

**BUSITEMA
UNIVERSITY**
Pursuing Excellence

P.O.Box 236, Tororo
Gen: +256-454448842
Dir: +256-454448864
Mob: +256-782999874
Fax: +256-454436517
Email: ar@acadreg.busitema.ac.ug
Website: www.busitema.ac.ug

**FACULTY OF AGRICULTURE AND ANIMAL SCIENCES
DEPARTMENT OF CROP PRODUCTION AND MANANAGENT**

RESPONSE OF IMPROVED GROUNDNUT LINES TO LATE LEAFSPOT DISEASE

BY

OSIA PAUL

BACHELOR OF SCIENCE IN AGRICULTURE

BU/UP/2018/2609

Email: paulosia.bsa@gmail.com

TEL: +256-787760096/+256704760864

ACADEMIC SUPERVISOR: DR.LUBADDE GEOFREY

FIELD SUPERVISOR: DR.KALULE OKELLO DAVID

**A RESEARCH REPORT SUBMITTED TO THE DEPARTMENT OF CROP PRODUCTION
AND MANAGEMENT IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR
THE AWARD OF A DEGREE IN BACHELOR OF SCIENCE IN AGRICULTURE OF
BUSITEMA UNIVERSITY**

MAY, 2023

DECLARATION


I, OSIA PAUL declare that this research report, which I submit to the department of crop production and management for examination in consideration of the award of degree of bachelor of science in agriculture is my original work and personal effort, and that to the best of my knowledge, the findings have never been previously presented to Busitema University or elsewhere for the award of any academic qualification, I hereby affirm that except for references to other people's works, which have been duly cited, this work is a result of my own insightful observations / research and that has not been presented in part or whole for any other degree in this University or elsewhere.

So I present it without any reservation for examination considerations.

Sign:  Date: 01/02/2024

OSIA PAUL

This research proposal was written under my supervision and has been submitted to the Department of Crop production and Management for examination with my approval as supervisor.

Sign:  Date: 05/02/2024

DR.LUBADDE GEOFREY

Lecturer/deputy dean (academics), Department of Crop Production and Management, Faculty of Agriculture and Animal Sciences, Busitema University.

DEDICATION

I dedicate this report to my academic mentors, academic friends, and family for the positive engagements towards this research study.

May the almighty God bless you all.

ACKNOWLEDGEMENT

I acknowledge and appreciate the almighty God for the abundant health given to me, completing the internship training report successfully. Thanks to my field supervisor Dr. Kalule Okello David and academic supervisor Dr Lubadde Geoffrey for the mentorship and guidance rendered to me while carrying out this study,

I also acknowledge Busitema university staff for the good academic training rendered, NARO –NaSARRI for granting the resources especially study materials and land for carrying out this study to its final conclusion.

I also extend sincere gratitude to Higher Education Students financing board for financing my final year of study that has seen this research process successful.

Not forgetting the groundnuts the groundnuts research team (Ivan Chapu, Edwongu Emmanuel, Oriokot Francis, and Aisu Peter) for tirelessly working with me during the research study.

TABLE OF CONTENTS

CONTENT

| | |
|--|-------------------------------------|
| DECLARATION | i |
| DEDICATION | ii |
| TABLE OF CONTENTS..... | iv |
| ABBREVIATIONS | vi |
| LIST OF TABLES AND FIGURES..... | vii |
| ABSTRACT..... | ix |
| CHAPTER ONE: INTRODUCTION..... | 1 |
| 1.1 Background of study | 1 |
| 1.2. Statement of the problem | 2 |
| 1.3 Justification of the study | 3 |
| 1.4 Objectives of study | 3 |
| 1.5 Specific objectives. | 3 |
| 1.6 Hypotheses of the study | 4 |
| 1.7 Significance of the study | 4 |
| 1.8 The scope of the study | 4 |
| 1.9 Geographical scope | 4 |
| 1.10 Content scope. | 4 |
| LITERATURE REVIEW | 5 |
| 2.1 Introduction | Error! Bookmark not defined. |
| 2.1.1 Origin and distribution of groundnuts | 5 |
| 2.1.2 Botany and morphology | 5 |
| 2.1.3 Importance of groundnut in the national economy (Uganda) | 6 |
| 2.1.4 Production environment. | 7 |
| 2.1.5 Production constraints | 7 |
| 2.2 Low level of inputs | 8 |
| 2.2.1 Pests and diseases | 8 |
| 2.2.2 Rainfall or soil moisture | 8 |
| 2.3 life cycle of late leaf spot disease and predisposing factors on groundnuts | 8 |
| 2.4 Disease Cycle | 9 |
| 2.4.1 disease management: | 9 |
| 2.4.2 Cultivation and management | 10 |
| CHAPTER THREE | 12 |
| 3.0 MATERIALS AND METHODS | 12 |

