INCIDENCES AND SEVERITY OF MAIZE EAR ROT CAUSING PATHOGENS AND RESPONSE OF SELECTED MAIZE HYBRIDS TO *DIPLODIA* (Stenocarpella spp.) IN SELECTED COUNTIES IN NYANZA REGION

BY

CHRISTINE ATENYA WESONGA

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN PLANT PATHOLOGY

DEPARTMENT OF BOTANY

MASENO UNIVERSITY

DECLARATION

I confirm that this work has not previously been submitted for a degree award in Maseno University or any other University in the world. The work reported herein is my own individual work, the sources of information have been acknowledged by way of references.

Signature... Date..

Christine Atenya Wesonga

PG/MSC/051/2006

Declaration by supervisors:

This thesis has been submitted for examination with our approval as the University supervisors:

Signature………………………………… Date……………………………………….

Prof. Dida. M. Mathews,

Department of Applied Plant Sciences,

School of Agriculture and Food security,

Maseno University.

Signature…………………………… Date……………………………………….

Dr. George Opande

Department of Botany,

School of Physical and Biological sciences,

Maseno University.

ACKNOWLEDGEMENTS

I am quite greatful to my two supervisors, Prof. Dida Mathews and Dr. Opande George for their tireless assistance during various stages of my research work. It would have been impossible to accomplish this work without their effort.

I sincerely acknowledge the support offered by Madam Dorah Ochieng of Bondo High School, Mr. Owen Olukohe of Vihiga High school and Mr. Amadi of Mbita High School for their assistance in the field during the identification of the diseases.

I also thank the Maseno University Botany laboratory technicians; Daniel Buyela and Bonface Juveri for assisting in isolation of the ear rots and providing assistance during the use of the laboratory equipment needed during the time.

I am indebted to my sister Janet Okwero, my brothers Philip, Albert and Sylvester for their encouragement and financial support. I appreciate my brother in laws; Philip Onyango and Victor Ochieng for sacrificing their time to show me the divisions in various counties in Nyanza region under which maize farming is done.

Sincere thanks goes to my cousins, Edward kutundo, Tophina Nanzala, Electine Kutondo, Betty Kutundo, Beatrice Nanzala, Sophia Wasie, Jane Mariko, Japheth Okello, Maurice Ngugi and Ruth Kisiangani for their sincere love advice and encouragement to do the course.

Special regards go to friends, Winnie Chelule, James Obila and Violet Mbati for their positive critique of the work.

Finaly, I exhault the almighty God the creator of the Universe for giving me good wisdom and strength to carry out the research.

DEDICATION

This thesis is dedicated to; my parents Mrs. Victorina Wesonga and Mr. Mathias Olando for their love and their role in providing education, my children Tony, Solomon, Paul and Leah for their patience and perseverance during my study and lastly, to my friends Violet Mbati, Zephania Monyeka, Joseph Mwita and Anne Nyasani for their prayers and Financial support. May God bless you all abundantly.

ABSTRACT

Maize (*Zea mays*) is a staple food grown in almost all agro-ecological zones in Kenya. The production output is very low (2.4 million tons annually) nationally. Nyanza region contributes about 5 million bags. This is not enough to feed its population of 5 million people. Maize ear rot disease contributes to low maize productivity in Nyanza, with annual lossess due to aar rot estimated at 18 percent. These pathogens are reported to lower the quality of the maize crop and produce mycotoxins, which are toxic to both livestock and human. *Stenocarpella spp.* is a major constraint to maize production in the mid altitude to lowland areas in Kenya. There is need for documented information of incidences and severity of ear rot causing pathogens in Nyanza Kenya. There are a few maize hybrids known to be resistant to ear rot causing fungi in other regions of the world. The hybrids grown in Kenya need to be evaluated for ear rot resistance. The objectives of this study were to survey and determine the severity and incidence of maize causing pathogens in Nyanza regions, to identify *Sternocapella spp* causing ear rots in Maseno, and to evaluate the response of selected maize hybrids to *Sternocapella spp.* The study was carried out in 12 Divisions of Nyanza region in successive short rain (September to December 2008) and long rain (February to July 2009) seasons. Stratified Random Sampling design (SRSD) was used, with the four counties representing a stratum. where, five farmers were selected from each strata. The `X` sampling technique was used for maize sample collection in the fields of farmers within the divisions whereby, the samples were randomly collected along the `X` like structured demarcation in fields. A field was sampled 100 times to avoid biasness. Farmer's were located at 5 km apart, and then experiment repeated in Maseno area. Cobs with ear rots were examined microscopically based on spore and mycelia features from isolated fungal cultures using the International Maize and Wheat improvement Center (CIMMYT) in order to approve them as *Sternocapella*, *Giberella*, *Fusarium*, and *Nigrosora*. Field experiments on hybrid performance against *Sternocapella spp.* were carried out in Maseno University Research farm, during short rains and long rains of 2008 and 2009 respectively. Nine maize hybrids (EH10, H614D, P323, EH15, EH14, H516, EH13, EH16 and H515) were evaluated in a Randomised Complete Block Design with three replications. These were inoculated artificially with *Stenocarpella spp.* Three replications were used in Randomised Complete Block Design. Severity and disease incidences were subjected to ANOVA after which the means separated using Fisher`s LSD. *Sternocapella* spp, *Giberella* spp, *Fusarium* spp and *Nigrospora* spp were isolated and identified using identification keys as ear rot causing pathogens. Their prevelance being only higher during long rains seasons than in the short rains season. There were significant differences (α=0.005) in incidences and the severity of the ear rots with *Stenocarpella* means being highest followed by *Fusarium* as earlier suggested by other researchers. This was also observed during study in Maseno area. Based on significant differences found within regions; Sakwa, Asego and Imbo were highly affected by the Fungi. This might be due to their adjacent locations dictating similar close environment and similar farming technique by farmers. The 9 hybrids studied had a mean severity score of 1.98. EH10, EH14, EH15, and P3253 hybrids were resistant to *Stenocarpella* spp., and H614D, EH13, H516, H515, EHI6 hybrids susceptible to the *Stenocapella* spp. Large number of maize hybrid that are not susceptible to ear rots should be identified and recommended to the farmers as ear rots are highly infested in farming soils of Nyanza regions.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF PLATES

LIST OF ABBREVIATIONS

CIMMYT: International Maize and Wheat Improvement Centre

EPPO: European and Mediterranian Plant Protection Organization

FAO: Food and Agricultural Organization

PDA: Potato Dextrose Agar

RSA – DT: Rabuor-Sinaga Area Development Trust

SRSD: Stratified Random Sampling Design

UN: United Nations

CHAPTER ONE

INTRODUCTION

1.1 Background Information

Maize (*Zea mays* L.) forms the staple carbohydrate sources for over 90 percent of the population in Kenya (Laboso and Ng`eny, 2006) and is grown almost in all agro ecological zones. It is the most important food crop in Kenya with national production of 2.4 million tons in a total area of 1.6 million hectares (Gebrekidan and Njoroge, 2002). However, the economy of Kenya depends on agriculture and losses due to diseases can be enormous leading to less production in the 1.6 million hectares. The yield of maize has not kept up with the ever increasing population growth, thus, this leads to food insecurity (Adejumo *et al*., 2007). The production of maize is constraint by a number of factors including poor soil fertility, rainfall and diseases. These diseases include leaf spot, leaf blights, maize streak virus and stalk and ear (cob) rots. Maize cob rots are caused by fungal complex including *Fusarium* spp., *Stenocarpella* spp., and *Aspergillus* spp. (Laboso and Ng`eny, 2007).

The ear rots are important because heavy infestations directly result in grain spoilage, significantly reducing both the yield and quality of the crop. The infested grains are light in weight and ears are discolored with shriveled grains. Yields from individual farms are generally low with majority of small holder farmers obtaining less than 1 to 4 tons per hectare (Olantinwo *et al*., 2004). The annual losses due to ear rot are estimated to be 18 percent in Honduras (Julian *et al.*, 2005). Cob rot fungi produce mycotoxins, which have been linked with a number of mycotoxicoses and carcinomas of humans and domestic animals including esophageal cytological abnormalities in humans, pulmonary edema, and hydrothorax in swine, intoxication and paralysis in cattle (Marasas *et al*., 2008; Castelo *et al*., 2008). Despite this, the demand for maize from feed industry, local brewers, small livestock producers and local consumers is high, indicating people and animals could be ingesting mycotoxins in Africa. For incidence, in Malawi, a South African country, where Cob rots have been ranked among the top three important maize diseases and fourth in distribution (Adipala and Malden *et al.,* 2003).

Yield loss of up to 10% due to cob rots in African countries have been reported (Adipala and Malden *et al.,* 2003). In tropical Africa, maize is produced under diverse ecological conditions and yields are governed primarily by soil moisture availability and atmospheric temperature. The mid altitude zone (800-1500m) represents the major maize growing areas in Kenya, being a high potential area with yield potential of 8-10 tons ha^{-1}. Most maize genotypes grown in these areas are susceptible to *Stenocarpella*, which has become a major biotic constraint to it`s cultivation (Fajemisin *et al*., 2002).

Stenocarpella ear rot caused by the fungus *Stenocarpella maydis* (berk.) Sutton (=*Diplodia maydis* (Berk.) Sacc., is an important disease in many maize growing regions of the world and was once the most important ear rot pathogen in the United States (Vincelli , 2003). It develops as a result of infection and subsequent inter-and intracellular colonization of the maize ear. *S. maydis* pycnidiospores germinate and colonize stalk, leaf and shank tissues by directly penetrating epidermal cell walls and host cytoplasm through the formation of appressorium and enzymatic degradation. Ears are usually colonized from the shank up into the ear, and losses are due to reduced seed weight and seed viability. Significant losses due to this disease have recently been reported from isolated locales within the United States (Hanson, 2002; Ajello *et al.,* 2003). Increased incidence of *Stenocarpella* ear rot is related to changes in tillage practices. High incidences of *Stenorcarpella* ear rot occur under conservation tillage systems. More pycnidia are produced and survived on maize stubble on the soil surface than on stubble buried in the soil (Flett and

Wehner, 2001). Hybrid genetics and weather are also major factors. Infection is enhanced by dry weather prior to silking followed by wet conditions at and just after silking. Ears are more susceptible to this disease during the first 2 days after silking. High disease incidences do not normally occur over wide areas but rather occur in isolated fields (Flett and Wehner, 2001).

In Kenya farmers have rated ear rots among their production constraints and have provided an estimate of their annual losses to ear rots at 18 percent (Ajang *et al*., 2008). Where as many countries have recognized maize ear rots as a disease of concern, in Kenya no quantifiable information is readily available about the incident and severity of the disease (De Leon, 2004). The broad objective of this study therefore is to obtain relative importance of different fungal ear rot causing disease in Nyanza and determine the relative importance of *Stenocarpella* spp and the response of maize genotypes to *Stenocarpella* spp. (Ajanga *et al*., 2008).

1.2. Problem Statement

Despite widespread dissemination of hybrid materials and fertilizers, yields of maize from individual farms are generally low with the majority of small holder farmer obtaining less than 1 to 4 tons per hectare (Dorrance *et al.,* 2008). Among the diseases that affect maize, ear rots cause significant yield losses that are stimated to is 18 percent (Ajanga *et al.,* 2008). This means that food for the ever increasing population. Reports from Africa indicate that plant pathogenic fungi is a significant constraint to increased maize production in farming systems. Some parts of the low-lying region of Kenya such as Nyanza have conditions that favor the occurrence of ear rots in maize (Ajanga *et al.,* 2008), but information on incidences and severity of fungi to maize is not available in Nyanza. There is no reference on Fungal severity and incidences in cooler environments of Maseno that can compare it to Nyanza fungal severity. Farmers in this region are not aware or do not consider ear rots as a norm (Berger, 2005) thus continuously experience heavy yield losses. Besides yield losses due to ear rots, rotten maize is utilized in various forms; food, beer livestock feed etc with disregard to health hazards associated with mycotoxins. Therefore information that is conclusive is not available on the ear rots within Nyanza and Maseno area and their effects to common maize hybrids grown by farmers. Its also known that Stenocarpella spp. Fungi maize ear rot is reported in most of the ares of maize production whenever ear rot Fungi are put into research but its not Known if the same apply for Maseno.

1.3. Justification of The Research Problem

There is availability of overall information on incidences and severity of ear rot causing pathogens in Nyanza and their contribution to crop loss. Pathogens evolve and become more virulent, this calls for the need to continually evaluate our germplasm for ear rot resistance. Information obtained will be utilized to sensitize farmers on importance of ear rots and associated risks. Maize (*Zea mays* L.) is the most important food crop in Kenya with a national production of 2.4 million tons in a total area of 1.6 hectares (Gebrikidan and Njoroge, 2002). Shortage of maize in Kenya often results in famine among the poor urban and rural people. Among the Fungi biotic stresses of over 90 percent of the maize crop diseases are reported in research and extension annual reports but very little is known about disease incidence and severity, pathogenic Fungi distribution, epidemiology, yield losses and physiological specialization and therefore information found in this experiments can is vital to basic data in plant breeding. Maize ear rot complexes caused mostly by *Stenocarpella* are a major constraint to maize cultivation in the mid altitude (800m-1500m) to lowland areas in Kenya. Therefore there is need to carry out a survey and have a clear picture of the incidence and severity of different ear rot causing pathogens in Nyanza regions regions. This will enable breeders to identify hybrids gene pools that can be induced for resistance to *Stenocarpella* ear rots.

1.4 Objectives

1.4.1 General objective

To survey and identify the incidence and severity of maize ear rot causing pathogens in selected counties of Nyanza region and Maseno area and evaluate the response of maize hybrids to *Stenocarpella spp.*

1.4.2: Specific objectives

1. To determine the severity and incidence of maize ear rot causing pathogens in Nyanza regions.
2. To identify *Stenocapella* spp causing ear rots in Maseno.
3. To evaluate the response of selected maize hybrids to *Stenocapella* spp

1.5 Hypotheses

1. There exists defferences in severity and incidence of maize ear rot causing pathogens in Nyanza region.
2. There exists differences in identity of *Stenocapella* spp causing ear rots in Maseno.
3. There exist differences in the response of selected maize hybrids to *Stenocapella* spp.

CHAPTER TWO

LITERATURE REVIEW

2.1 Importance of Maize

Maize is the world's third most important crop after rice and wheat with regard to cultivation areas and total production (Osagie and Eka, 2008). About half of this is grown in developing countries, where maize flour is a staple food for people and maize stalks provide dry season feed for farm animals. Diversified uses of maize Worldwide include: maize grain, starch products; corn oil; baby foods; popcorn; maize-based food items; maize flour; forage for animals; maize stalks providing dry season feed for farm animals; maize silage for winter animal feed in cold temperate regions and maize stalks as soil mulch where it is in abundance. Maize grain is used as feed for beef, dairy, hog and poultry operations in developed countries. Maize can be classified on the basis of its protein content and hardness of the kernel. In industrialized countries maize is largely used as livestock feed and as raw materials for industrial products e.g. in Australia as feed, silage , breakfast food and processing (breakfast cereals, corn chips, grits and flour), industrial starch and popcorn. In low-income countries it is mainly used for human consumption (Purseglove, 2002; Osagie and Eka, 2008).

In sub-Saharan Africa, maize is a staple food for an estimated 50 percent of the population and provides 50 percent of the basic calories Per capita. Maize consumption use in Kenya average more than 103 kg per person in a year (Pingali, 2001). It is an important source of carbohydrate, protein, iron, vitamin B and minerals. Africans consume maize as a starch base in a wide variety of porridges, pastes, grits and beer. Green maize (fresh on the cob) is eaten parched, baked, roasted or boiled and plays an important role in filling the hunger gap after the dry season. However, the yields are low, fluctuating around 1.0t/ha. Several African countries have focused attention on increasing maize production in the small holdings agricultural sectors, but such efforts have been ineffective because of heavy pre- and post-harvest losses caused by diseases, weeds and pest. In South Africa, in addition to the traditional uses, the country is considering maize fuel; an alcohol based alternative fuel produced by fermenting and distilling the starch rich grains of the crop (Pingali, 2001).

According to UN's Food and Agriculture Organization as reported by Ajang *et al*., 2008), maize yields currently average 1.5 t/ha in Africa, 3 t/ha in Latin America, and 1.7 t/ha in India. FAO indicates grain yields of 5-6 t/ha in dry land and 8-10 t/ha in irrigated lands. Maize silage with moisture content of 68-70 percent moisture content is produced at a rate of 20 t/ha in dry land and 42 t/ha in irrigated lands. Maize grain has yielded 5.5-6-3 t/ha in Yugoslavia and silage of 35-50 t/ha in France and 25-30 t/ha in the United Kingdom when using high yielding cultivars and intensive cropping practices.

2.2 Maize Ear Rot Causing Pathogens, Incidences and Disease Deverity of *Stenocarpella spp*

2.2.1 Ear rots causing pathogens

A wide range of pathogens cause maize ear rots. Some of these ear rots are;

Stenocarpella ear rot or dry rot is caused by the fungus *Diplodia maydis.* The same fungus is commonly associated with stalk rot and may cause seed rot-seedling blight. The husks of ears which are infected early appear bleached or straw-colored, in contrast to green healthy ears. Infections occurring within 2 weeks after silking cause the entire ear to be gray-brown, shrunken, very lightweight and completely rotted. Light weight ears stand upright, with the inner husks stuck tightly together and to the ear by white mycelia growth. Ears infected later in the season usually show no external evidence of disease. When the husks are opened a white mold is seen growing between the kernels. All or part of an ear may be rotted. In still later infections, the white mold may or may not be visible between the arrows of kernels. Ears sometimes appear healthy until after shelling, when the brown germs and dead kernels become evident. Infection usually begins either at the base of the ear progressing toward the tip or at an exposed ear tip, but can also advance from the stalk through the shank and into the ear (Sutton and Weterston, 2006).

Speck-sized, black fruiting bodies (pycnidia) of the Diplodia fungus are often found scattered on the husks and sides of the kernels as well as floral bracts and cob tissues. The pycnidia are filled with thousands of microscopic spores that may be carried to distances by the wind to initiate new infections. Rotted ears have both reduced nutritive value and reduced palatability to hogs. Dry weather early in the season followed by abnormally wet weather just before and after silking favors ear infections. Ears are most susceptible from silking to about three weeks later. Hybrids with poor husk coverage or thin pericarps are often very susceptible. Some isolates of *Diplodia maydis* may induce premature germination of kernels on the ear (Dhanraj, 2006).

