of fungicide per 20 litres of water with the minimum and maximum application rate of 5ml and 200ml per 20 litters of water respectively for insecticide and 2-500g per 20 litres of water for fungicides. None of the farmers mentioned that the mixtures or dilutions they use were following the recommendations by the manufacturer, which means that injudicious use of pesticides is common. Calvo FJ, (2012)

4.6 Pests and disease management

The farmers interviewed reported that several methods are used to control pests and diseases in tomato. Majority (95.7%) of them used chemical sprays (pesticides and fungicides) to manage tomato pests and disease. Most farmers perceive the use of chemicals as the most effective method to control pests as compared to other methods, namely, the use of organic concoctions as well as cultural practices: crop rotation, rouging, wider spacing and others. As such, there is need to create awareness on other possible methods, that can be used to control pests and disease such as the use of the egg York mixture that was found to be effective at managing tomato pests [28]. Adoption of an integrated pest management approach is important since relying on chemicals may lead to development of pest resistance over time, accumulation of chemical residues in the fruits and environmentally hazardous. Other pest and disease control measures used on small-scale were: rouging (12.1%), hand picking (9.9%), organic concoctions (2.6%), ash (6.0%), urine (2.6%) and frequent weeding. However, these are not often used in combination with the chemicals which render them less effective when used in isolation. The use of pheromone traps (0.4%) to control tomato pests was generally very low and unpopular among most farmers. This is probably due to the fact that the use of pheromones was recently introduced during the outbreak of invasive life miner (Tuta absoluta) to scout and monitor pest population in tomato fields. As such it is more of a monitoring tool rather than control, hence the reason as to why it is still less popular. The study revealed that farmers applied a range of pesticides and fungicides and in combination. Some of the pesticides used include: Dudu Cypermethrine, Ridomil, Dudu phenos, Rocket, while fungicides such as Agrozeb, Dimethoate, Greenzeb, Diathane M45, Indofil were used. The effectiveness of a practice of combining pesticides and fungicides, which

farmers reported needs to be investigated since the two are known to have antagonistic effects when mixed together.

The mixing of fungicides and insecticides could be the reason for the high frequency in spraying reported by farmers. Majority of farmers sprayed weekly (62.1%) and bi weekly (3%), respectively while 20.7% and 3% of farmers sprayed two and three times a week especially during the rainy season. Spraying three times per week is beyond what is recommended, an indication that chemicals are either wasted or not effective on the target pests and diseases. Farmers mixed on average 32.7ml of pesticides per 20 liters of water and 112.8g of fungicide per 20 liters of water with the minimum and maximum application rate of 5ml and 200ml per 20 liters of water respectively for insecticide and 2-500g per 20 liters of water for fungicides. None of the farmers mentioned that the mixtures or dilutions they use were following the recommendations by the manufacturer, which means that injudicious use of pesticides is common.

4.7 Tomato productivity

The smallholder tomato farmers interviewed cultivated between 0.1 - 3.5 acres with an average land holding of 0.68 acres allocated for tomato production (Table 6). The average yield per 0.68 acres of tomato was 3.2 tonnes, translating into 4.9 ton/acre. In terms of tonnes/hectare, farmers obtained 12 t ha-1. This yield was far below the expected yield potential of 16 t ha-1 under good agronomic management and weather conditions in East Africa . There is need, therefore, for technical capacity building and support to farmers to adopt improved agronomic practices in order to attain the potential yield.

5.0 CHAPTER FIVE:

5.1 DISCUSSION

The male dominance could be attributed to the fact that tomato production requires capital investment especially in land acquisition and in Uganda, men have more access to land than women. Besides, tomato production is considered a risky venture yet more women are risk averse as compared to men which limits the number of women involved in tomato growing.

The relatively low youth participation (38.4%) compared to adults (57.3%) was possibly due to limited or lack of capital for the youth to invest in acquisition of inputs that are required for tomato production. Similarly, the widespread understanding among the youth that agriculture is not rewarding also limits their engagement. Furthermore, the limited access to land by the youth

with their mentality that benefits from farming take a long time to be realized most often leads them to seek urban employment

This indicated that production is mainly done by lowly educated farmers, which could limit the uptake of improved production practices. Earlier studies attribute the low adoption of improved farming practices to low levels of education.

This was not different from the average acreage of other crops in Uganda, indicating that tomato is an important crop in the livelihoods of smallholder farmers, which is given a priority during land allocation for crop production.

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6.0 APPENDIX

6.1 QUESTIONNAIRE

Demographic Information of the participant.