| | |
|--|------------------------------|
| 3.1 Description of study location..... | 12 |
| 3.2 Experimental Materials..... | 12 |
| 3.3 Experimental research design..... | 13 |
| 3.4 Experimental field layout. | 13 |
| 3.5 Data collection | 14 |
| 3.5.1 Sampling strategy and technique..... | 14 |
| 3.5.2 Description of data tools..... | 15 |
| 3.5.3 Data on disease severity..... | 15 |
| 3.6 Modified 9-point scale used for field-screening groundnut genotypes for resistance to late leaf spot..... | Error! Bookmark not defined. |
| 3.7 Different yield related components to be measured..... | 15 |
| 3.7.1 50 % flowering | 15 |
| 3.7.2 Number of pods per plant | 15 |
| 3.7.3 100-seed weight (g)..... | 15 |
| 3.7.4 Plot pod yield (Kg ha ⁻¹) | 16 |
| 3.8 Data analysis and interpretation | 16 |
| CHAPTER FOUR: RESULTS | 18 |
| 4.1 OBJECTIVE ONE: To determine the level of resistance to late leaf spot across the groundnuts genotypes..... | 18 |
| 4.1.1 Response of individual genotypes to late leaf spot. | 19 |
| 4.1.2 Response of the three groundnut botanicals to late leaf spot..... | 20 |
| 4.2 Objective Two: To determine the effect of late leaf spot on groundnut yield (dry pod yield and fresh haulm yield)..... | 22 |
| 4.2.1 Haulm yield..... | 22 |
| 4.2.2 Relationship between disease and yield parameters | 25 |
| 4.2.3 Graphs showing yield reductions for the various varieties as a result of LLS disease severity | 26 |
| CHAPTER FIVE: DISCUSSION..... | 28 |
| 5.1 Dry pod yield:..... | 28 |
| 5.2 Haulm yield: | 29 |
| CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS..... | 30 |
| 6.1. CONCLUSION | 30 |
| 6.2. RECOMMENDATIONS..... | 30 |
| APPENDICES | 31 |
| RESEARCH PHOTOS..... | 31 |
| Datasheet used for collection of data..... | 31 |
| REFERENCES: | 32 |

ABBREVIATIONS

| | | |
|---------|---|--|
| LLS | : | Late leaf spot |
| ANOVA | : | Analysis of variance |
| BUAC | : | Busitema University Arapai Campus. |
| FAAS | : | Faculty of Agriculture and Animal Sciences. |
| BSA | : | Bachelor of Science in Agriculture. |
| CLS | : | cercospora leaf spot |
| NaSARRI | : | National semiarid resources research institute |
| SGV | : | Serere groundnuts variety |
| ICGV | : | ICRISAT groundnuts variety |
| NARO | : | National agricultural research organisation |
| ELS | : | Early leaf spot |
| RCC | : | Relative chlorophyll content |
| AUDPC | : | Area under Disease Progress Curve |
| PDI | : | Percentage disease incidence |
| Kg/ha | : | kilograms per hectare |
| SGV | : | Serere groundnuts variety |
| ICGV | : | ICRISAT groundnuts variety |
| ICRISAT | : | International crops research institute for semi-arid tropics |