Gibberella ear rot sometimes referred to as red ear rot, is caused by the fungus *Gibberella zeae* is common in western part of Kenya in some years. This fungus, however, is much more important as a major cause of stalk rot. A reddish mold, usually starting at the tip of the ear, is characteristic of *Gibberella* ear rot. All kernels become reddish as the fungus colonizes the entire ear (Appendix 11; Plate 3). The husks may adhere tightly to the ear and a pinkish to reddish mold often grows between them. Superficial, speck-sized, blue to black perithecia occasionally develop on the husks and ear shanks. The corn ears are generally susceptible only when they are very young, and cool, wet weather within 3 weeks of silking favors disease development. Ears infected early in the season may rot completely, although complete rotting is rare. Ears with loose, open husks are often more susceptible than those with good husk coverage. Sap beetles are capable of transmitting conidia and ascospores of the fungus, both within and between corn ears, thus increasing the amount of ear rot. Inbreds and hybrids differ in susceptibility. Corn infected with *Gibberella* ear rot is particularly toxic to hogs, dogs and other animals with similar digestive systems, causing vomiting, dizziness, loss of weight, or even death in severe cases. Infected maize is also toxic to humans (Payne, 2009).

Nigrospora ear rot or cob rot is caused by the fungus *Nigrospora sphaerica*, synonym *N. oryzae*, teleomorph *Khuskia oryzae*. As infection usually starts at the butt end of the ear or sometimes at the tip, this eventually calls for a reduced production since affected ears do not become conspicuous and the disease is widely distributed. Grain production is really reduced by ears that appear chaffy and weigh less than healthy ears and kernels that are loose on the cob. Other features of the rot include; ears that are shredded and sometimes found knocked to the ground by mechanical pickers, Cobs that break into small pieces during shelling, ears that show large numbers of speck-size, jet-black spore masses that are scattered in the shredded pith of the cob and on the tip ends of the kernels that are slightly bleached, whitish streaked kernels that start at the tips and extend towards the crowns and may show a gray mycelia growth. *Nigrospora* rotted maize has almost the same nutritive value as healthy maize. However, it leads to severe arrest to plant growth, killing plants prematurely when other stresses set in such as frost, drought, hail, stalk and root rots, leaf blights, insect damage, root injury an infertile soil (Kirimelashvili *et al*, 2009).

Fusarium kernel rot or ear rot Caused by the fungi *Fusarium moniliforme* and *F. subglutinas*, is the most wide spread disease attacking maize ears in Kenya (Gebrekidan and Njoroge, 2002). Delayed beyond harvest physiological maturity, leads to this fungi increase in occurrence. The first symptom is a salmon pink-to-red brown discoloration of the caps of individual kernels or groups of kernels scattered over the whole ear. As the disease progresses, infected kernels become covered with a powdery or cottony-pink mold growth composed of large numbers of microscopic spores. Kernels infected late in the season develop whitish streaks on the pericarp. The same fungi are commonly found in stalks and seeds (Adejumo *et al*, 2007). Infection commonly follows some form of injury. Bird feeding encourages infection at the tip of the ear. Disease development and spread are favored by dry, warm weather. Leading to heavy redcuction to grain yield.

Gray ear rot is caused by the fungus *Botryosphaeria zeae*, synonym *Physalospora zeae*, and anamorph *Macraphoma zeae*, is a rare ear rot and occur only in restricted areas to it. Early infections may produce symptoms similar to those of *Diplodia* ear rot. A gray white mold develops on and between the kernels, usually starting at the base of the ear; in early infections the husks are bleached and adhere tightly to the ear, the ears are lightweight, stand upright and at harvest are slate gray instead of grayish brown, as in *Diplodia* ear rot and, when the shank and butt are rotted, the ear breaks off . In later stages, gray ear rot may be distinguished from *Diplodia* by the presence of numerous, small, black specks (sclerotia) scattered throughout the interior of the cob, on the husks and under the seed oat of the kernels. Kernels may develop a uniform slate gray to black streaking. The fungus growth on the surface of the ear and between the kernels is also a darker gray than a *Diplodia*-rotted ears. Early infection usually causes the ear to be shriveled, black, and mummified. Disease development is favored by extended periods of warm to hot weather for several weeks after silking (KARI, 1992).

Penicillium rot (*Penicillium* spp.) is found occasionally, particularly on ears injured mechanically or by corn earworms and European corn borers. The typical powdery, blue - green or green mold grows on and between the kernels which are frequently bleached and streaked. Damage usually occurs at the tip of the ear, but may be found on other parts. The same fungi cause seedling blight and 'blue-eye'' storage rot of shelled corn with high moisture content (Tenuta, 2006).

Aspergillus ear rot (*Aspergillus* spp.) is ordinarily of little importance before harvest. However, *Aspergillus* infections often follow drought stress and damage done by maize earworms, therefore there is need to determine the occurrence of this fungi and how it affects maize hybrids, as other stresses have been covered in several research (Lipps and Mills, 2007). A tan, sooty-blank, green yellow mold grows on and between the kernels. Damage is most common at or near the tip of the ear. Silk infection is favored by high day and night temperatures. *Aspergillus flavus* and *Aspergillus. parasiticus*) produce aflatoxin that cause ear and kernel rot. Aflatoxins invades cracks and injuries in shelled maize under storage, then during consumption, as a carcinogenic substance, aflatoxin causes serious digestive problems in a wide range of animals. Maize hybrids grown under nitrogen deficiency are commonly found to contain aflatoxins prior to harvest (Naidoo, 2002).

Trichoderma ear rot caused by *Trichoderma viride* is evident as a green, fuzzy mold growing on and between the husks and kernels. *Trichoderma* is usually secondary to insect or mechanical damage to the ear (Laboso and Ng`eny, 2006).

Cladosporium Kernel rot or ear rot that is initiated by *Cladosporium herbarum,* synonym *Hermodendrum cladosporioides* cause symptoms that include the development of dark, blotched and/or streaked kernels scattered over the ear. The black discoloration appear near the tips of the kernel first and develops toward the crown in more or less irregular streaks. The fungus may also invade crowns damaged by growth cracks however, further rotting may occur during storage leading to reduced weight (Klapproth, 2001).

Black ear rot is caused by Biplorais zeicola, synonym Helminthosporium carbonum, Races 1 or 2; Bipolaris maydis, synonym Helminthosporium maydis, race T; and Exserohilum rostratum synonym Helminthosporium rostratum, is occasionally found, mostly on certain inbred lines, therefore need to study effects of several fungi to a number of hybrids. The same fungi also cause stalk rots, leaf blights and seedling blights. Damage ears have a black ‘‘felty’’ or velvet-like mold growth over and between the kernels.Such ears appear to have been charred by fire (Shurtleff, 2000).

Rhizopus spp ear rot is characterized by a coarse white mold over the ear in which numerous black sporangia appear as black specks. *Rhizopus* rot is usually found only on ears injured by insects or hail a few weeks after silking during and following hot or very humid weather (Nyall,2 009).

Physalospora ear rot is caused by *Botryosphaeria festucae,* synonym *Physalospora zaeicola*, anamoprh *Diplodia frumentii*. It is a rare fungi of maize that develops as dark brown to black mold growth on the ear. Mildy infected ears may have few blackened kernels near the base of the ear that is common during warm, humid weather that favors fungi reproduction (Berger, 2005).

Rhizoctonia ear rot is caused by *Rhizoctonia zaeae* that is a rare fungus. It is recognized in its early stages by a salmon-pink mold growth on the ear. Infected ears later become dull gray. Numerous white to salmon-colored sclerotia develop on the outer husks that later turn to brown and then to black under warm-to-hot, and humid weather (Hassan *et al*., 2008).

2.2.2 Disease severity and incidences of *Stenocarpella spp*

Wet weather immediately following silking increases disease severity. The disease is also more prevalent where maize follows maize and crop rotation is not used, as it is seen farmers do in Nyanza region mostly. Additionally, the disease is more prevalent where ears are damaged due to insect injury such as those caused by stalk borers. Generally, *Stenocarpella* ear rot is highly and always an expected problem in the fields (Vincelli, 2003).

2.2.2.1 Damage caused by *Stenocarpella Spp*

Stenocarpella Spp cause plant damage by rotting the ear and the kernels leading to reduced weight and nutritional content that causes yield loss. Yield reduction is because of it`s infection at kernels during blister stage that cause reduced kernel size and grain filling. This damage that leads to reduced yield becomes most critical if infection occurs early, that is immediately following flowering. The earlier stage infection is effective, for entire ear may rott or kernels may not develop fully. *Stenocarpella maydis* and *S. macrospora* produce the mycotoxin that make grains harmful to animals especially, birds. Livestock may sense the toxins and refuse grains that are severely affected by *Stenocarpella* ear rot (Patrick and Mills, 2001; Vincelli 2003).

Stalk and grain rots are universally important and among the most destructive disease of maize throughout the world (Kirimelashvilli and Dolizde, 2009). In most cases, a complex of several species of fungi and bacteria causes rots, rather than by a single species, indicating that, it is difficult to assess the loss due to a single fungal pathogen alone. Losses due to stalk and grain rots varies as per seasonal and regional differences, but may be greater than 50 percent by *Stenocarpella macrospora* alone. Although a less percentage of 0-20 yield reductions is common. Losses arise directly from grain filling and indirectly from harvest losses because of lodging. In comparison, *S. maydis* has been found to cause a loss that range between 5 and 37 percent during germination (Kim, 2000). It is also a serious pathogen in maturing plants. Generally, *Stenocarpella* causes up to 80% of the ears roots leading to considerable yield loss worldwide (Patrick and Mills, 2001). Infected ears can weigh up to 35 percent less than healthy ears. Furthermore, infected grain has been reported to cause mycotoxicosis when fed to cattle sheep and humans (Vincelli, 2003).

2.2.2.2 Control of *Stenocarpella* ear rots

Rotation with other crops is the best approach to control *Stenocarpella*. Rotation deprives starve the fungus by denying food base. This becomes possible, since no crop other than maize is susceptible to *S. maydis* as an example (Woloshuk and Wise, 2009). This clearly suggests that, crop represents a suitable alternative for managing *Stenocarpella* ear rot (Vincelli, 2003). Any rotation away from maize, even for one year, helps to reduce build up of inoculum by allowing infected corn residues to begin decomposition. In fields with moderate to high levels of *Stenocarpella*-infested residues, rotation of two to three years may be required to reduce inoculum to acceptable levels (Woloshuk and Wise, 2009).

Research by Lin *et al*. (2009) indicates that the level of *Stenocarpella* ear rot is proportional to the amount of infested maize residue on the soil surface. However, this is highly expected only if the weather conditions become conducive for disease development during silking (Schaafsma *et al*., 2003). Tillage practices that partially or completely bury maize residue can provide substantial disease control by greatly reducing spore levels in the field. On contrary, because of soil erosion concerns, many informed farmers may not wish to exercise this option and may even restricted from doing so by their soils conservation organisations. Deep tillage is not a guarantee against the disease since some infested residue may remain on the soil surface. Considerable strength is therefore put to rotation as a preferred option for dealing with fields where *Stenocarpella* ear rot is a single problem (Vincelli, 2003).

Maize hybrids currently on the Kenyan market have not been fully determined of their resistance level to *Stenocarpella* ear rot as found done by Rabie *et al*. (2005). Owing to this information of not knowing the status of *Stenocarpella* ear rot disease in this Kenyan maize hybrids is a limiting factor in increased maize production, because this fungi develop on any maize hybrid provided that the conditions during silking are favorable to it. However, it is known that hybrids differ in their level of susceptibility to the fungus or any other stress (Pittet, 2008). For instance, The problem for producers is that little information currently is available on hybrid susceptibility to *Stenocarpella* ear rot (Lipps and Mills, 2007). This clearly indicates that, several maize seed companies that have active breeding programs do not currently have enough data to reliably predict varietal performance in the presence of the disease and therefore needed. While all hybrids tested thus far are susceptible to some degree, for example (Ajanga *et al*., 2008). This literally indicates that, certain hybrids are probably too susceptible for fungus in an infested field (Fajemisin *et al*., 2002). Hybrids that have repeatedly suffered very high levels of ear rot i.e.,50 percent or more of the ears diseased should be avoided (Vincelli, 2005), but the idear is it will be impoternt to determine the severity fungi to these Kenyan hybrids.

2. 3. Isolation and Identification of Ear Rot Causing Pathogens

2. 3. 1. Sampling techniques

There are many sampling techniques for obtaining data, such as simple random samples, systematic samples, and stratified samples. A common technique of sampling is by random method or uniform interval sampling along a path of predetermined design. Conventional sampling techniques is by diagonal, W, V and X (Lin *et al.*, 2009). The points chosen will take this shapes, such that the whole whole field or restricted subdivisions of a field are represented. According to Line *et al* (2009), in there sampling when studying clustered disease distribution concluded they found out that the sample sizes are more important than the sampling design when the disease is randomly distributed. Entire field sampling design of ``X`` and ``W`` are equivalent to each other and most precise (Cochrans, 2007) and therefore ``X`` applied for this study. Cochrans (2007) described stratified random sampling design (SRSD) as a design where an entire population in a field is divided into uniform sectors. These sectors are none overlapping and together make the entire field.

In his case, once the sector is determined, a randomly located sample is collected from each sector. In this design each plant has an equal chance of being sampled. This design also has the advantage of giving an unbiased estimate of disease incidence and the sectors are also uniform and independent. Stratified random sampling design and variance analysis have been used when studying *Stenocarpella spp* by Klapproth, (2001) and maize inbrids in Nigeria (Kim, 2000). Plant pathologists seldom have good 'rules of thumb' on how many samples to take or how to interpret results from a given number of samples. For example, Madden and Hughes (2009) stated that the precision of estimated disease incidence can be evaluated under a wide set range that includes the hierarchical sampling of groups of individuals, the various levels of spatial heterogeneity of disease, and the situation when all individuals are disease free.

2. 3. 2. Fungal identification

Fungal identification requires a stronger visual acuity than bacteria. The characteristics of fungi are determined by observing colonial growth both microscopically and macroscopically (OEPP., 2006). Morphological features are the classical methods that are routinely used in fungal classifications and identification (Nyall, 2009). There are inabilities and difficulties in identification of fungi in the genus or at specific level. These is due to the fact that, there is ever increasing number of fungi which are difficult to identify using morphological criteria, because by natural selection some do not sporulate (Lin *et al*., 2009). Therefore other methods have been created at recent times, for example; biochemical tests and DNA analysis. Morphological criteria and biochemical tests were chosen for this study they are readily available and mostly used to determine the genus and species of the fungi. Morphologically, microscopic structures and macroscopic features used for fungal identification include colour, type, shape, size and arrangement of the spores, as well as septation of the hyphae (Sangeetha, 2013). Pictorial guides and fungal identification keys are also useful just like the scotch tape mount that has been found to be easy and fast. This is a faster method that is mostly used in identification of filamentous fungi on which most structures are found intact for observation (Lipps and Mills, 2007). In this method, lacto-phenol mount is used, whereby the fungi is immersed in the solution. This make the fungi safe for handling outside of the biological safety hood. The tape always dissolve, therefore, no permanent mounts can be made. Meaning, the procedure can only be performed on moulds growing from plates **(**Navi *et al*, 2009).

2. 3. 3. Culture preparation

Culture preparation is always done aseptically to reduce contamination and to enable the production of pure cultures. Some of the aseptic procedures include the use of the laminar flow hood, moist heat sterilization, and disinfection of benches using acetone, alcohol (Hauser, 2006).

2. 3. 4 Maize inoculation techniques

Methods chosen for inoculation by breeding programs are those that show up as clearly and closely the infection under natural conditions (Berger, 2005). For instance, spraying and pouring methods resulted in higher incidence of *S. maydis* in maize grains, and therefore, higher incidence and higher severity of *Stenocarpella spp* in ears as found by Dai *et al*. (2007) when studying *S. Maydis*. The selected method used in their study therefore, provide consistent data over the years, locations and genotypes, thus making it possible to define a clear distinction of hybrids under study. For it is known that, artificial methods of inoculation in maize breeding programs for evaluation and selection of genetic material for resistance to ear rots are necessary for use (Mario *et al.*, 2011). The pouring method as used by Dai *et al*. (2007) during study of *S. Maydis* lead to the highest incidence of the disease, and therefore this method allow researchers to get clear distinction of the susceptible germplasm from the resistant one. In addition it is so because, climatic oscillations hardly influence it (Flett and Van, 2011). The pouring method can be recommended for breeding programs and germplasm screening to select genotypes and populations for resistance to ear rot by *S. maydis.* When using this method, both incidence and severity of *S. maydis* can be used as variables for germplasm screening to resistance against the pathogen under field conditions. (Silva *et al*, 2007).

2.4. Response of Maize Hybrids to *Stenocarpella spp*

Diplodia ear rot is one of the ear diseases found in maize growing fields in Kenya (Gabrekidan and Njoroge, 2002) and it is caused by *Diplodia (Stenocarpella spp*). In 2.3 above, its noticed that during the growing season with abundant rainfall, disease severity can be high in certain fields that are planted with susceptible hybrids (Adejumo *et al*., 2007). Indeed, the hybrids used in this study have been developed most recently and proven to have got a high production rate under the changing environments, however there is need to evaluate their response to *Stenocarpella spp*. that affect maize production. The justification is that, the incidence of ear rot in affected fields generally ranges from less than 1% to over 35% of the ears damaged in most of the hybrids. The disease is most severe in fields planted to continuous maize, especially when the previous maize crop residues are left on the soil surface (Dhanraj, 2006).

Lipps and Mills (2001) found out that *Diplodia* ear rot causes damage to corn by causing light weight kernels that reduced grain yield and reduced nutritional value of the affected grain (Appendix 11, Plate 1). High levels of affected grains when used in making feeds calls for unpalatable ability. Under most conditions, damage caused by *Diplodia* ear rot is limited to the field. However, it can be a problem in storage if grain moisture is 20 percent or above (Lipps and Mills, 2001)

2.4.1. Biology of the *Diplodia*

Hybrids with poor husk coverage or thin pericarps are often very susceptible to *Diplodia*. An organic substance secreted by *Stenocarpella maydis,* induce growth of *Stenocarpella macrospora* (Christensen and Wilcoxson, 2007). For instance, *S. macrospora* can utilize complex carbohydrates only when a growth factor required by the fungus is present. The infection cycle and over wintering are very similar in two species, but *S. maydis* fungus generally occurs in cooler regions. Conidia in *S. maydis* rapidly lose their viability at high temperatures and on exposure to sunlight. At least 24 strains have been reported. Variability appears to be related to temperature requirements (Christensen and Wilcoxson, 2007).