In this section fill in your required details.

1	Sex(Male/Female)	
2	Age	
3	Occupation	
4	Town or Area of residence	
5	Acreage of farming	
6	Tomato variety	
7	Marital status	
8	Nationality	

SECTION B: OBJECTIVES.

A. Farmers'/participants' socio-economic status (SES).

   Part1. Family or household SES.

In this section tick the right the right hand box against the most appropriate alternative that suits you and describes the socio-economic status of your family.

1. How much do you earn as a Family through farming in a month.

1	Greater than 1,500,000shs.	
2	1,000,000-1,499,999shs	
3	600,000-999,999shs	
4	400,000-599,999shs	
5	Less than 400,000shs	

2. What is your highest education level?

1	PhD	
2	Masters degree	
3	Bachelor's degree	
4	Diploma	
5	College certificate	
6	S.6 certificate	
7	S.4 certificate	
8	PLE certificate	
9	Primary but below P.7	
10	Never gone to school	

3. How many acres of land do you posses?

1	4 and above	
2	3-4 acres	
3	3 acres	
4	2 acres	
5	1 acre	
6	Half an acre	

4. For how long have you been growing tomatoes?

1	More than 5 years	
2	4 years	
3	3 years	
4	2 years	
5	1 year	
6	Less than a year	

5. Has the activity been productive?

   YES

   NO

6. Are you in position to access all the inputs for your tomato production?

   YES

   NO

7. Have you ever been affected by bacterial wilt in your activity of growing tomatoes?

   YES

   NO

8. If yes how long has it affected you?

1	5 years	
2	4 years	
3	3 years	
4	2 years	
5	1 year	

B. CHALLENGES AND STRATEGIES

In this section write ad many answers as possible depending on your experiences.

9. What are the challenges you face when carrying out growing of tomatoes in your farm? You can write as many challenges as possible in the space provided.

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10. How do you usually overcome the challenges above in qn.9?

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11. Back to bacterial wilt, which signs does the disease show on your tomatoes?

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12. What damages does bacterial wilt cause on your tomatoes in the garden?

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13. What are the strategies you have taken in solving bacterial wilt in your garden?

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Part 2. Other Information:

1. Would you wish to participate in my further surveys about tomato diseases in the time to come? And why?

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……

Thank you for your engagement in my study, as I look forward to finding a better strategy towards tomato farming in our nation.

God bless you.