LIST OF TABLES AND FIGURES

Tables

| | |
|--|----|
| Table 1: list of study materials | 13 |
| Table 2: modified 9 point scale used for field scoring of late leaf spot disease | 15 |
| Table 3: ANOVA for late leaf spot severity under unsprayed treatment for season 1 and 2..... | 19 |
| Table 4: means for unsprayed treatment for season 1 and 2..... | 19 |
| Table 5: AUDPC ANOVA for unsprayed genotypes for season 1 and 2..... | 19 |
| Table 6: mean AUDPC for unsprayed genotypes for season 1 and 2..... | 20 |
| Table 7: ANOVA for late leaf spot disease severity under sprayed treatment for season 1 and 2 .2022..... | 21 |
| Table 8: mean AUDPC for sprayed genotypes for season 1 and 2..... | 21 |
| Table 9: AUDPC for sprayed genotypes for season 1 and 2..... | 21 |
| Table 10: mean AUDPC for sprayed genotypes for season 1 and 2..... | 21 |
| Table 11: ANOVA for PDI AUDPC..... | 22 |
| Table 12: ANOVA for relative chlorophyll content | 22 |
| Table 13: T test for percentage disease incidence..... | 22 |
| Table 14: ANOVA for pod yield under unsprayed treatment for season 1 and 2 | 24 |
| Table 15: mean ANOVA for pod yield under unsprayed treatment across season 1 and 2.... | 24 |
| Table 16: ANOVA for grain yield under unsprayed treatment for season 1 and 2..... | 24 |
| Table 17: mean ANOVA for grain yield under unsprayed treatment for season 1 and 2..... | 24 |
| Table 18: ANOVA for haulm yield under unsprayed treatment for season 1 and 2..... | 24 |
| Table 19: mean ANOVA for haulm yield across season 1 and 2..... | 24 |
| Table 20: ANOVA for pod yield under sprayed treatment for season 1 and 2..... | 24 |

| | |
|--|----|
| Table 21: mean ANOVA for pod yield under sprayed treatment for season 1 and 2..... | 24 |
| Table 22: ANOVA for grain yield under sprayed treatment for season 1 and 2..... | 25 |
| Table 23: mean ANOVA for grain yield under sprayed treatment for season 1 and 2..... | 25 |
| Table 24: ANOVA for haulm yield under sprayed treatment for season 1 and 2..... | 25 |
| Table 25: mean ANOVA for haulm yield for season 1 and 2..... | 26 |
| Table 26: relationship between disease and yield parameters..... | 26 |
| Table 27: T test for sprayed and unsprayed treatments..... | 26 |

Figures

| | |
|--|----|
| Figure 1A and 1 B: late leaf spot on groundnuts leaves and severe late leaf spot on groundnuts leaves..... | 3 |
| Figure 2A and 2B: conidiophores of <i>C. personatum</i> and conidia of <i>C. personatum</i> | 10 |
| Figure 3: 5 X 10 alpha lattice design..... | 15 |
| Figure 4: rain fall trend in season 1 and 2022..... | 17 |
| Figure 5: graph showing yield reduction for various genotypes as a result of late leaf spot disease of groundnuts..... | 28 |

ABSTRACT

Foliar fungal diseases account for over 80% reduction in groundnut productivity in most parts of Uganda. Late leaf spot (LLS) caused by *Cercosporidium personatum* Deighton. Spots of late leaf spot are black and usually without yellow halo. Spread and severity is influenced by the field cropping history, temperature, and relative humidity. The leaf spot disease epidemics, Genetic variation exists in cultivated groundnut for LLS resistance, but the resistant genotypes are generally late maturing. Direct selection for leaf spot resistance in groundnut is also difficult and has been reported to be associated with low yield, poor pod, and kernel characteristics and late maturity. As a result, there is the need to consider other physiological traits that can confer tolerance to the two foliar diseases and enhance pod and haulm yields. This research study assessed 50 selected groundnuts lines for late leaf spot resistance and high yield in Uganda.

The main objective of the study was to determine the response of improved groundnuts varieties to leaf spot severity

Specific objectives were:

To determine the effect of late leaf spot on groundnut yield (pod / seed, haulm) .

To determine the level of resistance to late leaf spot across the groundnuts genotypes (three selected botanicals of groundnuts)

The research study was conducted for two (2) consecutive seasons in the first rains of 2022, season (2022A) and the second rains of 2022; season (2022B)

This study was to determine the influence of leaf spot disease severity on selected groundnuts lines in terms of yield (pod, seed, and haulm).

Fifty (50) groundnut genotypes with varying degrees of tolerance to leaf spot were evaluated under marginal environments in the field,

Each of the genotype was planted in 5 X 10 alpha lattice design a 3 row plot measuring 1.5x 1.5 meters using a spacing of 45cm x 10 cm in both season A and B year 2022 at NaSARRI Uganda.

Data collection accounted to all the plants per plot at the start of the experiment

Disease severity was assessed at weekly intervals for 12 consecutive weeks. Data on yield and yield component such as, number of pods per plant, and 100 seed weight (grams/kilograms), plant stand, 50% flowering, was collected at 7 days interval. The severity

of LLS infection was scored on a scale of 1 to 9 with 1 being completely resistant and 9 a dead plant.