Stenocarpella maydis over winters as viable pycnidia and mycelium on maize debris in the soil, or on seed (Appendix 11; Plate 2). Under warm, moist conditions, spores are extruded from pycnidia in long cirrhi and disseminated by wind, rain and probably, by insects (Keehler, 2000). Maize plants are infected primarily through the crown, mesocotyl, roots and occasionally, at the nodes between crown and ear. Following this, stalks are invaded (Dhanraj, 2006). The development of the stalk rot phase is favored by dry weather in the early growing season, followed by extended periods of rainfall shortly after silking. In stalk infections, injury to the vascular system disrupts translocation and consequently, reduces grain size, unbalanced fertility, low potassium, poor drainage, mechanical and insect damage. At this stage, cultivar and planting density influence disease severity. The ear and grain-rotting phase is similarly favored by above-normal rainfall at stage of silking to harvest, and that, at this phase ears are most susceptible during the weeks after silking (Dhanraj, 2006). Invasion of the ear is usually by way of the shank (Sutton and Watterson, 2006).

2.4.2. Detection and identification symptoms of *Diplodia*

2.4.2.1. Seedlings

Infected seed gives rise to pre-emergence death in cold soils or blight coloured seedlings in warmer soils. Seedlings develop brown, cortical lesions on the internodes between the scutellum and coleoptile and the seminal roots are frequently destroyed (Sutton and Waterston, 2006) .

2.4.2.2. Stalk rot

Symptoms do not usually appear until several weeks after silking, and generally arise following root infection. Oval irregular or elongate, single or confluent lesions, 1-10 cm long, with pale cream-brown centers and indeterminate darker borders are frequently associated with stalk rot infection (Dhanraj, 2006). Leaves wilt, become dry and appear grey to green and the symptoms resemble those of frost damage leading to sudden death of plant. The green color of the internodes fades and they become brown to straw-colored, spongy and easily crushed (Sutton and Waterston, 2006). The pith disintegrates and becomes discolored, with only the vascular bundles remaining intact. Dark, sub-epidermal pycnidia may be seen clustered near the nodes, and white fungal growth may also be present on the surface (Dhanraj, 2006).

2.4.2.3. Ear rot

Infection usually starts at the ear base, moving up from the shank. If infection occurs within two weeks after silking; the entire ear turns to grey then to brown, becomes shrunk and completely rotten with light weight. Sometimes, early infections result in bleached or straw-colored husks. Light weight ears usually stand upright with inner husks adhering tightly to one another or to the ear because of mycelial growth between them. Black pycnidia may be scattered on husks, floral bracts and the sides of kernel. Late infection on the ears show no external symptoms. In this case, ears are broken and grains removed, it is also noticeable by a white mould that is found growing between the grains whose tips are discolored (Walker, 2009).

2.4.2.4. Morphology

A number of primary and secondary fungi may be present on a plant at a time. Therefore, microscopic observation of fruiting bodies is advisable for correct diagnosis. This microscopic diagnosis identify the fungi as pycnidia are immersed, spherical (Diameter; 200-300 µm), with multicellular walls and a circular protruding papillate ostiole (Diameter; 30-40 µm). Conidia of *S. macrospora* are seen straight or curved, rarely irregular, 1(0-3) septate, smooth-walled, pale-brown, with rounded or truncated ends that are relatively large and estimated to be 7.5-11.5x 44-82 µm (Appendix11; Plate 4a). Conidia of *S. maydis* are straight, curved or irregular, 1(0-2) septate, smooth -walled and pale-brown with rounded or truncated ends, 5-8x15-34 µm (Shurtleff, 2000).

2.4.2.5. Detection and inspection methods

The detection and inspection methods for *S. macrospora* and *S. maydis* as outlined in EPPO's Quarantine Procedure No. 35 (EPPO, 2006). As per EPPO, seeds of maize should be placed on 1% malt agar and incubated at 20 ^{0}C for 7 days. This is then followed by microscope observation that reveals the presence of the fungi. On the contrary, the Japanese plant protection service proposes a procedure which required less time by removing the outer layers of the seeds halfway through the incubation period, with subsequent microscopic examination (Dai *et al*., 2007).

2.4.3.6. Disease cycle

Stenocarpella ear rot is caused by *Stenocarpella maydis*; the same fungus that causes *Stenocarpella* stalk rot. For decades, this fungus was known as *Diplopodia maydis*. Scientists now recognize that the proper name for this fungus is *Stenocarpella maydis* (Rabie *et al*., 2005). Another related fungus, *Stenocarpella macroscopora*, has been found in the United States causing a similar ear rot during warm humid weather (Vincelli, 2005). *Stenocarpella macroscopora* also produces brown spots and streaks on leaves. *Stenocarpella maydis* survives between seasons in residue of maize stalks, cobs and fallen kernels. Spores of the fungus are produced in fruiting structures called pycnidia which are produced on infested corn residues. During wet weather, the microscopic spores ooze out of these fruiting structures, they then spread by rain splash. When plants are silking spores that are splashed up to the ear leaf and then deposited by rain water around the ear shank have an opportunity to cause infection. These spores can germinate and penetrate the ear shank, growing up into the cob and outward into the kernels. Ears are most susceptible to infection within a week or two of when 50 percent of plants have completed silking (Walker, 2009). Susceptibility of ears steadily declines after 50 percent silking as found by Sutton and Waterston (2006), although some ears can still be infected as long as four weeks after mid silk (Olantinwo *et al*., 2004). Wet weather and moderate temperatures during silking allow infection if spores are present. But before silking, the disease is enhanced by dry weather followed by warm, rainy weather. This occasionally prevents spores from being released until the plants are silking (Walker, 2009).

Field observations suggest no association between bird damage or insect injury and *Stenocarpella* ear rot. Without crop rotation, The residue of can produce large amounts of spores that can splash to the next crop as *S.maydis* affects maize alone. There is no research in Kenya, although research conducted in South Africa showed that survival of pycnidia and incidence of *Stenocarpella* ear rot was consistently higher under conservation tillage system (Vincelli, 2005).

CHAPTER THREE

MATERIALS AND METHODS

3.1. Field Site and Soil Characteristics

Twelve divisions in four counties that represents maize growing regions of Nyanza were studied as shown in Table 1 The counties included were Kisumu, Homabay, Migori and Siaya. Five farms in each division were selected randomly and infected cobs with different ear rots within their farms counted. The study was carried out in these counties during the short rains season of September to December 2008 and during the long rains season of February to July 2009.

Table 1. Shows Counties, Divisions, and number of participating farmers during survey in Nyanza region

County	Division	Number of participating farmers
Kisumu	Maseno	5
	Kombewa	5
Homabay	Kasipul	5
	Kabondo	5
Siaya	Sakwa	5
	Imbo	5
Homabay	Rangwe	5
	Asego	5
Migori	Awendo	5
	Rongo	5
Siaya	Madiany	5
	Asembo	5
	Total	**60**

Hassan (1998) defined Nyanza region to be moist mid -altitude zone. This forms a belt around Lake Victoria, from its borders at an altitude of 1110 meters, up to an altitude of about 1500 meters above sea level. Jaetzold and Schmidt (1982) indicate this zone to have characters that corresponds largely with the lower midland temperature belt. These includes;

humidity range from 1(humid) to-6 (arid), and annual rainfall average between 700 mm and 1800 mm and is bimodal, first rainy season starts in February/March and second in August /September. At lower elevation, in particular at the shore of Lake Victoria. The rainfall is less and the second season is less reliable.

Responses of maize hybrids to *Starnocarpella spp* were evaluated at Maseno University Research Farm during the same short rains season and long rains season as those of Nyanza region. Njau (2001) classified Maseno soils as acrisol deep reddish brown clay and well drained with a pH range of 4.5-5.4. Maseno receives both short and long rain averaging to 1750mm per annum with a mean temperature of 28.7^0C. Latitude extent 0^0 $1^/$N – 0^0 $12^/$S; Longitude extent 34^0 $25^/$E – $34^0 47^/$E is its location at approximate 1500 m above sea level.

3.2. Determination of Disease Severity and Incidences of Maize Ear Rot Causing Pathogens in Nyanza region

3.2.1. Survey methods and analysis used in Nyanza region

Marley and Abar (2001) methods of survey and analysis was used. As adopted from their method, the sample size was one hundred maize plants per every farmer in Nyanza region. The sampling sectors selected were twelve divisions and the five farmers field/experimental plots per division where the maize plants were planted represented the Sampling fields. Lastly disease incidences were the Percentage of diseased plants in a sampling site or sector.

3.2.2. Sampling procedure used in Nyanza region

Stratified random sampling design (SRSD) as stated in Nyall (2009) was used. The samples were stratified by dividing Nyanza divided into four counties that each county represented a stratum. To make sure that, at least 30% of Nyanza region was covered, five farmers were selected from each division. The `X` sampling technique was used for maize sample collection in the fields of farmers within the divisions whereby, the samples were randomly collected along the `X` like structured demarcation in fields. A field was sampled 100 times to avoid biasness.

3.2.3. Collection of fungi samples in Nyanza regions

The five farmers in each division were at least 2 Kilometres apart. A sample of 100 maize cobs were picked randomly along the `X` demarcation and infected maize cob determined from each farmer. Samples were carefully packed in carton boxes and then taken to Maseno Botany laboratory for analysis. Within the laboratory, 5 kernels from each cob, were picked and fungi cultured on 1 percent malt agar on a petri dish, under a laminar flow hood and incubated at 27 ^{0}C for 7 days as done by Flett and Winner (1991). Subsequent microbial observation revealed the presence of various ear rot causing fungi (Flett *et al*., 1992), ie., *Diplodia* as in Appendix 11; Plate 2, Giberella (Appendix 11; Plate 4) and *Fusarium* and *Nigrospora* were also determined basing on the microscopic structures.

3.2.4. Determination of infectional severity in nyanza region

The severity of ear rot infection per year was recorded for the short and long rains of on scale of 1-5 as stated in CYMMYT (2004), where;

1= 0% no infection on kernels or tips of the ear

2 =1-25% of the kernels on the ear have visible infection

3= 26-50% of the kernels on the ear have visible infection

4= 51-75% of the kernels on the ear have visible infection

5=76-100% of the kernels on the ear have visible infection

3.2.5. Determination of infection incidences in Nyanza region and Maseno Area

The incidence per type of ear rot was physically examined and recorded after being calculated equation of Berger (2005) as shown below;

The incidence per type of ear rot = The number of ears affected by a specific type of ear rot ÷ The total number of the ears assessed.

3.3. Determination of severity and incidences of various ear rot causing pathogens from maize fields in Maseno area

3.3.1. Collection of fungi samples in Maseno area

Just as in when studying in Nyanza (3.2.2. above), five farmers located atleast at least 2 Kilometres apart were selected randomly in Maseno area. A sample of 100 maize cobs were picked randomly along the `X` demarcation and infected maize cob determined from each farmer. Samples were carefully packed in carton boxes and then taken to Maseno Botany laboratory for analysis. Within the laboratory, five kernels from each cob, were picked and fungi cultured on 1 percent malt agar on a petri dish, under a laminar flow hood and incubated at 27 ^{0}C for 7 days as done by Flett and Winner (1991). Subsequent microbial observation revealed the presence of various ear rot causing fungi (Flett *et al*., 1992)

3.3.2. Determination of fungi infectional severity in Maseno area

The severity of ear rot infection per year was recorded for the short and long rains of on scale of 1-5 as stated in CYMMYT (2004), where;

1= 0% no infection on kernels or tips of the ear

2 =1-25% of the kernels on the ear have visible infection

3= 26-50% of the kernels on the ear have visible infection

4= 51-75% of the kernels on the ear have visible infection

5=76-100% of the kernels on the ear have visible infection

3.4. Isolation, identification and evaluation of the response of maize Hybrids to *Stenocarpella* spp in Maseno University Research farm

The fields were laid during short rains season of September to December 2008 and during the long rains season of February to July 2009.

3.4.1. Maize hybrid seeds

A total of nine maize hybrids treatments that comprised of popular commercial hybrids EH10, EH13, EH14, EH15, EH16, H515, H526, H614D and P3253 were obtained from Kenya seed company.

3.4.2. Agronomic practices and experimental design

The plots were mechanically hand ploughed to depths of 25-30cm. Three seeds of maize hybrids EH10, EH13, EH14, EH15, EH16, H515, H526, H614D and P3253 were then planted per hill, drilling was at a depth of 3-4cm in the ridges and thinned to two plants per hill to give an approximate plant density of 53,333 plants per hectare as done by Bello *et al*. (2012). The plot size was be 3.75 × 3 m and the plant spacing of 75 cm × 30 cm, giving 5 rows per plot each with 10 plants (Wabungu *et al*., 2012). Paths of 0.3 m and 0.75 m were left between the plots in a block and between the blocks, respectively. First planting was done in August, 2008 for short rains season and the second crop planting was done in April, 2009 during long rains season. At planting, the plots were fertilized at 60 kg N and 60 kg P per hectare using the fertilizer 23: 23: 0. The same plots with plants were then later top dressed, with Urea (46% N) at 100 kg N per hectare. Randomized complete block design (RCBD) with three replicates was used in Alpha (0, 1) lattice way (Patterson and Williams, 1976) to take care of soil variability (Banziger and Vivek, 2007). Two treatments were applied inoculation and a non- inoculation.

3.4.3. Isolation of *Stenocarpella* ear rot causing fungus

Pathogens were isolated and identified by the method of CIMMYT (2004). Fungi were isolated from 5 infected ear kernels, then the surface was surface sterilized in 50ml of a 1:10 dilution of commercial hypochlorite. For better sterilization less than 1ml of ethanol was added to help break surface tension on the seed. After two minutes the seed was removed and rinsed with distilled water. The seeds were blotted dry on sterile paper and in this case, three seeds were separated by equal distance on a 9 cm diameter glass petri dish containing half strength acidified potato dextrose agar (PDA).

This was incubated at 27 ^{0}C under inflorescent lighting for 3-4 days sufficient growth of the fungus inorder to obtain pure cultures of the pathogens. From Pure cultures spores were transferred from 0.2 mm^2 sections of the growing tip of the mycelium that showed no mixture of different types of mycelium or bacterial growth, to 6 new Petri dishes of half strength acidified PDA. One transfer was made to the center of each Petri dish for development of the culture. After 2-3 weeks when the fungus had covered the surface of the agar, one of the representative cultures were observed in the microscope to assure that the correct fungus was isolated on morphological structures as per the characters for fungi in 3.2.3. The cultures were stored in sealed plastic bag in the refrigerator 10^{0}C to maintain the good quality cultures for preparing the inoculum (CIMMYT, 2004)

3.4.4. Preparation of *Stenocarpella* inoculum that was induced into maize hybrids

Colonized tooth picks were prepared. Prior to use of tooth pick; inhibitory compounds such as tannins and phenolic compounds were removed from tooth picks by boiling 2 times, 1 hour each time in tap water to remove toxic substances that would inhibit the growth of fungi. After each boiling the toothpicks were washed in fresh tap water and dried thoroughly in an oven and then placed in glass jars with 200 tooth pick/jar (CIMMYT, 2004).

Forty five millimeters of potato dextrose broth was used to provide sufficient liquid to moisten the tooth picks for good mycelia growth, with a slight excess of liquid in the bottom of the jar. The jar of toothpicks was sterilized for 30 minutes immediately after the broth was added, it was then allowed to cool and inoculated with the mycelium of the pathogen and two bits of agar cultures. After about 3 weeks of incubation at 27 ^{0}C the *Stenocarpella* was ready for use *Pycnidia* had colonized the tooth picks (CIMMYT, 2004).

3.4.5. Inoculation of maize hybrids using *Stenocarpella* in Maseno university farm

CIMMYT (2004) procedure was used to inoculate all the maize plants with pycnidia *Stenocarpella spp* within a week of mid-silking. A colonized tooth pick with pycnidia was inserted into the shank of the ear at 21 days post female flowering (Silking) as done by Latterel and Rossi (1983), in the process, care was taken not to hurt the peduncle tissue. This is because *Stenocarpella* normally enters the ear through the shank. Therefore, this inoculation method allowed *Stenocarpella* fungus to passes and arrive in the ear. The tooth picks also served to mark the sites of inoculation. Determination of infected maize cobs was then done at harvesting.

3.4.6. Determination of Stenocarpella infectional severity in Maseno University research farm

The responses of the maize hybrids were evaluated at harvesting on the following scale by description of CIMMYT (2004) to show severity in Maseno,

1 = 0% no infection on kernels or tips of the ear

2 =1-25% of the kernels on the ear have visible infection

3= 26-50% of the kernels on the ear have visible infection.

4 = 51-75% of the kernels on the ear have visible infection

5 = 76-100% of the kernels on the ear have visible infection

3.4.7. Determination of infected Stenocarpella maize grain yield, plant stand and days to silking as responses in Maseno University research farm

The maize grain yield was determined and converted to tones/ha, plant stand in percentage and days to silking was also counted for the hybrids in order to compare the responses of hybrid`s to *Stenocarpella* infection.

3.5. Statistical data analysis

The data were subjected to Factorial analysis of variance (ANOVA) using SAS statistical computer package (Steel *et al*., 2006). The factors in Maseno University research farm experiments were two treatments levels i.e. inoculation and non inoculation treatments, three replicates and nine maize hybrids. No inoculation was done within farmers fields during isolation and identification. Measurements for parameters were repeated for one factor, that is maize hybrids (Quinn and Keough, 2006). Fisher's LSD test at 5% level was used to separate the means.

CHAPTER FOUR

RESULTS

4.1. Survey and Determination of Severity and Incidences of Maize Ear Rot Causing Pathogens in Nyanza Regions

4.1.1. Severity of maize ear rot causing pathogens in Nyanza regions during short rains seasons of 2008 and long rains season of 2009

Stenocarpella spp. Fungi is much in Nyanza regions compared to *Giberella*, *Fusarium*, *Nigorosa* and other Fungi (Figure 4.1.1). Imbo and Sakwa have high Fungi severity compared to other regions. During the entire two periods of short rains and long rains severity showed significant differences ($p<0.05$) within the regions in Nyanza (Appendix 2: Table 1). There were significant differences among five Fungi identified, regions and within the two seasons but no significant differences within farmers ($p>0.05$). The interaction between fungi and regions had a significant difference ($p<0.05$). The interaction between seasons with regions had a significant difference ($p<0.05$). In Appendix 2: Table 2, mean of fungus *Stenocarpella spp*. (3.040) had a significant difference when compered to each of Fusarium (2.41), Giberella (2.34), Nigrosara (2.04), and other Fungi (1.827). There were significant differences when Imbo region mean (2.84) and Sakwa region mean (2.78) were each compared to each of the following regins means; asego(2.6), Madiany (2.36), Asembo (2.3), Kabondo (2.24), Rangwe (2.2), Awendo (2.08), Kombewa (2.08), Kaspul (2.08), and Rongo (2.04). Long rains season means of 2.92 had a significant difference to short rains season means 1.743.