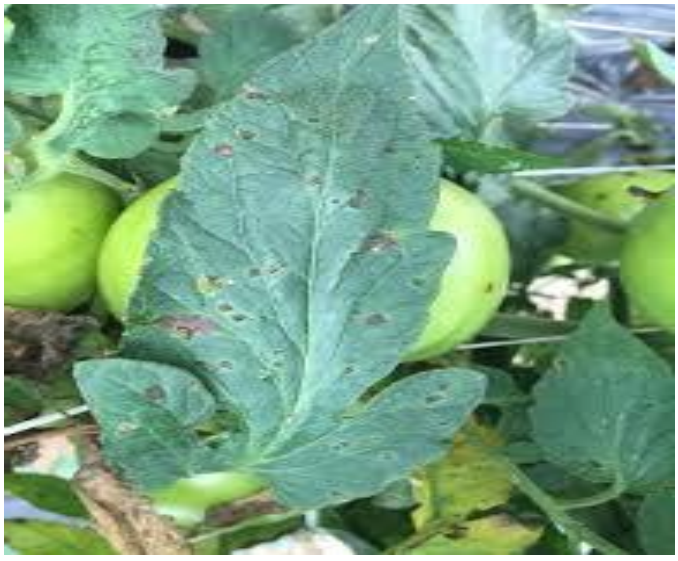

Figure 1 showing tomato worms and white flies

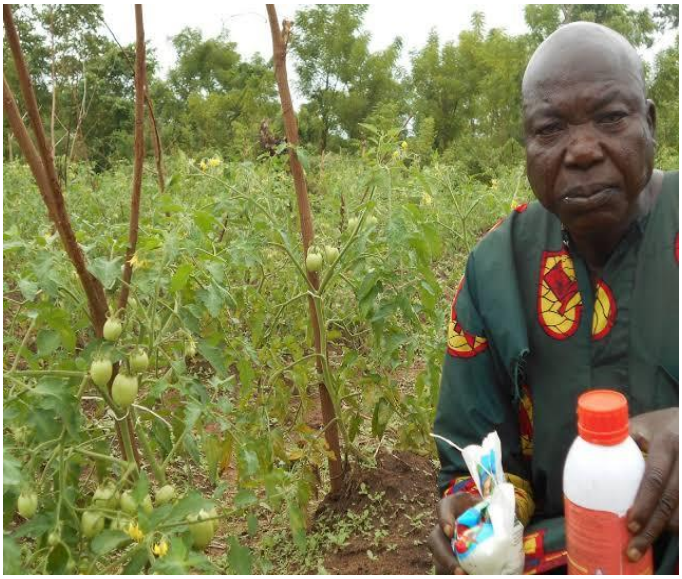

Figure 2 showing chemical pest and disease control in tomatoes

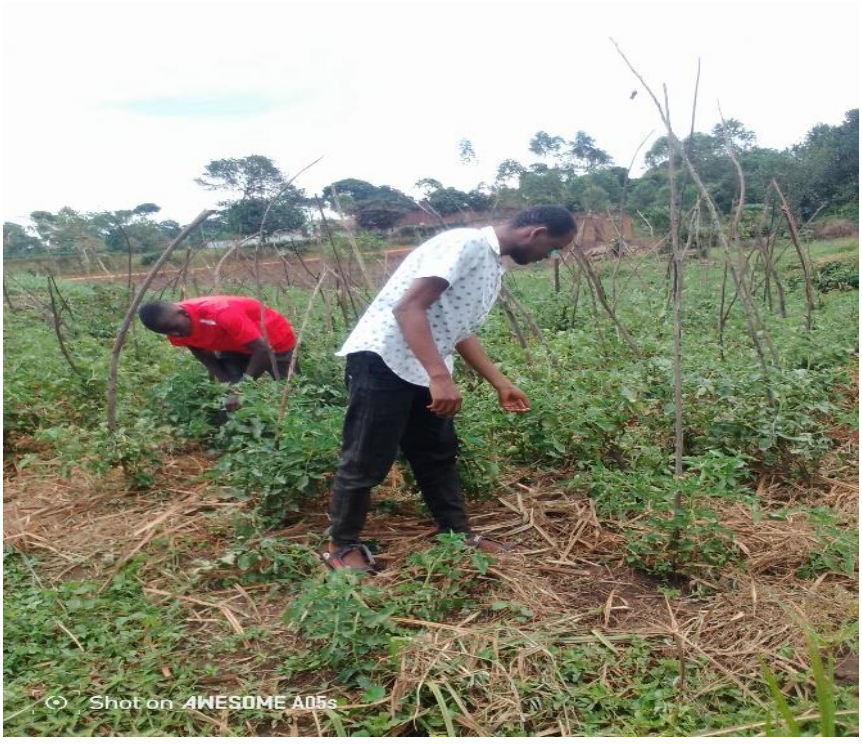

Figure 3 showing tomato staking and mulching

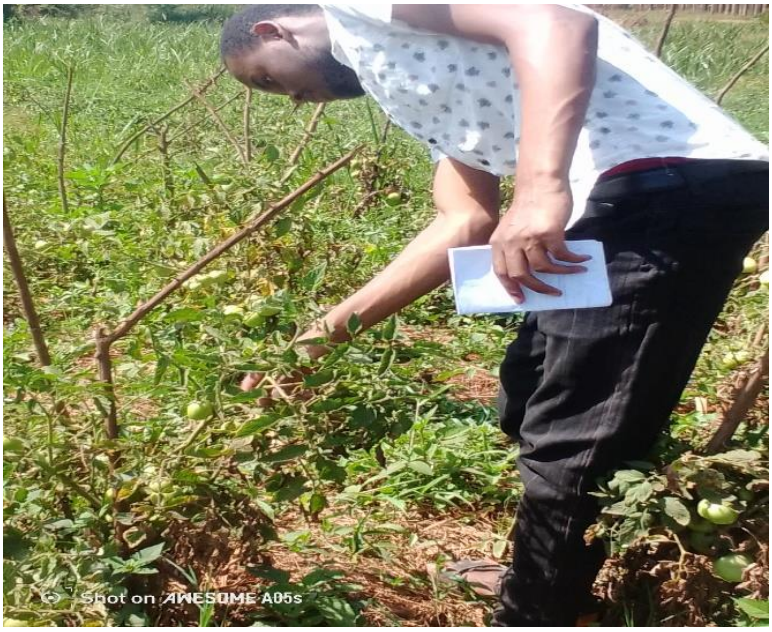

Figure 4 showing tomato inspection