CHAPTER ONE

INTRODUCTION

1.1 Background of study

Groundnut, also known as peanut, (*Arachis hypogaea* L.), is cultivated in the semi-arid tropical and subtropical regions of nearly 100 countries on six continents between 40° N and S of the equator. It is an important legume grown and consumed globally and in particular in sub-Saharan African countries (Okello et al., 2010). For people in many developing countries, groundnuts are the principal source of digestible protein (25-34%), cooking oil (44-56%), and vitamins. These qualities make groundnut an important nutritional supplement to mainly cereal diets of maize, millet and sorghum of many Ugandans. In many countries, groundnut cake and haulms (foliage, straw/stems) are used as livestock feed. Groundnut is also a significant source of cash income in developing countries that contributes significantly to livelihoods and food security (Okello et al., 2010).

Groundnut being a legume improves soil fertility by fixing nitrogen and thereby increases productivity of other crops in the semi-arid cereal cropping systems. Groundnuts are grown in most of SSA by smallholder farmers as a subsistence crop under rain-fed conditions. Yields per hectare are generally low compared to those from developed countries like the USA, because of a combination of factors such as unreliable rainfall, mostly non-irrigated cultures, traditional small-scale farming with little mechanization, outbreaks of insect pest infestations and diseases, the use of low-yielding varieties, poor quality seed, increased and/or continued cultivation on marginal land, poor adoption of agronomic practices and limited extension services (Okello et al., 2010). Insecurity, instability and the frequently unsupportive oilseed policies have also played their role in low groundnut productivity. Therefore, there is excellent potential for yield improvement.

Despite its importance in providing income and food for smallholder farmers, fodder for livestock, and improving soil fertility through biological nitrogen fixation, groundnut yields are lowest on farmers' fields in Sub-Saharan Africa due to biotic and abiotic constraints exacerbated by weather patterns such as hot and wet conditions. Temperatures in the range of 25 to 30°C and high relative humidity favour disease infection and development. Efforts have been directed at chemical control of leaf spot diseases in eastern Uganda. However, it has only been partially effective in controlling the disease on farmers' fields and substantially increases cost of production. The development and adoption of leaf spot resistant cultivars

REFERENCES:

- Culbreath, A. K., Stevenson, K. L., & Brenneman, T. B. (2002). Management of late leaf spot of peanut with benomyl and chlorothalonil: A study in preserving fungicide utility. *Plant Disease*, 86(4), 349–355. <https://doi.org/10.1094/PDIS.2002.86.4.349>
- Debele, S., & Ayalew, A. (2015). *Integrated management of Cercospora leaf spots of groundnut (Arachis hypogaea L .) through host resistance and fungicides in Eastern Ethiopia*. 9(February), 82–89. <https://doi.org/10.5897/AJPS2014.1260>
- Diseases, A. (n.d.). *The Disease Compendium Series of The American Phytopathological Society*.
- Kefa, O. H. (n.d.). *Groundnut Production Guide for Uganda : GROUNDNUT PRODUCTION GUIDE FOR UGANDA : Recommended practices for farmers*.
- Mohammed, K. E., Afutu, E., & Odong, T. L. (2018). *Assessment of Groundnut (Arachis hypogaea L .) Genotypes for Yield and Resistance to Late Leaf Spot and Rosette Diseases Assessment of Groundnut (Arachis hypogaea L .) Genotypes for Yield and Resistance to Late Leaf Spot and Rosette Diseases. March*. <https://doi.org/10.9734/JEAI/2018/39912>
- Okello, D. K., Biruma, M., & Deom, C. M. (2010). *Overview of groundnuts research in Uganda : Past , present and future*. 9(39), 6448–6459.
- September-October-November-December (SOND) 2022 Seasonal Forecast.pdf*. (n.d.).
- Subrahmanyam P., D. McDonald, F. Waliayar, L.J. Reddy, S.N. Nigam, R W Gibbons, V Ramanatha Rao, AK Singh, S Pande, PM Reddy, & Rao, P. S. (1995). Screening Methods ad Sources of Resistance to Rust and Late Leaf Spot of Groundnut. *Information Bulletin*, 47, 21.

Varieties, G., Hypogaea, A., & Cultivars, L. C. (2019). *RESEARCH TEAM AND ROLE*.