4.1.2. Incidences of maize ear rot causing pathogens in Nyanza regions during short rains seasons of 2008 and long rains season of 2009

High incidences of maize ear rot causing pathogens found in Nyanza showed *Stenocarpella spp*. to be high when compared to the rest (Figure 4.1.2a). Sakwa and Imbo had high incidences. Appendix 2: Table 1, indicates that values measured had significant differences ($p<0.05$) in Nyanza during the short rains of 2008 and long rains of 2009. There were significant difference ($p<0.05$) within fungi and even regions of Nyanza. There were no significant difference ($p>0.05$) when Fungi interacted with regions and when seasons interacted with fungi and regions. Interactions between seasons and fungi, seasons and regions both a significant difference ($p<0.05$). *Stenocarpella spp.*fungus mean of 3.0455 (Appendix 2; Table 2) was significantly different ($p<0.05$) when compared to each of Fusarium (2.44), Giberella (2.3455), Nigrosora (2.0182), and other Fungi (1.8273). significant differences were observed when each of regions Sakwa (13.772) and Imbo (12.727), was compared to each of the following regions means; Asego (10.066), Rangwe (9.466), Asembo (9.2806), Madiany (8.751), Kabondo (7.8198), Rongo (7.603), Kaspul (7.5286), Awendo (7.506) and Kombewa (7.2186). long rains season mean of 11.5615 was significantly different ($p<0.05$) to short rains season means of 6.938.

Apositive correlation value of 0.60445 (Appendix 2, Table 3) between means of severity of ear rots and means of incidences of ear rots in the twelve regions of Nyanza was significantly different ($p<0.05$) during short rains of 2008 and long rains of 2009. Regression value of 0.223 (Figure 4.1.2 b) was observed when the incidences means were compared to severity.

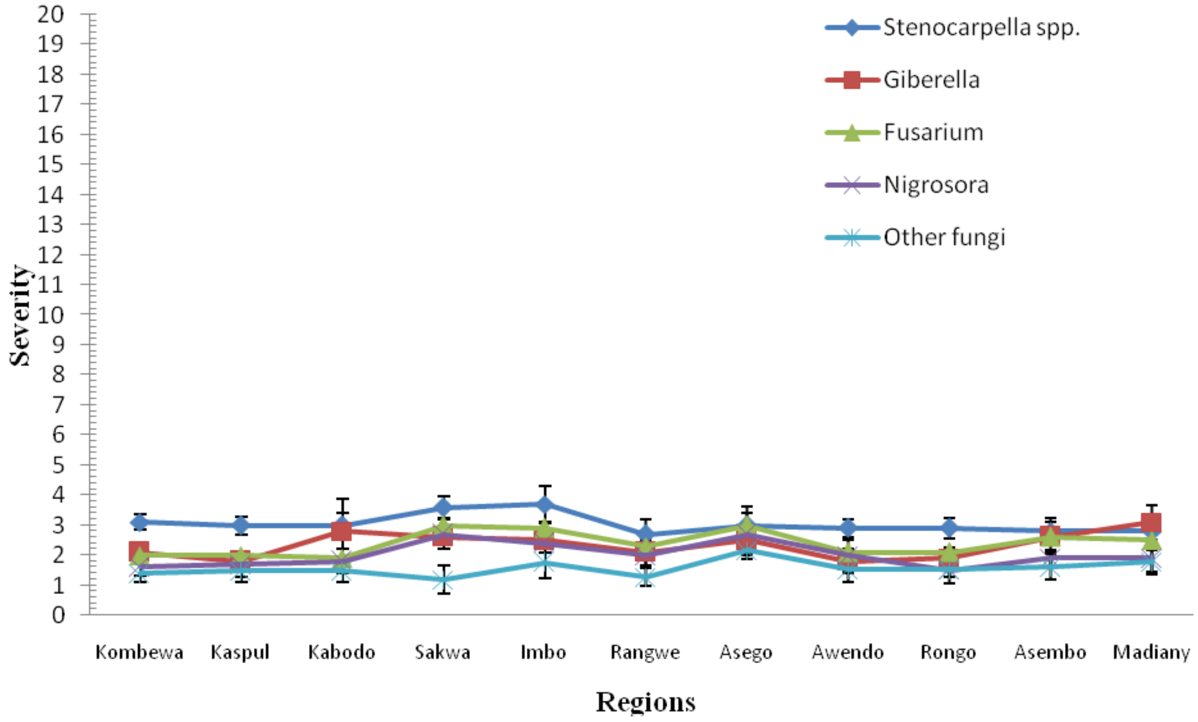


Figure 4.1.1: Severity of maize ear rot causing pathogens in Nyanza regions during short rains season of 2008 and long rains season of 2009. Values are means of five farmers ± SEs.

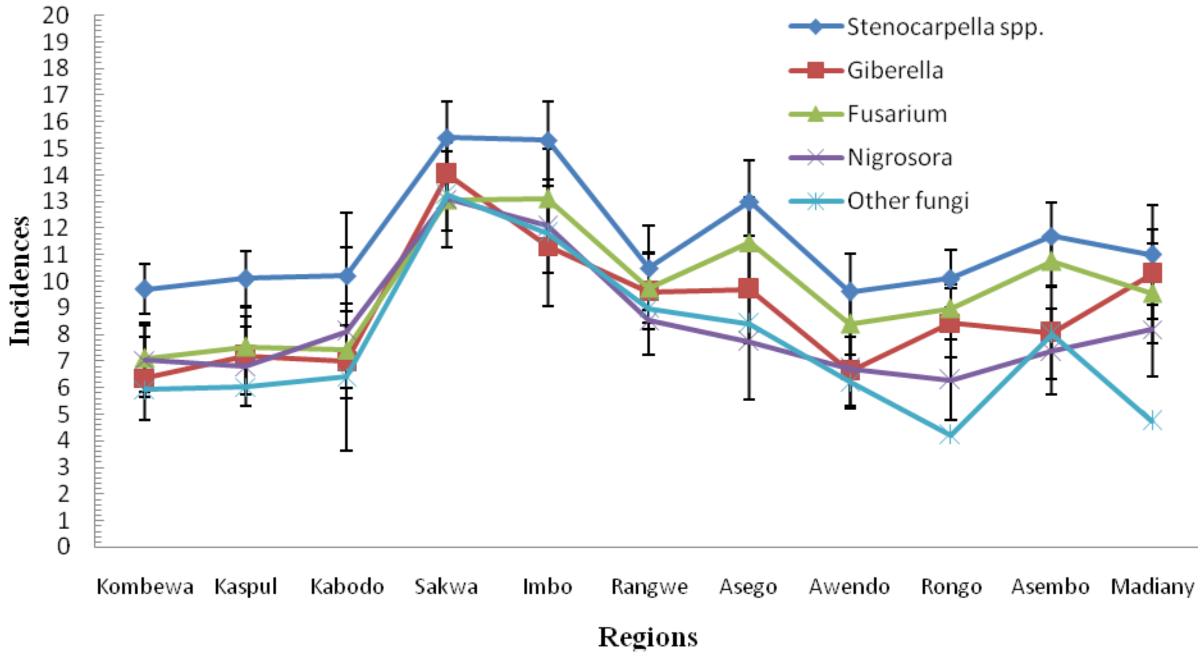


Figure 4.1.2a Incidences of maize ear rot causing pathogens in Nyanza regions during short rains seasons of 2008 and long rains season of 2009. Values are means of five farmers±SEs.

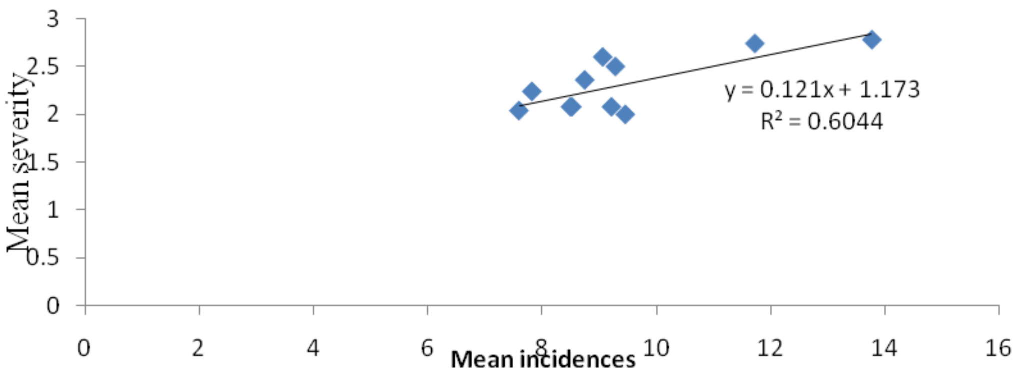


Figure 4.1.2b: Correlation between severity and incidences of maize ear rot causing pathogens in Nyanza regions during short rains seasons of 2008 and long rains season of 2009

4.1.3. Severity of maize ear rot causing pathogens in Nyanza regions during short rains seasons of 2008

Severity of Fungi maize ear rot was very high in Kabondo during short rain season when compared to other regions (Figure 4.1.3). Stenacarpella spp. was high in all other regions when compared to the rest. There were no significant differences ($p<0.05$) in severity of maize ear rot causing pathogensduring short rains of 2008 within Nyanza region (Appendix 2; Table 5).Alarge value of coefficient of variation (60%) was contributed to by significant differences ($p<0.05$) that were observed within fungi. There were no significant differences ($p>0.05$) when fungi interracted with regions. *Stenocarpella spp*. Fungi mean of 2.127, Giberella mean (1.836), and Fusarium mean (1.781) had no significant differences ($p<0.05$) when each one of them was compared to each other. But, significant differences were observed whenever each one of them was compared to each of; Nigrosora mean (1.5455) and other Fungi mean of 1.3818 (Appendix 3; Table 6).

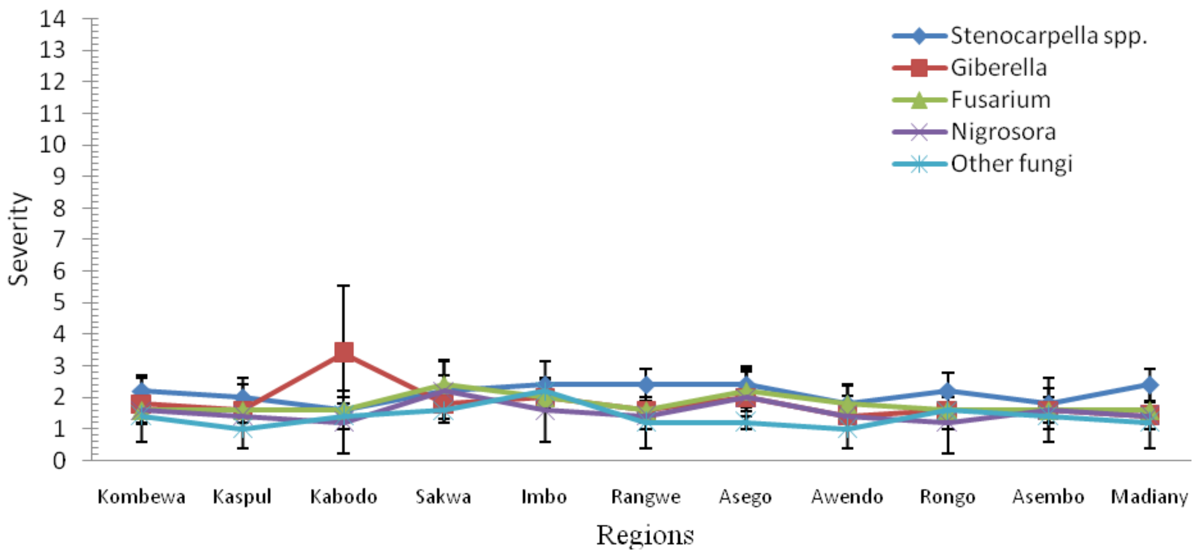


Figure 4.1.3: Severity of maize ear rot causing pathogens in Nyanza regions during short rains seasons of 2008**.** *Values are means of five farmers ± SEs.*

4.1.4. Incidences of maize ear rot causing pathogens in Nyanza region during short rains seasons of 2008

Sakwa and Imbo had more incidences compared to other regions (Figure 4.1.4). *Stenocarpella spp.* was seen to have more incidences compared to the rest of the Fungi. Significant differences ($p<0.05$) were observed in incidences of maize causing pathogens during short rain seasons of 2008 within Nyanza region (Appendix 3: Table 5). Fungi and regions had significant differences in their incidences within themselves that contributed to a coefficient of variation of 48%. No significant interaction was observed when Fungi interacted with Regions. *Stenocarpella spp.* (Appendix 3: Table 5) mean (8.4) was significantly different whenever it was compared with each of the following; Fusarium mean (6.9647), Giberella mean (6.6338), Nigrosora mean (6.4487), and other Fungi mean (6.2434). During short rains season, Sakwa region mean (9.8125), Imbo region mean (9.5968) and Rangwe mean (8.1315) of incidences had no significant differences ($p<0.05$) whenever each was compared to with the other.But, the three had significant differences when ever each was compared to each of; Asego mean (6.8568), Madiany mean (6.7168), Asembo mean (6.5668), Awendo mean (6.0896), Rongo mean (6.0228), Kaspul mean (6.009), Kabondo mean (5.532) and Kombewa mean (4.9849). Apositive correlation value of 0.35649 (Appendix 2, Table 7) between means of severity of ear rots and means of incidences of ear rots in the twelve regions of Nyanza was significantly different ($p<0.05$) during short rains of 2008.

4.1.5. Severity of maize ear rot causing pathogens in Nyanza region during long rains seasons of 2009

Rangwe had similar severity of all the Fungi (Figure 4.1.5). *Stenocarpella spp*. fungi had a greater difference in mean when compared to the rest of the fungi. In Kombewa, Kaspul, Kabando, Sakwa, Imbo, and Awendo, *Stenocarpella spp*. had high rate of severity. During long rains of 2009, Nyanza region showed a non significant difference ($p>0.05$) in severity of maize ear rots (Appendix 4: Table 10). Fungi had a significant differences ($p<0.05$) within them. Non significant difference were observed within regions and also when there was an interaction between Fungi and regionss ($p>0.05$). In appendix 4: Table 10, Fungus *Stenocarpella spp*. had a mean of 3.9636 that was not significantly different when compared to each of the following; Fusarium mean (3.0182), Giberella mean (2.8545), and Nigrosora mean (2.4909). Other Fungi found in these regions had a mean of 2.2727 that was always significantly different ($p<0.05$) whenever compared to the First four Fungi named above. Reagions means of Imbo (3.64) and Sakwa (3.52) had significant differences whenever each them was compared to each of Asego mean (3.24), Madiany mean (3.12), Asembo mean (3.0), Rangwe mean (2.76), Awendo mean (2.68), Kabondo mean (2.68), Kaspul mean (2.64), Kombewa mean (2.44) and Rongo mean (2.44).

4.1.6. Incidences of maize ear rot causing pathogens in Nyanza region during long rains seasons of 2009

High incidences were found to be caused by *Stenocarpella spp.* Sakwa, Imbo, had more incidences for both Fungi (Fugure 4.1.6). There were significant differences ($p<0.05$) in the incidences of maize ear rots in Nyanza regions (Appendix 4: Table 9). Both Fungi and regions had significant differences ($p<0.05$) within themselves. The interactions within regions and Fungi were not significantly different ($p>0.05$). Fungi *Stenocarpella spp*. mean (14.6182) of incidences had significant differenes ($p<0.05$) whenever it was compared to any of the following (Appendix 4: Table 10); Fusarium incidence mean (12.5149), Giberella incidence mean (11.3887), nigrosora incidence mean (10.2638), and other type of Fungin incidence mean (9.0218). Sakwa region region mean (17.732) of incidences and Imbo mean (15.857) of incidences were significantly different when each was compared to each of the following; Asego (13.276), Asembo (12.01), Rangwe (10.801), Madiany (10.786), Kabando (10.108), Kombewa (9.452), Rongo (9.184), Kaspul (9.047) and Awendo (8.922). Apositive correlation value of 0.59028 (Appendix 4, Table 11) between means of severity of ear rots and means of incidences of ear rots in the twelve regions of Nyanza was significantly different ($p<0.05$) during long rains of 2009.

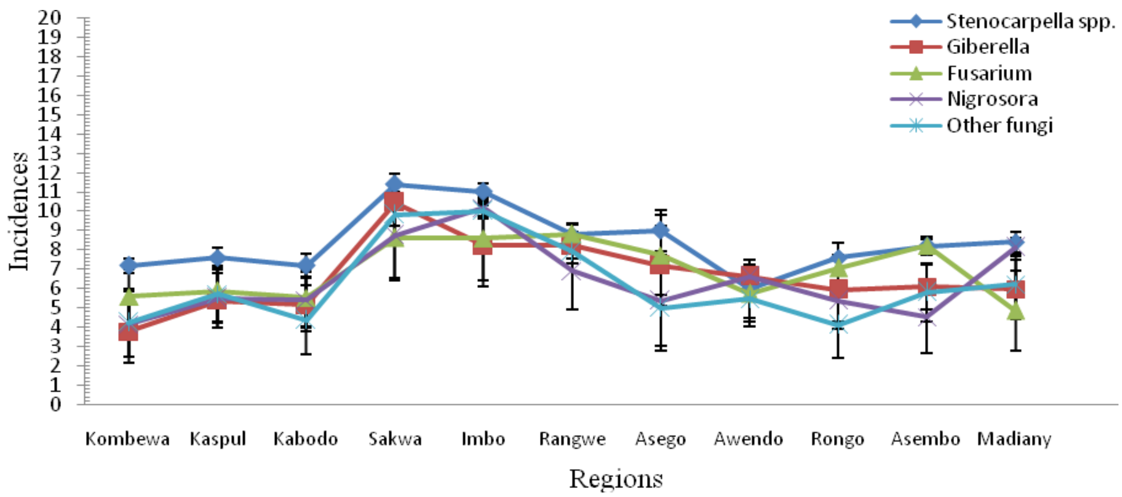


Figure 4.1.4: Incidences of maize ear rot causing pathogens in Nyanza regions during short rains seasons of 2008**.** Values are means of five farmers ± SEs.

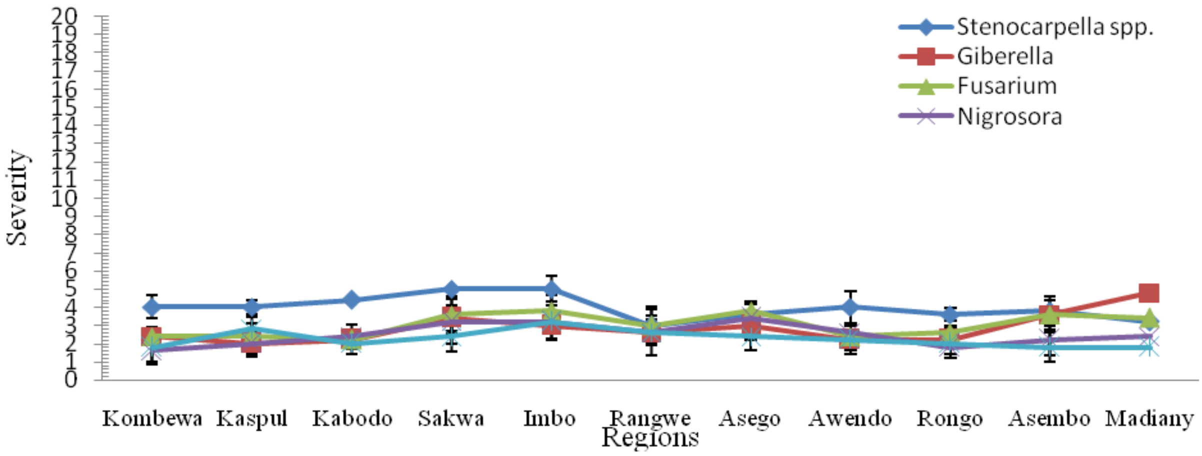


Figure 4.1.5: Severity of maize ear rot causing pathogens in Nyanza regions during long rains seasons of 2009**.** Values are means of five farmers ± SEs.

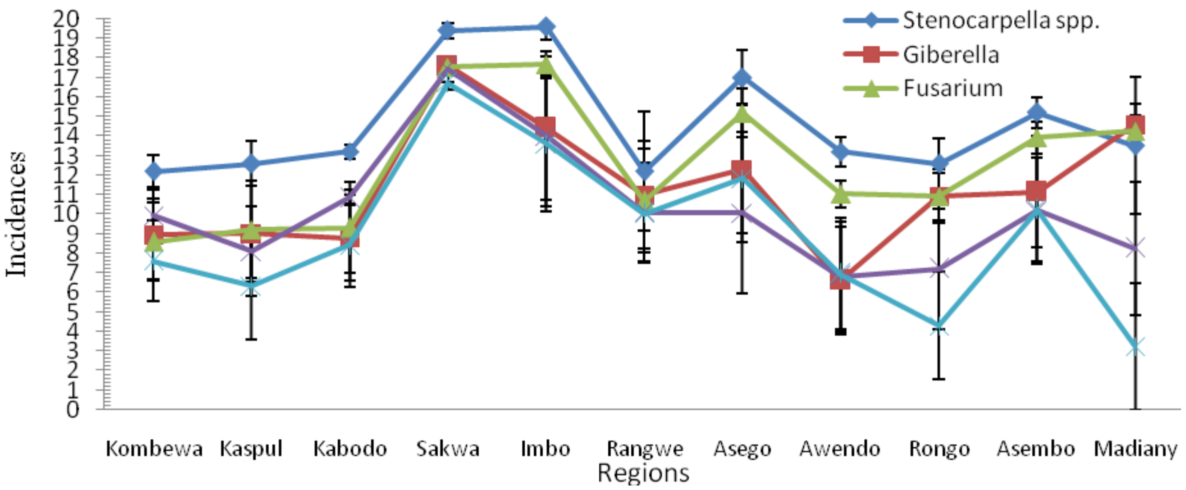


Figure 4.1.6: Incidences of maize ear rot causing pathogens in Nyanza regions during long rains seasons of 2009**.** Values are means of five farmers ± SEs.

4.2. Survey of Severity and Incidences of Various Ear Rot Causing Pathogens from Maize Fields in Maseno Area

4.2.1. Severity of maize ear rot causing pathogens in Maseno area during short rains season of 2008 and long rains season of 2009

Severity was very low in other Fungi, but high and almost equal for *Stenocarpella spp.* Giberella, Fusarium and other Fungi (Figure 4. 2a). Appendix 5: Table 13, indicates that severity of maize ear rot causing pathogens was not significantly different (p>0.05) when identified in Maseno area during short rains season of 2008 and long rains season of 2009. Fungi and seasons had significant differences (p< 0.05) within themselves when identified. Fungi *Stenocarpella spp.* severity mean (2.2) and Giberella severity mean (1.7) were each significantly different (p>0.05) when compared to each of; *Fasarium* severity mean (1.5), *Nigrosora* severity mean (1.5) and other types of Fungi severity mean of 1.0 (Appendix 5; table14). Long rains season severity mean of 1.88 was significantly different to short rains severity mean (1.28) during short rains season of 2008 and long rains of 2009 in Maseno area.

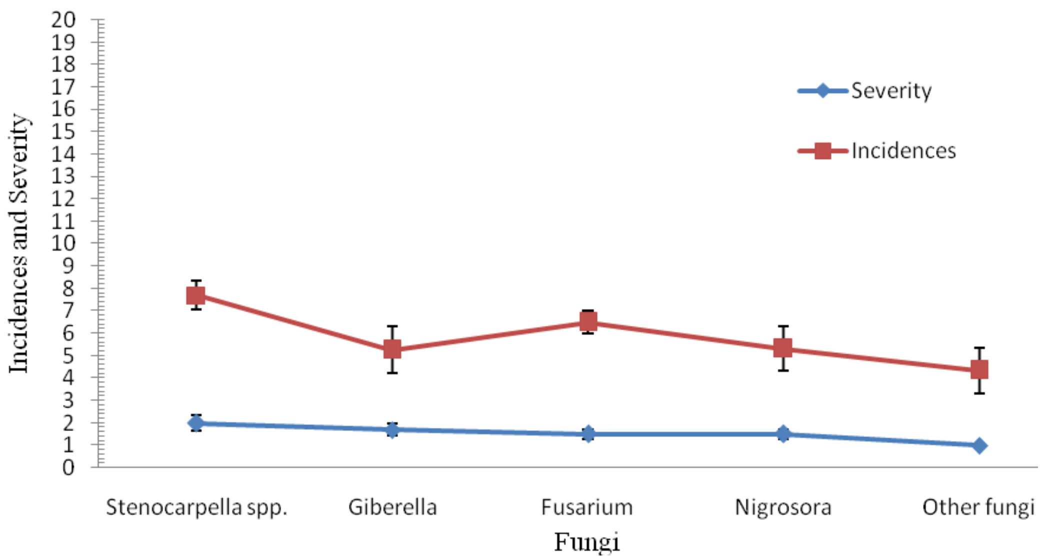


Figure 4.2a. Severity and incidences of maize ear rot causing pathogens in Maseno area during short rains season of 2008 and long rains season of 2009. Values are means of five farmers and two seasons±SEs

4.2.2. Incidences of maize ear rot causing pathogens in Maseno area during short rains season of 2008 and long rains season of 2009

Stenocarpella spp. had high severity rate compared to compared to the rest, followed by Fusarium (4.2a). There was a significant differences ($p<0.05$) in disease incidences when identified in masenon area (Appendix 5: table 13). Fungi and seasons had significant differences ($p<0.05$) but when fungi and season interacted there was no significant difference ($p>0.05$). Fungi *Stenocarpella spp.* severity mean (7.7) when compared to each of Fasarium severity mean (6.4913), Nigrosora severity mean (5.3239), Giberella severity mean (5.2563) and other Fungi type severity mean (4.3460) was significantly different ($p<0.05$). The mean of Fasarium was always significantly different ($p<0.05$) when compare to each of Nigrosora, Giberella and other types of fungi means (Appendix 5: table 14).

4.2.3. Severity of maize ear rot causing pathogens in Maseno area during short rains season of 2008

Fungi means were always low during short rains of 2008 (Figure 4.2b). *Stenocarpella spp*., had the highest severity in maize. During short rains, there was no significant differences ($p>0.05$) in severity of maize ear rot causing pathogens in Maseno area. There was no significant differences ($p>0.05$) in the Fungi (Appendix 6: Table 17). When means were separated, there wignificant differences ($p<0.05$). *Stenocarpella spp*. had a significant difference ($p<0.05$) when compared to each of the following fungi severity mean; Giberellia (1.4), Fasarium (1.2), Nigrosora (1.2) and other fungi (1.0).

4.2.4. Incidences of maize ear rot causing pathogens in Maseno area during short rains season of 2008

Incidences were low, but during short rains season of 2008 (Fugure 4.2c), high incidences were found in *Stenocarpella spp*. and Fusarium. During short rains was no significant difference ($p>0.05$) in incidences of maize ear rot causing pathogens (Appendix

6: Table 17). There were no significant difference (p>0.05) in Fungi incidences. Disease incidences showed Fungi to lack significant differences (p>0.05) in their means (Appendix 6: Table 18). *Stenocarpella spp.* incidence mean was 6.2, Fasarium incidence mean (6.036), Giberella incidence mean (4.528), Nigrosora incidence mean (3.622) and other fungi group (3.512).

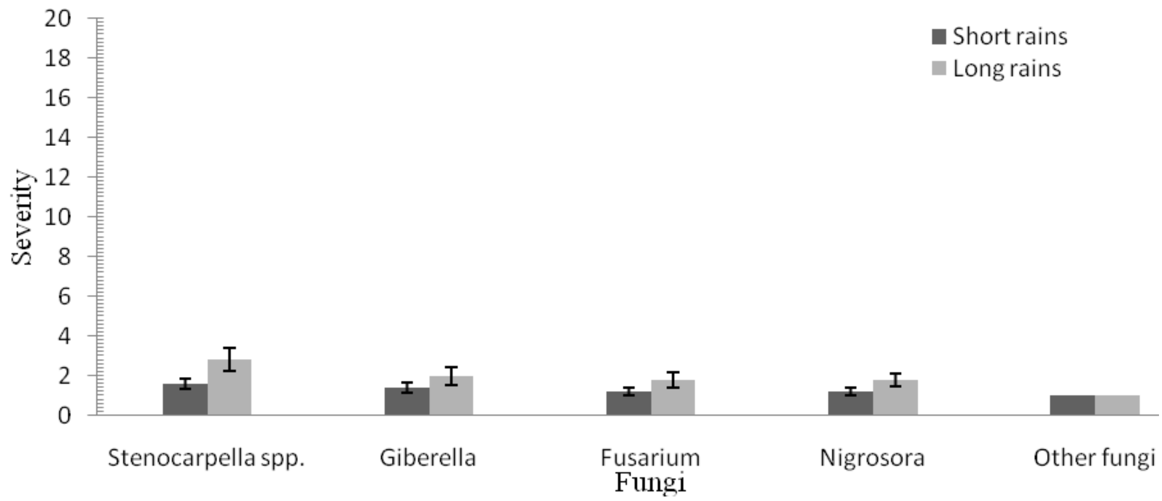


Figure 4.2b. Severity of maize ear rot causing pathogens in Maseno area during short rains season of 2008 and long rain season of 2009. Values are means of five farmers and rain seasons±SEs.

4.2.5. Severity of maize ear rot causing pathogens in Maseno area during long rains season of 2009

High severity rate was seen to have been caused by *Stenocarpella spp*. during long rains of 2009 (Figure 4.2b). During long rains, there were significant differences (p<0.05) in severity of maize ear rot causing pathogens in Maseno area. This parameter had a coefficient of variation of 23.31% and that Fungi had significant different (p<0.05) for severity (Appendix 7: Table 21). Fungi *Stenocarpella spp.*had a severity mean of 2.5 that was significantly different (p<0.05) if compared to mean severity of Giberella mean (2.0), Fusarium (1.8), Nigrosora mean (1.8) and other Fungi that have a severity mean of 1. 0 (Appendix 7: Table 22).

4.2.6. Incidences of maize ear rot causing pathogens in Maseno area during long rains season of 2009

High incidences were experienced during long rains of 2009 (Figure 4.2c). Very high incidences were found in *Stenocarpella spp.* During long rains, they were significant differences (p<0.05) in incidences of maize ear rot causing pathogens in Maseno area. This parameter had a coefficient variation of 4.0948 % (Appendix 7: Table 21). *Stenocarpella spp.* Fungi mean of incidences (9.4) was significantly different (p<0.05) if compared to each of Nigrosora incidences mean (7.026), Fusarium incidence mean (6.9466), Giberella incidence mean (5.9846) and other Fungi incidence mean of 5.18. Giberella was significantly different when it`s mean was compared to other Fungi and Nigrosora mean of incidences. Nigrosora incidence mean had no significant difference when compared to Fusarium mean of incidences but when each of the two was compared to each of the rest there was a significant difference (p<0.05).

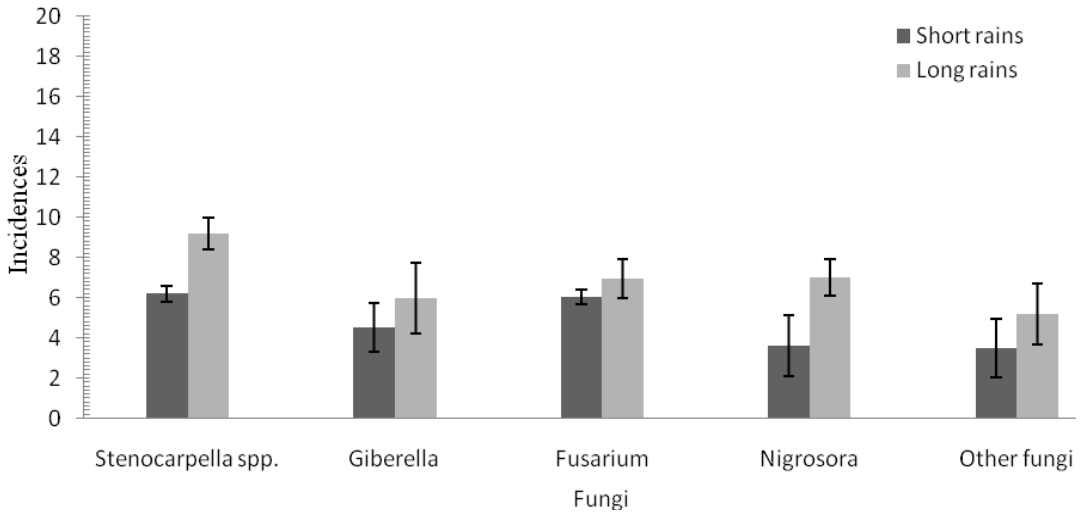


Figure 4.2c. Incidences of maize ear rot causing pathogens in Maseno area during short rain season of 2008 and long rains season of 2009. Values are means of five farmers and rain seasons ± SEs.

4.3.1. Evaluation of severity of Maize hybrids to *Stenocarpella spp.* within Maseno University research farm during short rains season of 2008

During the short rains of 2009, the mean yield was 6.63 with EH10 and EH15 giving the highest yields of 8.75 and 8.09 tones /ha. The plant stand after inoculation with *Sternocapella* was highest in H614D (91.68%) and lowest in P3253 (73.82%). The mean severity score was 1.63 with the EH10, EH14, H641D, and H516 being resistant while the rest of the hybrids were susceptible to *Sternocarpella* infections.

Table 2. Mean values for grain yield, *Sternocapella* severity scores and other agronomic characters measured on maize hybrid evaluated at Maseno during the short rains of 2008

HYBRID	GYD(tons/ha)	PLT STD (%)	SEVERITY SCORE	DAT TO SILKING
EH10	8.75	76.18	1.36	75.0
EH14	8.09	90.96	1.56	74.5
EH15	7.32	82.14	1.70	74.5
EH13	7.15	85.71	2.04	73.5
H614D	3.69	91.68	1.50	74.5
H516	5.78	78.57	1.39	74.0
H515	6.77	75.00	1.93	74.5
P3253	6.22	73.82	1.94	73.5
EH16	5.89	85.71	1.28	74.0
Mean	**6.63**	**81.09**	**1.63**	**74.22**
Standard Dev	**1.48**	**5.88**	**0.28**	**0.51**

Key: PLT STD (Plant stand), GYD (Grain Yield)

There was statistically significant variation in the incidences, severity, plant stand and days to silking in assessing the response of maize hybrids to *Sternocapella spp.*There was no significant variation in the plant stand. The model accounts for at least 36% of the variation amongst the hybrids (R-Square 0.36 for failed ears).

Table 3. Summary for ANOVA table for disease severity, incidences, and response of maize hybrids to Sternocapella spp. In Maseno University research farm during short rains of 2008

Parameter	R-Square	C.V	Root MSE	Mean	F value	Pr>F
Severity	0.58	35.94	0.54	1.49	2.82	0.0001
Incidences	0.47	41.98	2.04	4.85	1.85	0.014
Yield (T/ha)	0.47	29.75	0.32	1.08	1.85	0.014
Failed Years	0.36	159.63	4.15	2.60	1.16	0.29
Plant stand	0.99	0.94	0.78	83.28	161.84	<0.0001
Days to silking	0.65	1.23	0.90	73.35	3.86	<0.0001

In table 4 above there is a significant variation in severity among the hybrids tested, there is no significant variation between EH15 and EH13.

The incidences does not significantly vary between the inoculated and non inoculated hybrids. The yields significantly vary between the inoculated and non inoculated hybrids. There is no significant variation between the hybrids EH10, EH14, EH15 on yield. Hybrid H614D has the highest mean number of failed ears after inoculation (10.667). There is a significant difference in the plant stands between the inoculated and non-innoculated hybrids Table 5 shows combined means for the severity of *Sternocapella* innoculum and other agronomic characters of the various hybrids tested during the long rains of 2009.The yield ranged from 4.5 tones/ha to 10.5 tons/ha. The plant stand ranged from 79% to 91.67% , while the severity of the *Sternocapella* infection on the ear was from 1.7-3.0. The days to silking ranged from 71.5 days to 74 days. H614 hybrid gave the lowest yield while the highest yield was given by EH10 hybrid. The highest severity score was observed in H614D, EH10, EH14, EH13 and P3253 showed high susceptibility, with the rest of the hybrids showed high resistance.

Table 4. LSD test for disease severity, incidences, and response of maize hybrids to *Sternocapella spp*. In Maseno University research farm during short rains of 2008

Hybrid	Severity	Incidences	Yield	Failed years	Plant stand	Days to silking
EH10	1.1667 b	5.62 a	1.42a	1.67b	92.83a	72.33b
EH13	2.5 a	2.95 b	1.05ba	1.33b	87.5c	70c
EH14	1.833ba	5.29 a	1.19ba	2.17b	89.83b	73.33ba
EH15	2.1667a	4.95 a	1.25a	2b	83.17d	73.33ba
EH16	1.333 b	2.95b	1.12ba	2b	90.5a	73.33ba
H515	1.333 b	5.95a	1.15ba	4.17ba	80.17f	73.67a
H516	1.333 b	5.29a	1.15ba	2.17b	82.5ed	73ba
H614D	1.833 ba	1.95b	0.79b	10.67a	92.17a	73ba
P3253	1.333b	6.62a	1.05ba	2.33b	81.83e	73.67a

N=36.Means with the same letter in the same column do not significantly differ at p=0.05

High severity was shown with inoculation in hybrids EH14, EH15, and H614D. In non-innoculation high severity was seen in EH15 and EH13 (Table 2). Disease severity means during the short rains seasons (Appendix 9: Table 29) when *Stenocarpella spp*. was introduced in Maseno University research farm showed significant differences ($p<0.05$). Treatments and maize hybrids showed a significant differences within them ($p<0.05$) but the interaction within them did not show a significant difference ($p>0.05$). Maize hybrids EH13 severity mean (2.5) and EH15 severity mean (2.1667) were each significantly different ($p<0.05$) when compared (Appendix 9: Table 30) to each of the following maize hybrid means; EH14 (1.833), H614D (1.833), P3253 (1.3333), EH16 (1.33), H516 (1.33), H515 (1.33) and EH10 (1.1667). Severity mean (1.963) of short rains season was significantly different when compared to long rain season mean of 1.333.

High incidences was shown with inoculation in hybrids H515, and P3253, In non-innoculation high incidences was seen in EH10 and EH15 (Table 4.3b). Incidences had significant differences ($p<0.05$) under *Stenocarpella spp*. (Appendix 10: Table 39). There were significant differences ($p<0.05$) in maize hybrids, but a non significant differences ($p>0.05$) was observed in maize hybrids interaction with treatments. In a descending order, incidence mean in hybrids were as follows; P3253 (6.6185), H515 (5.9518), EH10 (5.6185), EH14 (5.2852), H516 (5.2852), EH15 (4.9518). This six hybrids were significantly different (Appendix 9: Table 30) when each of them was compared to each of EH13 (2.9581), EH (2.9518), and H614D (1.958).

High yield was shown with inoculation in hybrids EH10, and EH15, In non-innoculation high yield was seen in EH10 (Table 3). Yield showed a non significant difference ($p>0.05$) when *Stenocarpella* spp. was introduced as a treatment (Appendix 9: Table 29). There were non significant differences ($p>0.05$) in maize hybrids and when maize hybrids interacted with treatments, But a significant difference was observed within the means of the two treatment ($p<0.05$). Hybrids EH10 mean (1.4183) EH15 mean (1.2517) EH14 mean (1.185) mean H515 (1.1517) mean H516 mean (1.1517) mean EH16 mean

(1.118) mean EH13 (1.0517) mean P3253 (1.05) had no significant difference (Appendix 9: Table 30). When their means in brackets were compared to each other. But when each of them was compared to hybrid H614D mean of 0.785, there was a significant difference ($p<0.05$). A significant difference was found when inoculated maize yield mean (1.244) was compared to non inoculated maize yield mean of 1.0144.

Table 5. Mean values for grain yield, *Sternocapella* severity scores and other agronomic characters measured on maize hybrid evaluated at Maseno during the long rains of 2009

HYBRID	GYD(tons/ha)	PLT STD(%)	SEVERITY SCORE	DAT TO SILKING
EH10	10.5	90.26	1.8	72.0
EH14	10.2	88.96	1.9	73.5
EH15	9.25	82.00	1.7	74.0
EH13	9.4	85.71	2.0	71.5
H614D	4.5	91.67	3.0	73.0
H516	7.36	80.57	2.8	72.0
H515	8.72	79.00	2.9	73.5
P3253	8.22	80.21	1.85	74.0
EH16	7.85	89.00	2.9	74.0
Mean	8.44	85.26	2.32	73.06
Standard Dev	1.81	4.89	0.56	0.98

Key:PLT STD (Plant stand), GYD (Grain Yield)

4.3.10. Evaluation of Failed ears of Maize hybrids to *Stenocarpella spp.* within Maseno University research farm during short rains season of 2008

High failed ears was shown with inoculation in hybrids EH15, and H614D, In non-innocation high failed ears mean was seen in H515 (Table 4.3b). Failed ears did not indicate a significant difference ($p>0.05$) during the short rains when *Stenocarpella spp.* was introduced to maize hybrids in Maseno University Research farm (Appendix 9: Table 29). Hybrid maize H615D mean (10.667) was significantly different when compared to other maize hybrid means. In this case H515 (4.167), P3253 (2.333), EH14 (2.167), H516 (2.167), EH15 (2.0), EH16 (2.0), EH10 (1.667) and EH13 mean of 1.333 (Appendix 9: Table 30).

4.3.11. Evaluation of plant stand of Maize hybrids to *Stenocarpella spp.* within Maseno University research farm during short rains season of 2008

High mean of plant stand was shown with inoculation in hybrid EH10. In non-innocation, high mean of plant stand was shown by H614D (Table 4.3b). Plants stand showed a significant difference ($p<0.05$) when *Stenocarpella spp* was introduced to maize hybrid under Maseno University Research farm (Appendix 9: Table 29). Significant differences ($p<0.05$) were seen within treatments, maize hybrids and when treatments interacted with maize hybrids. Maize hybrids H10 mean (92.833) and H614D mean (92.1667) was significantly different when compared to each of EH16 (90.5), EH14 (89.833), EH13(87.5), EH15 (83.1667) , EH516 (82.5), P3253 (81.833) and H515 (80.1667). EH16 and EH14 had a significant difference when each was compared to each of EH15 and H516. H13 had a significant comparison to each of H15, H516, P3253 and H515. Long rains seasons (Appendix 9: Table 30) mean (88.22) had asignificant difference to short rains mean (85.22).

4.3.12. Evaluation of days to silking of Maize hybrids to *Stenocarpella spp.* within Maseno University research farm during short rains season of 2008

High mean of days to silking was shown with inoculation in hybrid EH15. In non-innocation high mean of days to silking was seen in EH10 (Table 4.3b). There were significant differences ($p<0.05$) in maize hybrids under *Stenocarpella spp*. in Maseno University Research farm in the means of days of silking (Appendix 9: Table 29). Maize hybrids had significant differences amongst themselves; but non significant differences were observed in treatments and when toots interacted with maize hybrids (Appendix 9: Table 29). Maize hybrids P3253 (73.67 and H515 (73.67) had a significant difference in there means in brackets when each was compared to each of the following; EH16 (73.33), EH15

(73.33), EH14 (73.0), H614D (73.3), H615 (73.0), EH10 (72.33) and EH13 (70.0). Treatment means did not show a significant difference (p>0.05) (Appendix 9: Table 30).

4.3.13. Evaluation of severity of Maize hybrids to *Stenocarpella spp.* within Maseno University research farm during long rains season of 2009

High mean of severity was shown with inoculation in hybrid EH14. In non-innocation high mean of severity was seen in EH15 and EH13 (Table 4.3c). This were significant differences (p<0.05) in means of severity in maize hybrids treated with *Stenocarpella spp*. under Maseno University Research farm during long rains of 2009 (Appendix 10: Table 33). Hybrids and the interaction between hybrids and treatments had no significant differences (p>0.05). Significant difference was observed in treatments (p<0.05). Maize hybrids P3253 mean (1.5), EH13 mean (1.5) and EH14 mean (1.5) each showed a significant difference when compared to mean of each of EH15 (1.33), H614D (1.33), EH16 (1.1667), EH10 (1.1667), H516 (1.00). Inoculation mean showed a significant difference when compared to non innoculation (1.67 and 1.0 respectively) in Appendix 10: Table 34.

4.3.14 Evaluation of incidences of Maize hybrids to *Stenocarpella spp.* within Maseno University research farm during long rains season of 2009

High mean of incidences was shown with inoculation in hybrid EH14 and EH10. In non-innocation, high mean of incidences was seen in P3253 (Table 4.3c). Incidences showed no significant differences (p>0.05) in when *Stenocarpella spp*. was inoculated into maize hybrids in Maseno University Research farm (Appendix 10: Table 33). Maize hybrids had significant difference (p<0.05) amongest them, but no significant difference were observed in treatments and in the interaction between treatments and maize hybrids. There were no significant differences when mean of inoculation (5.2963) was compared to the mean of non innoculated (4.8753). Maize hybrids means P3253 (7.123), H515 (6.79), EH10 (6.456), H516 (5.79), EH14 (5.123) and EH15 (4.79) were significant different when each one of them was compared to each of EH13 (3.79), EH16 (3.79) and H614D (2.123) in Appendix 10: Table 34.

4.3.15. Evaluation of Yield (Tones/ha) of Maize hybrids to *Stenocarpella spp.* within Maseno University research farm during and long rains season of 2009

High mean of yield was shown with inoculation in hybrid EH10. In non-innocation high mean of yield was seen in EH15 and EH10 (Table 4.3c). Yields in tonnes per ha had significant differences ($p<0.05$) when *Stenocarpella spp*. was introduced to maize hybrids in Maseno University Research farm (Appendix 10:Table 33). Hybrids and treatments showed significant differences ($p<0.05$). Appendix 10: Table 34 indicates that, yield mean of 1.4107 in maize hybrid EH10 was significant different when compared to each of EH15 (1.1773), EH13, (1.144), EH14 (1.1107), H515 (1.0776), P3253 (0.9773), H516 (0.9107), EH15 (0.9107) and H614D (0.5107). There was a significant difference in mean due to inoculation (1.18148) when compared to mean due to non inoculation (0.86948).

4.3.16. Evaluation of Failed ears of Maize hybrids to *Stenocarpella spp.* within Maseno University research farm during long rains season of 2009

High mean of failed ears was shown with inoculation in hybrid EH14 and h515. In non-innocation high mean of failed ears was seen in EH15 and EH14 (Table 5 and 6). There were no significant difference ($P>0.05$) in failed ears when *Stenocarpella spp*. was introduced into maize hybrids of Maseno University Research farm (Appendix 10: Table 33). Significant differences ($P<0.05$) were observed between treatment but no significant differences were observed amongest maize hybrids and maize hybrid interactions with treatment. There was a significant difference when mean due to inoculation (2.5185) was compared (Appendix 10: Table 34) to non inoculation mean (1.5556).

4.3.17. Evaluation of plant stand of Maize hybrids to *Stenocarpella spp.* within Maseno University research farm during long rains season of 2009

High mean of plant stand was shown with inoculation in hybrid EH13. In non-innocation high mean of plant stand was seen in EH16 (Table 4.3c). There were significant differences (P<0.05) in plant stand when *Stenocarpella spp*. was introduced to maize hybrid of Maseno University Research farm (Appendix 10: Table 33). Significant differences were observed between treatments and amongst maize hybrids (P<0.05). Interaction between maize hybrids and treatment was not significant (P>0.05). There were significant differences when each of EH13 mean (85.833), EH16 mean (85.5), was compared to each (Appendix 10: Table 34) of EH15 (81.5), EH14 (81.1667), H614D (81.1667), H516 (78.833), EH10 (75.5), H515 (75.1667) and P3253 (73.833). Non inoculation mean (80.33) had a significant difference when compared to inoculation mean of (79.33).

4.3.18. Evaluation of days to silking of Maize hybrids to *Stenocarpella spp.* within Maseno University research farm during long rains season of 2009

High mean of days to silking was shown with inoculation in hybrid EH10. In non-innocation high mean of days to silking was seen in EH10 (Table 4). No significant differences (P>0.05) were observed in mean of days to silking when *Stenocarpella spp*. was introduced under Maseno University Research farm (Appendix 10: Table 33). Maize hybrids showed significant differences (P<0.05) amongst their means. However, there were no significant differences (P>0.05) in treatments and when treatments interacted with hybrids during long rains season of 2009. A mean of 75.0 in hybrid for EH10 showed (Appendix 10: Table 34). it to be significantly different (P<0.05) when compared to each of EH13 (74.0), EH14 (74.0), EH15 (74.00), EH14 (74.00), EH16 (74.00), H515 (74.00), H516 (74.00) and H614D (73.00).

Table 6. LSD tests for disease severity, incidences and response of maize hybrids to *Sternocapella* spp. In Maseno University research farm during long rains seasons of 2009.

Hybrid	Severity	Incidences	Yield	Failed years	Plant stand	Days to silking
1EH10	1.667ba	6.456ba	1.411a	0.833a	75.500a	75.000a
2EH13	1.500a	3.790bc	1.144ba	1.667a	85.833	74.000ba
3EH14	1.500a	5.123ba	1.111ba	2.830a	81.167b	74.000ba
4EH15	1.330	4.790ba	1.773ba	1.833aa	81.500b	74.000ba
5EH16	1.667ba	3.790bc	0.911b	2.500a	85.500a	74.000ba
6H515	1.500ba	6.790a	1.077ba	2.667a	75.167d	74.000ba
7H516	1.000b	5.790ba	0.911b	1.833a	78.833c	74.000ba
8H614D	1.330ba	2.123c	0.511c	2.667a	81.167b	74.000b
9P3253	1.500a	7.123a	0.977b	1.500a	73.833e	73.000c

N=36.Means with the same letter in the same column do not significantly differ at p=0.05

CHAPTER FIVE

DISCUSSION

5.1. Severity and Incidences of Maize Ear Rots

Fungi are present in divisions of Nyanza region. There is an also significant difference to maize severity and incidences that indicates these divisions to be under different rate of Fungi infestation. This is well in agreement with reports by Fajemisin *et al.* (2005) that most maize grown in Kenya is susceptible to the ear rot fungus which has become a major constraint in maize cultivation. This has further affirmed that yield losses in maize production systems are partly attributable to the ear rots (Ajanga, 2009). The incidences could still rise, as currently there are no maize hybrids on the market that have high level of resistance to ear rots. Farmers are also not aware of the maize hybrids that repeatedly suffer high levels of ear rot (Vincelli, 2003).The prevalence of maize ear rots could also be attributed partly to multiple yearly cropping cycles that allow the ear rot causing pathogens to build up to a large proportions (Dragich and Nelson, 2014). Similar mean percentages incidences as observed in adjacent divisions of Asembo and Madiany as well as Kabondo, Asego, Sakwa is attributable to the fact that ear rot incidences are associated with the tillage practices that may be similar and also, weather conditions as major factors in adjacent areas (Flett and wehner, 2001).

A significant variation in mean incidences both in the short and long rain seasons would suggest that, the weather conditions could be a contributing factor to the ear rot incidences as also earlier suggested by Ajanga (2009). An occurrence of various ear rot causing fungus studied ie., *Diplodia*, *Giberella*, *Nigrospora* spp, *Fusarium* spp and other minor ear rot pathogens goes in hand with reports by Flett (1992). The reports suggests that, maize ear rots may be a complex of various fungi some of which include the *Fusarium* spp, *Stenocarpella* spp and *Aspergillus spp*. *Diplodia spp.* had the highest incidence, and this is usual as it has been ranked among the top three important in causing maize ear rot (Kapindu *et al.*, 2009). In Kenya, there is no clear quantifiable information that is readily available on the incidences and severity of the maize ear rot (Ajanga, 2009), the existence of the pathogens shows some need for concern. *Fusarium spp.* and *Giberella spp*. ear rot causing fungus are the second most prevalent fungus. This has also been found by (Ajanga, 2009) in western Kenya regions. Although earlier reports show that *Fusarium moiliforme* is the most wide spread disease attacking maize in Nigeria (Adejumo *et al*, 2007), in this study it emerged the second in its prevalence. This is a non coherence that can be due to the yearly variation of the ear rot incidences (Dhanraj, 2006). For instance, *Fusarium* spp can be recovered from highly decomposed debris after two years of burial (Adejumo *et al.*, 2007). Therefore, this becomes limiting to the chances of the total eradication of the fungus inoculums in the current farming circumstances where there is high land pressure and high cropping index.

Since *Fusarium spp*. susceptibility is higher during growth period than in adult period (Agrios, 2005), the incidences observed could be attributed to an earlier infection. Presence of propagules incidences that were higher as observed in the surveyed farms in the divisions could also attribute to this suseptability. This might also have had a role in leading to no clear significant differences during inoculation and non inoculation when *Stenocarpella spp.* was introduced under Maseno University Research farm study. Silmilarly there is a complex of several species of fungi causing ear rots rather than a single species, as done by introducing *Stenorcapella spp*., this therefore made it difficult to assess losses due to a single fungal pathogen alone. Losses due to ear rots also vary significantly due to season and between regions (Nwigwe, 2004) as found in this study. Maize crop is the only host of *S*. maydis so innoculum levels are usually highest in fields of continous maize cultivation that calls continual infestation as maize residue are left on the soil surface predisposes the prevalence of *S.maydis* (Vincelli, 2003).

There was a general trend of increase of incidences of ear rots during the rainy season. To rxplain this, it is known that monocyclic diseases are not affected by climate change although moisture (rain, dew, high humidity) plays a significant factor in the incidences and epidemics caused by fungi. High moisture promotes infection and spore release and germination in many fungi. Prolonged and repeated moisture lead to epidemics with the pathogens most active at 18^0 -24^0 C. With trends towards warmer summers there is an expected reduction or slowing of progress in number of disease cycles resulting in reduced primary innoculum (Olantinwo, 2004), Thus higher means of incidences being found in long rains seasons of 2009.

A non significant difference in the interaction between the ear rot type and the site suggests the possibility of other factors that influence the ear rot incidences in the twelve divisions studied (Flett *et al*, 2001). *Stenocarpella spp.* ear rot is consistendly high with conventional ploughed systems compared to other tillage system. Relationship exists between incidences and amount of maize stabble affected by environmental conditions and that the rate of relationship also varies with localities. Crop rotation would therefore reduce the incidences significantly for host specific *S.maydis* in 24 months or 2 cropping seasons without a host crop being planted (Flett *et al.*, 2001).

Fusarium spp. incidence is by system infection from contaminated seeds with fungus moving up the plant from the roots and then, sporulation on the tassels of previous crop residues infection depending on physiological state of the silks after pollination will eventually affect the succeeding plant crop (Payne, 2009). Other factors like the ability of *Fusarium spp*. to stay in buried maize stubble for a long period predisposes it prevalence.

Correlation analysis shows a positive correlation between severity and incidence over long and short rains seasons. This indicates that, plant ear rot disease intensity is an occurring a problem over years. Therefore measures of incidence are more easily acquired, that can determine a qualitative relationship and greatly facilitate the evaluation of disease intensity when accurate assessment of disease severity aren't available. The relationship between incidence and severity due to correlation imply that there exist other factors that contributes largely to this correlation.

Mean severity of various ear rots had significant differences in the divisions studied and during the two seasons of 2008 (short rains) and 2009 (long rains). The absolute severity levels ranged from 1.1(Kasipul Division, *Nigrospora* spp.) to 2.6 (Asembo, *Giberella* spp). From score percentages, a majority of the mean severities scores represented a kernel infection of 1-25%. Yield losses of up to 10% due to cob rots have been reported by Kapindu *et al*. (2009).This loses are also accompanied by this range of severity and that severity score of 2 are unusual (Kapindu *et al.*, 2009). High severities have been reported in farmer`s fields like those found in Sakwa and Imbo suggest them to be planted continuously with maize. Therefore, relatively high severity as observed in Asembo could have been attributed to by cultural practices adopted by the maize farmers. However it should be noted that, significant differences in severity can also be attributed to by other environmental stress factors that were not determined. These factors include; low potassium, poor drainage, mechanical insect damage to hybrids, and planting density used by farmers in the regions (Dhanraj, 2006). There was an observed a general increase in ear rot severity during the long rains. The ear and the grain rotting phase is generally influenced by high amounts of rainfall (Dhanraj, 2006). The ear rot studied normally have the monocyclic disease cycles. Monocyclic crop disease severity is directly proportional to the amount of innoculum present after the over wintering period. Maize ear rots express this pattern due to the relative short period of susceptibility of the host plant. This has been confirmed by comparing the ascospore and conidial inoculums with studies showing that disease dispersal during the season indicates the essence of a secondary infection (Flett and Wehner, 2001).

5.2. Ear Rot Fungi Severity and Incidences in Maseno Area

Although Maseno area is located in a relatively cooler environment as compared to the other area studied for the ear rots in Nyanza (Jaetzold and Schmidt, 1982), it`s ecological condition does not deter the maize ear rot incidences. The ear rot incidences ranged from 3.5%-6.2% during the short rains and 5.18-9.4% during the long rains. The higher humidity in Maseno could be a cause to this range in ear rot that had significant differences as earlier suggested by (Flett *et al*., 1992). The *Diplodia*, *Fusarium*, *Nigrospora* and *Giberella* were the main fungi identified on the infected maize ears in Maseno. The variations in the geographical conditions in the 12 divisions studied and the Maseno area seem not to have had significant differences as to warrant the specialization of various ear rot fungi in Maseno area. Ear rots existence in the Maseno area could therefore be attributed to some of the reasons that contribute to the other divisions studied as suggested also by Kirimelashvili *et al*. (2009). The higher means of severity and incidences found found in *Nigrospora* infected maize ears indicates that, *Nigrospora* and *Fusarium* are widely distributed and damages could be made severe with condusive weather conditions, prevalence also varies greatly annually with seasons (Kirimelashvili *et al*, 2009). In both long rains seasons and short rains seasons of Nyanza and Maseno area, *Stenocarpella spp*. showed highest means that suggest it to be the most common ear rot causing Fungi. This therefore, suggested it to be chosen for further studies in Maseno university research farm. Response it causes to specific maize hybrid can therefore determine the extend and magnitude of its effects.

5.3. Maize Hybrid`s Response to *Stenocarpella spp.*

There are 3 groups of the maize hybrids responding differently to the *Diplodia* inoculum. The EH15, EH14, EH16 group, EH10, P3253 group, and EH13, EH16 group of maize hybrids which responded similarly to inoculation by *Stenocapella* spp fungus. The (EH15, EH14, EH16), shows the least effects from the innoculum based on responses, but was the highest in means for severity, and incidences. Hybrid H614D is distinct in its response to the inoculation by *Stenocarpella* spp. It experiences the highest mean effects, although it has been suggested that hybrids would be important to the management of *Stenocapella* ear rots, Maize hybrids vary in their susceptibility (Vincelli, 2003).

During the short rains of 2008, the highest mean yield was for EH10 and EH15. The plant stand after inoculation with *Stenocarpella* was highest in EH13. The mean severity score was 1.63 and EH10, EH14, H641D, H516, and EH16 being resistant while the rest of the hybrids being susceptible to *Stenocarpella* infections. The plant stand significant differences in maize hybrids might have been contributed by genetical (Vincelli, 2003) effects rather than being affected by *Stenocarpella spp.* This is in consideration to the late age at which inoculation was done. Failed ears significant differences in treatments indicated that inoculation had effects to maize hybrids. This is explained by the significant differences in severity and incidences, but the later two caused a reduction in yield due to its significant differences. In some cases there were no significant differences in response effects of *Stenocarpella spp.* treatment when compared to the noninnoculation to maize hybrids during long rains and short rains. This indicates that there were some amount of *Stenocarpella spp.* Fungi in the soils of cultivation in Maseno Universty research farm. This agrees with Vincelli (2003) that there is generally unreliable prediction of hybrid performance in the presence of the disease, while all hybrids tested thus far are susceptible to some degree. Up to 5 out of the 9 varieties tested during the short rain season showed high susceptibility, while 4 varieties showed severity score below the mean severity score of 1.63. Some relatively resistant hybrids such as EH16 gave relatively lower yields (5.89 tones/ha) and relatively lower percentage plant stand. This suggests that, although ear rots reduce the yields in maize they could also be interacting with other factors in the environment including the temporal as well as environmental stresses or edaphic factors as earlier reported by Olantinwo *et al*. (2004).

The general increase in mean severity scores in long rains as compared to the severity scores during the short rains was observed alongside the other agronomic aspects checked. This agrees with studies by Vincelli (2003) and Walkers (2009) that have implicated wet weather during silking for it enhances severity. The hybrids (H516 and EH16) which were originally resistant during the short rains have been rendered susceptible during the long rain season. For these two varieties, their response suggests a possible interaction between the genetic aspects of resistance and the weather conditions. This therefore would be an aspect for consideration during the selection for resistance to *Stenocarpella* spp ear rots. In table 10, plant stand does not correspond to high yields as is the case of hybrid H614D with a high plant stand (91.68%) yet relatively lower yield (4.10 tones/ha). The plant stand can therefore not be used for indirect selection for yield. There is no significant interaction between the hybrid and the season on the severity scores. There seem to be a contribution of other factors that lead to severity of ear rot attack. These could be attributed to the innoculum load that must be sufficient to achieve a certain severity level. Innoculum load could be further influenced by the local agricultural practices. Lack of significant interaction could also imply that severity of various ear rots could increase irrespective of the season or hybrid used.

CHAPTER SIX

CONCLUSIONS, RECOMMENDATIONS AND SUGGESTIONS FOR FUTURE STUDIES

6.1. Conclusions

Maize ear rots are prevalent in all the twelve divisions studied, with the main ear rot causing fungi being *Diplodia* spp., and *Fusarium* spp. The prevalence is higher during the long rains as there was a significant difference in the Fungi means. There is an association between the incidence and the severity of the ear rots as to when incidences increased severity also increased causing a positive correlation. Adjacent regions ie Sakwa, Imbo and Asembo had more incidences and severity of Ear rot causing fungi due to slight changes to environments and common cultural practices of the farmers. But significant differences shoe Sakwa as a region to be hihly infested by the Fungi.

The mean severity scores of the 9 hybrids studied show that EH10, EH14, EH15, and P3253 hybrids are resistant to *Stenocarpella spp*. ear rot causing fungus. H614D, EH13, H516, H515, EHI6 hybrids are susceptible to the *Stenocapella* spp ear rot causing fungus. The hybrids (H516 and EH16) which were originally resistant during the short rains are again rendered susceptible during the long rain season. For these two varieties, their response suggests a possible interaction between the genetic aspects of resistance and the weather conditions. This is an aspect for consideration during the selection for resistance to *Stenocarpella* spp ear rots. Failed ears significant differences in treatments indicated that inoculation had effects to maize hybrids. This is explained by the significant differences in severity and incidences, but the later two causes a reduction in yield due to its significant differences. Innoculation and non inoculation had no significant differences suggesting presence of other Fungi infestation in Maeseno Univesity farm.

6.2. Recommendations

1. Its recommended that Fungi distribution is expected in most regions because, Maseno area is located in a relatively cooler environment as compared to the other area studied for the ear rots in Nyanza but it has been found that it`s ecological condition does not deter the maize ear rot incidences. Its also recommended that all the regions studied as Maseno are highly infected with *Stenocarpella spp*. as it was found significantly varying when compared to other Fungi both during long and short seasons.

2. Despite the lack of consistence for significant differences in between inoculation and noninnoculation, and some responses such as failed ears, there was some consistence results where Severity, Incidence, and yield showed that maize hybrids EH10, EH13 and EH16 stood out as showing higher tolerance to ear rots. Based on this results the hybrids may be recommended for cultivation in this ear rot and Fungi accumulated soils soils, where cultural practices that increase the innoculum load should be avoided through extension services to the farmers.

6.3. Suggestions for Future Ftudies

1. In this study survey for severity and incidences were done for two concecutive years within the regions, prevalence should be replicated more over longer periods to monitor epidemiology of the ear rots within the regions.

2. The factors of co-occurrence of the studied ear rots should be probed further in Maseno area as Maseno area was found to have same fungi affecting maize despite`s cooler environment for example Maseno area can be sub divided further into several areas for Fungi severity and incidences to be clearly determined.

3. The maize hybrids should be replicated over several sites for their yield performance and resistance levels to be determined before being sampled for farmers as resistant. Response parameters measured such as days to silking were not conclusive and should combine with physiological parameters such as gas exchange parameters for instance measurements of photosynthetic rate, stomatal conductance and transpiration rate among others, because this would indicate the overall rate of photosynthesis since chlorophyll fluorescence concentrated on the activities of photosynthetic apparatus.

Combined fungual treatments ie., all Fusarium, Stenocarpella and Giberella can also be considered se they under long continual experiments because they all occure in maize growing fields at all times. The amount of innoculum given to maize hybrids should also be increased as in normal field condition Fungal multiply within the whole maize life span.

REFERENCES

Adejumo, T., O., Hettwer, U., and Karlovsky, P. (2007). Occurrence of *Fusarium* species and trichothecenes in Nigeria maize. *International Journal of food Microbiology,* **116**: 350-357.

Adipala, E., Lipps, E.P., and Madden, L.,V. (2003). Occurrence of *Exserohilum turcicumon* maize in Uganda. *Plant Diseases*, **77**: 202-205.

Agrios, G., N. (2005). Plant pathology, 5th Ed. Elsevier academic press, London, Pp. 65

Ajang, S, Monda, E., O., Alakonya, A., E. (2008). Management of Fusarium verticilloides Root infection Court in Maize using Organic soil amentments. *World Applied Science Journal*, **5**: 161-170.

Ajello, L., Georg, L., K., Kaplan, W., and Kaufman, L. (2003). Laboratory Manual for medical mycology. *United States Public Health Service*. 994.

Bansiger, M., and Vivek, B., S. (2007). Field book: Software for managing a maize breeding programme.CIMMYT, Mexico.

Bello, O., B., Ige, S., A., Azeez, M., A., Afolabi, M., S., Abdulmaliq, S., Y., and Mahamood, J. (2012). Heritability and Genetic Advance for Grain Yield and its Component Characters in Maize (*Zea Mays* L.). *International Journal of Plant Research*, **2**: 138-145

Berger, R.D. (2005).Disease incidence and infection rates of *Cercosporaapii*in plant spacing plots. *Phytopathology,* **65**: 485-487.

Castelo, M., M., Summer, S., S., and Bullerman, L., B. (2008). Occurrence fumonisins in corn- based food products. *Journal of Food Science,* **63**: 696–698.

Christensen, J., J., and Wilcoxson, R., D. (2007). Stalk rot of corn. Monograph of the America. *Phytopathological Society,* **3**: 59Pp.

CIMMYT. (2004). Maize Diseases: A guide for field Identification.4th edition Mexico.

Cochran,W., G. (2007). Sampling techniques, 3rded, Wiley Newyork, NY. 428 Pp.

Dai, K., Nagai, M., Sasaki, H., Nakumara, H., Takechi, K. and Warabi, M. (2007). Detection of *Diplodia maydis* from imported corn seed. *Research Bulletin of the Plant Protection Service of Japan*, **23**: 1-6.

De Leon, C. (2004). Maize Diseases: A Guide for Field Identification. CIMMYT 4th edition. Mexico.

Dhanraj, K., S. (2006). Dry rot maize caused by *Diplodia macrospora*. *Indian-Phytopathology,***19**: 120.

Dorrance, A., E., Hinkelman, K., H., and Warren, H., L. (2008). Diallel analysis of Diplodia ear rot resistance in maize. *Plant Disease,* **82**: 699-703.

Fajemisin, J., M., Kim, S., K., Efron, Y., Sign, J., Bjarnason, M.,Thottapilly, G., and Rossel, H., W. (2002). Maize pathology. In Annual Report, International Institute of Tropical Agriculture, **1**: 59-65.

Flett, B., C., and Van Rensburg, J., B. (1992). Effect of *Busseola fusca* on the incidence of maize ear rot caused by *Fusarium moniliform* and *Stenocapella maydis*.*South Africa Journal of Plant Soil,* **9**: 177-179.

Flett, B., C., Mclaren, N., W., and Wehner, F., C. (2001). Incidence of *Stenocarpella maydis* ear rot of corn under crop rotation systems. *Plant disease,* **85**: 92-4.

Gebrekidan, B., B., and Njoroge, K. (2002). Agroecological zoning in relation to maize research priorities in Kenya. In KARI proceeding of a workshop, Review of The Kenya National Maize Research program KARI/ ISNAR Management Training Linkage Project. Pp 100.

Hassan, R, M. (2008).Maize Technology developments and transfer: AGIS Application for research planning in Kenya .Wallingford (United Kingdom): CAB international

Hassan, R., M., Njorge, K., Njore, M., Otsyula, R., and Laboso, A. (2008). Adoption patterns and performance of improved maize in Kenya. In R. M. Hassan (ed.). Maize Technology Development and Transfer: AGIS Application for Research Planning in Kenya. Wallingford, UK: CAB International, CIMMYT, and Kenya Agricultural Research Institute.

Hauser, J., T. (2006). Techniques for Studying Bacteria and Fungi,York Road, Burlington, North Carolina, USA, Pp 1-30.

Jaetzold, R., and Schmidt, H. (1982). Farm Management Handbook of Kenya .Ministry of Agriculture in cooperation with GTZ, Nairobi, Kenya.

Julian, A., M., Wareing, P., W., Philips, S., I., Medlockl, V., F., P., MacDOnald, M., V. and Del Rio, L., E. (1995). Fungal contamination and selected mycotoxins in pre-and post harvest maize in Honduras. *Mycopathologia*, **129**: 5-16.

KARI. (1992). Information bulletin No 7 Nairobi Kenya.

Kim, S., K. (2000). Archival Report of Maize Inbred, Hybrid and Mid-Altitude Breeding Ibadan, Nigeria: Maize Research program, International Institute of Tropical Agriculture.

Kirimerilashvili, I., S., and Dolizde, M., I. (2009). Materials for studies of *Nigrospora* Ear Rot in Georgia. *Reports of plan Protection in Georgia,* **21**: 92-93.

Klapproth, J., C. (2001). Evaluation of four inoculation techniques for infecting corn ears with *Stenocarpella maydis*. *Plant Disease,* **75**: 1057-1060.

Koehler,B.(2000). Corn stalk rots in Illinois.Bulletin, University of Illionois Agricultural Experiment Station No.6589.

Laboso, A., K., and Nge'ny, J., M., A. (2006). Some factors affecting genotypic. Perfomance in the Kenya highland maize programme. CIMMYT Maize programme. In Proceedings of the fifth Eastern and Southern Africa region maize Conference, held in Arusha,Tanzania. 3rd -7th June, 1996.

Lin, C., S., Poushinky, G., and Mauer, M. (2009). An examination of five sampling methods under random and clustereed disease distributions using simulation. *Canadian Journal Plant Science,* **59**: 121-130.

Lipps, F., E., and Mills, D., R. (2007). Diplodia ear Rot of Corn. Ohio State University Extension Fact sheet AC-0046-01. http://ohioline.osu.edu/ac-fact/0046.html downloaded on 31 August 2007.

Madden, L., V., and Hughes, G. (2009). Sampling for plant disease incidence. *Phytopathology,* **89**: 1088-1103

Marasas, W., F., O., Jasiewicz, K.,Venter, F., S., and Van Schalkwyk, D., J. (2008). *Fusarium moniliforme* contamination of Maize in human oesophageal cancer areas in Transkei. *South Africa Medical Journal,* **74**: 110-114.

Mário, J., L., Reis, E., M., and Juliatti, F., C. (2011). Three inoculation methods for screening corn germplasm to white ear rot resistance.*Trop. plantpathol*. 36: Pp1-4.

Marley, P., S., and Aba, D., A. (2009). Current status of sorghum smuts in Nigeria. *Journal of Sustainable Agriculture*, **15**: 119-132.

McGee, D., C. (2008). Maize disease. A reference source for seed technologies America Phytopathology Society Press, St .Paul, Minnesota, USA.

Navi, S. S., R., Bandyopadhyay, A., Hall, J., Paula .J., and Bramel C. (2009). A Pictorial Guide for the Identification of Mold Fungi on Sorghum Grain Information Bulletin no. **59**: 237-239 International Crops Research Institute for the Semi-Arid Tropics, Pp100 Held on 2/4/2014. Accessed on *link.springer.com/chapter/10.1007%2F978-1-4614-2356-0_19*

Mwai, G., N., (2001). Growth response of spider plant (*cleome gynandra* L.) to salinity. Msc. thesis, Maseno University, Kenya.

Nyall, R., F., (2009). Field crop Disease handbook, 2nd ed (AVI), (New York Van Nostrand Reinhold), Pp108-109.

OEPP/EPPO (2006). Data sheets on quarantine pests No.67: *Stenocarpella macrospora* and *Stenocarpella maydis* http://www.epo/QUARANTINE/ fungi/StenocarepIla_ macrospora/ DIPDSP_ds.pdf downloaded opn 31 August 2007.

Olantinwo, R., K., Cardwell, A., Menkir, M., and Julian, A. (2004) .Inheritance of Resistance to Stenocarepalla (Earl) Ear Rot of Maise in the Mid-Altitude Zone of Nigeria. *European Journal of Plant Pathology*, **105**: 535-43.

Osagie, A., U., and Eka, O., U. (2008). Nutritional Quality of Plant Foods. Post Harvest Research Unit, University of Benin, Benin. Pp.34-41.

Payne, G., A. (2009). Ear and Kernel Rots. In Donald G. White (ed), Compendium of Corn Diseases. St. Paul, Minnesota: *The America Phytopathology Society*, Pp 44-7.

Pingali, P., L. (2001). CMMYT 199-2000 world maize facts and trends. Meeting world maize needs. Technology opportunities and priorities for the public sector. CIMMYT, Mexico.

Pittet, A. (2008). Natural occurrence of mycotoxins in food and feeds. An updated review.

Psychopathological Society, StPaul, Minnesota, USA.

Purseglove, J., W. (2002). Tropical Crops.Monocotyledons.Longman Scientific and Technical, NewYork, Pp 300-305.

Quinn, G., P., and Keough, M., J. (2006). Split-plot and repeated measures designs: Partly nested analyses of variance, Pp. 301–338. In: Quinn, G., P. and Keough, M., J. (eds.). Experimental design and data analyses for biologist. Cambridge University Press, Edinburgh, UK.

Rabie, C., J., Kellerman,T., S., Krick, N., P., Van der Westhuizen, C., A., and De Wet, P. (2005). Toxicity of Diplodiamaydis in farm and laboratory animals. *Journal of Food Chemistry and Toxicology,* **23**: 349-353.

Schaafsma, A., W., Miller, J., D., Savard, M., E., and Ewing, R., J. (2003). Ear rot development and mycotoxin production in corn in relation to inoculation method ,corn hybrid,and species of *Fusarium*. *Canadian Journal of Plant Pathology* **15**: 185-192.

Shurtleff, M., C. (2000). A compendium of corn diseases, pp.27, 44-45, 51-52. American

Silva, A., R., Juliatti, F., C., Brito, C., H., and Gomes, L., S. (2007). Métodos de inoculação de *Stenocarpella maydis* emtrêspopulações de milho.Summa. *Phytopathologica*, **31**: 79 - 83.

Steel, R., G., D., Torrie, J., H., and Dickey, D., A. (2006). Principles and Procedures of Statistics: a Biometrical Approach. Academic Internet Publishers, Moorpark.

Sutton, B., C., and Waterston, J., M (2006). *Diplopodia maydis*.CMI Descriptions of Pathogenic Fungi and Bacteria No.84 CAB International, Wallingford, UK.

Tenuta, A. (2006). Identifying Corn Ear Molds.Ontario Ministry of Agriculture, Food and Rural Affairs. http://www.omafra.gov.on.ca/english/crops/friend/news/croppest/

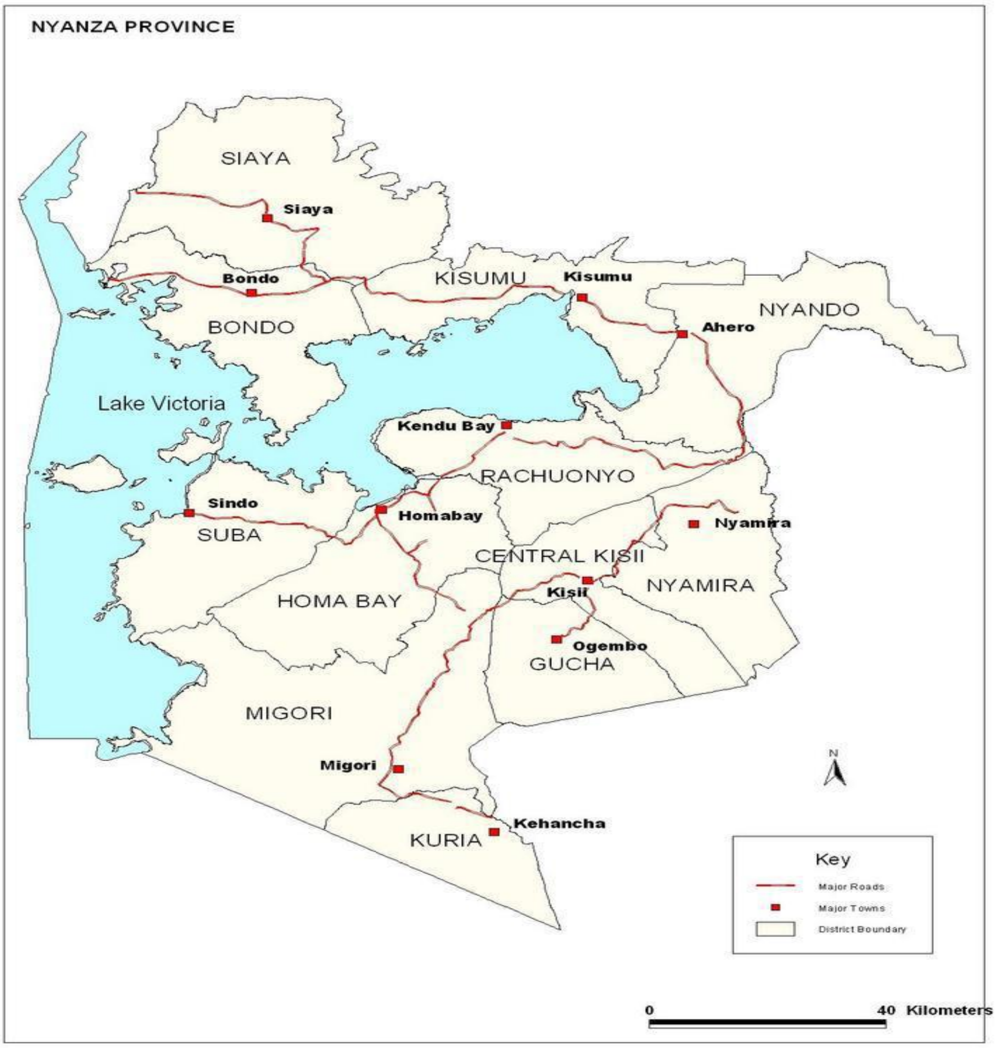
Vincelli, P. (2003). Ear Rot of Corn Caused by *Stenocarpella maydis*(=*Diplodia maydis*) University of Kentucky Cooperative Extension Service. Datasheet PPA- 43 http://www.ca.uky.edu/agc/pubs/ppa/ppa43.pdf downloaded on 31 August 2007.

Walker, J., C. (2009). Plant pathology (3rd edition), Pp335, 341.McGraw-Hill, New York ,USA.Zad,J.; Ale Agha , N. (1985) A note on the mycoflora of maize in Iran.

Wambugu, P., W., Mathenge, P., W., Auma, E., O., and vanRheenen H., A. (2012). Constraints to on-farm maize (Zea mays L.) seed production in western Kenya: Plant growth and yield. *International scholary research notices Agronomy*, 7Pp.

APPENDICES.

Appendix 1: Map showing sites used in Nyanza regions



Source (RSA-DT, 2005).

Appendix 2: Disease severity and incidences of maize ear rot causing pathogens in Nyanza regions during short rains seasons of 2008 and long rains season of 2009

Table 1: Anova for severity and incidences of maize ear rot causing pathogens in Nyanza regions during short rains of 2008 and long rains season 2009

Dependent Variable: severity

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	389	1004.676364	2.582716	1.72	<.0001
Error	160	240.414545	1.502591		
Corrected Total	549	1245.090909			

R-Square	Coeff Var	Root MSE	severity Mean
0.806910	52.67119	1.225802	2.327273

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Fungi	4	95.3636364	23.8409091	15.87	<.0001
Region	10	41.6909091	4.1690909	2.77	0.0035
Season	1	193.2290909	193.2290909	128.60	<.0001
farmers	4	6.6727273	1.6681818	1.11	0.3537
Fungi*Region	40	32.8363636	0.8209091	0.55	0.9866
Season*Fungi	4	16.4618182	4.1154545	2.74	0.0306
Fungi*farmers	16	89.0545455	5.5659091	3.70	<.0001
Season*Region	10	11.8509091	1.1850909	0.79	0.6397
farmers*Region	40	53.7272727	1.3431818	0.89	0.6525
Season*farmers	4	5.3345455	1.3336364	0.89	0.4728
Season*Fungi*Region	40	51.6581818	1.2914545	0.86	0.7070
Fungi*farmers*Region	160	311.7454545	1.9484091	1.30	0.0507
Season*Fungi*farmers	16	68.0654545	4.2540909	2.83	0.0005
Season*farmer*Region	40	26.9854545	0.6746364	0.45	0.9981

Dependent Variable: incidences

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	389	13377.15710	34.38858	2.67	<.0001
Error	160	2060.87759	12.88048		
Corrected Total	549	15438.03469			

R-Square	Coeff Var	Root MSE	incidences Mean
0.866506	38.80012	3.588939	9.249815

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Fungi	4	969.659863	242.414966	18.82	<.0001
Region	10	2419.665489	241.966549	18.79	<.0001

Season	1	2939.125432	2939.125432	228.18	<.0001
farmers	4	174.556150	43.639037	3.39	0.0108
Fungi*Region	40	336.096674	8.402417	0.65	0.9430
Season*Fungi	4	205.611036	51.402759	3.99	0.0041
Fungi*farmers	16	310.052948	19.378309	1.50	0.1038
Season*Region	10	368.190674	36.819067	2.86	0.0027
farmers*Region	40	1529.611188	38.240280	2.97	<.0001
Season*farmers	4	56.750221	14.187555	1.10	0.3578
Season*Fungi*Region	40	394.708536	9.867713	0.77	0.8374
Fungi*farmers*Region	160	2428.145781	15.175911	1.18	0.1503
Season*Fungi*farmers	16	288.910165	18.056885	1.40	0.1467
Season*farmer*Region	40	956.072943	23.901824	1.86	0.0039

Table 2: LSD tests for severity and incidences of maize ear rot causing pathogens in Nyanza during short rains of 2008 and long rains season of 2009

NOTE: 1. This test controls the Type I comparison wise error rate, not the experiment wise error rate.
2. Fungi 1, 2, 3, 4, 5 are Diplodia (*Stenocarpella spp*), Giberella, Fusarium, Nigrosora, and other fungi respectively; Regions 1, 2, 3, 4, 5, 6, 7, 8, 9, are Kombewa, Kasipul, Kabondo, Sakwa, Imbo, Rangwe, Asego, Awendo, Rongo, Asembo, and Madiany respectively; seasons 1 , 2 are short rains of 2008 and long rains of 2009 respectively.

LSD tests for Severity in Fungi, Regions, Seasons, and farmers

Alpha	0.05
Error Degrees of Freedom	160
Error Mean Square	1.502591
Critical Value of t	1.97490
Least Significant Difference	0.3264

Means with the same letter are not significantly different.

t Grouping	Mean	N	Fungi
A	3.0455	110	1
B	2.4000	110	3
B			
B	2.3455	110	2
C	2.0182	110	4
C			
C	1.8273	110	5

Alpha	0.05
Error Degrees of Freedom	160
Error Mean Square	1.502591
Critical Value of t	1.97490
Least Significant Difference	0.4842

Means with the same letter are not significantly different.

t Grouping		Mean	N	Region
	A	2.8400	50	5
	A			
B	A	2.7800	50	4
B	A			

B A C	2.6000	50	7
B A C			
B D A C	2.3600	50	11
B D C			
B D C	2.3000	50	10
D C			
D C	2.2400	50	3
D C			
D C	2.2000	50	6
D			
D	2.0800	50	8
D			
D	2.0800	50	1
D			
D	2.0800	50	2
D			
D	2.0400	50	9

LSD tests for Severity in Fungi, Regions, Seasons, and farmers continues

Alpha	0.05
Error Degrees of Freedom	160
Error Mean Square	1.502591
Critical Value of t	1.97490
Least Significant Difference	0.2064

Means with the same letter are not significantly different.

t Grouping	Mean	N	Season
A	2.9200	275	2
B	1.7345	275	1

Alpha	0.05
Error Degrees of Freedom	160
Error Mean Square	1.502591
Critical Value of t	1.97490
Least Significant Difference	0.3264

Means with the same letter are not significantly different.

t Grouping	Mean	N	farmers
A	2.4364	110	2
A			
A	2.4000	110	1
A			
A	2.3909	110	5
A			
A	2.2727	110	4
A			
A	2.1364	110	3

LSD tests for incidences in Fungi, Regions, Seasons, and farmers

Alpha 0.05
Error Degrees of Freedom 160
Error Mean Square 12.88048
Critical Value of t 1.97490
Least Significant Difference 0.9557

Means with the same letter are not significantly different.

t Grouping		Mean	N	Fungi
	A	11.5091	110	1
	B	9.7398	110	3
	B			
C	B	9.0113	110	2
C				
C	D	8.3563	110	4
	D			
	D	7.6326	110	5

LSD tests for incidences in Fungi, Regions, Seasons, and farmers continues

Alpha 0.05
Error Degrees of Freedom 160
Error Mean Square 12.88048
Critical Value of t 1.97490
Least Significant Difference 1.4176

Means with the same letter are not significantly different.

t Grouping		Mean	N	Region
	A	13.7724	50	4
	A			
	A	12.7270	50	5
	B	10.0662	50	7
	B			
	B	9.4662	50	6
	B			
	B	9.2886	50	10
	B			
C	B	8.7512	50	11
C				
C	D	7.8198	50	3
C	D			
C	D	7.6034	50	9
C	D			
C	D	7.5286	50	2
C	D			
C	D	7.5060	50	8
	D			
	D	7.2186	50	1

Alpha 0.05
Error Degrees of Freedom 160
Error Mean Square 12.88048
Critical Value of t 1.97490

Least Significant Difference 0.6044

Means with the same letter are not significantly different.

t Grouping	Mean	N	Season
A	11.5615	275	2
B	6.9381	275	1

Alpha 0.05
Error Degrees of Freedom 160
Error Mean Square 12.88048
Critical Value of t 1.97490
Least Significant Difference 0.9557

Means with the same letter are not significantly different.

t Grouping	Mean	N	farmers
A	10.0069	110	2
A			
B A	9.6166	110	5
B A			
B A C	9.3928	110	1
B C			
B C	8.7841	110	4
C			
C	8.4487	110	3

Table 3: Correlation analysis during short rains of 2008 and long rains of 2009 in Nyanza regions

Variables: Season Fungi farmers Region severity incidences

Simple Statistics

Variable	N	Mean	Std Dev	Sum	Minimum	Maximum	Label
Season	550	1.50000	0.50046	825.00000	1.00000	2.00000	Season
Fungi	550	3.00000	1.41550	1650	1.00000	5.00000	Fungi
farmers	550	3.00000	1.41550	1650	1.00000	5.00000	farmers
Region	550	6.00000	3.16516	3300	1.00000	11.00000	Region
severity	550	2.32727	1.50596	1280	1.00000	12.00000	severity
incidences	550	9.24981	5.30286	5087	0	22.00000	incidences

Pearson Correlation Coefficients, N = 550
Prob > |r| under H0: Rho=0

	Season	Fungi	farmers	Region	severity	incidences
Season	1.00000	0.00000	0.00000	0.00000	0.39395	0.43633
Season		1.0000	1.0000	1.0000	<.0001	<.0001
Fungi	0.00000	1.00000	0.00000	0.00000	-0.25976	-0.22444
Fungi	1.0000		1.0000	1.0000	<.0001	<.0001
farmers	0.00000	0.00000	1.00000	0.00000	-0.01709	-0.02069
farmers	1.0000	1.0000		1.0000	0.6892	0.6283

Region	0.00000	0.00000	0.00000	1.00000	0.00076	-0.00619
Region	1.0000	1.0000	1.0000		0.9857	0.8849
severity	0.39395	-0.25976	-0.01709	0.00076	1.00000	0.60445
severity	<.0001	<.0001	0.6892	0.9857		<.0001
incidences	0.43633	-0.22444	-0.02069	-0.00619	0.60445	1.00000
incidences	<.0001	<.0001	0.6283	0.8849	<.0001	

Table 4: Means breakdown for short rains of 2008 and long seasons of 2009

-- Effect=FARMERS --

Season	Fungi	farmers	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of INCIDENCES	INCIDENCES
.	.	1	.	0.13057	2.40000	0.50403	9.3928
.	.	2	.	0.14061	2.43636	0.48818	10.0069
.	.	3	.	0.13636	2.13636	0.48732	8.4487
.	.	4	.	0.15547	2.27273	0.48443	8.7841
.	.	5	.	0.15396	2.39091	0.55543	9.6166

-- Effect=FUNGI --

Season	Fungi	farmers	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of INCIDENCES	INCIDENCES
.	1	.	.	0.14577	3.04545	0.43679	11.5091
.	2	.	.	0.15251	2.34545	0.50808	9.0113
.	3	.	.	0.13184	2.40000	0.46719	9.7398
.	4	.	.	0.13728	2.01818	0.51511	8.3563
.	5	.	.	0.12311	1.82727	0.52360	7.6326

-- Effect=Overall --

Season	Fungi	farmers	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of INCIDENCES	INCIDENCES
.	.	.	.	0.064214	2.32727	0.22611	9.24981

-- Effect=REGION --

Season	Fungi	farmers	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of INCIDENCES	
.	.	.	1	0.16373	2.08	0.59347	7.2186
.	.	.	2	0.19132	2.08	0.62216	7.5286
.	.	.	3	0.27636	2.24	0.59230	7.8198
.	.	.	4	0.19855	2.78	0.65868	13.7724
.	.	.	5	0.24304	2.84	0.81670	12.7270
.	.	.	6	0.19588	2.20	0.62059	9.4662
.	.	.	7	0.22678	2.60	0.89387	10.0662
.	.	.	8	0.19967	2.08	0.61100	7.5060
.	.	.	9	0.18508	2.04	0.64115	7.6034
.	.	.	10	0.19431	2.30	0.69085	9.2886
.	.	.	11	0.22635	2.36	0.82271	8.7512

Table 4: Means breakdown for short rains season of 2008 and long season of 2009 continues

-- Effect=SEASON --

Season	Fungi	farmers	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of INCIDENCES
1	.	.	.	0.066341	1.73455	0.20395	6.9381
2	.	.	.	0.097768	2.92000	0.35254	11.5615

----------------------------------- Effect=FARMERS*REGION ------------------------------------

Season	Fungi	farmers	Region	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of INCIDENCES
.	.	1	1	0.40689	1.9	1.03296	8.0562
.	.	1	2	0.44845	2.3	1.62226	6.9420
.	.	1	3	0.47140	2.0	1.18043	8.4130
.	.	1	4	0.34801	3.1	1.47005	14.3632
.	.	1	5	0.53852	2.7	1.72305	12.1010
.	.	1	6	0.46667	2.2	1.54700	8.7457
.	.	1	7	0.41633	2.8	1.70189	12.1490
.	.	1	8	0.37859	2.1	1.59865	7.7510
.	.	1	9	0.42164	2.0	1.43313	5.9780
.	.	1	10	0.37118	2.4	1.55627	8.4100
.	.	1	11	0.48189	2.9	2.01517	10.4115
.	.	2	1	0.36515	2.0	1.38087	6.9830
.	.	2	2	0.45338	2.5	1.00111	11.4018
.	.	2	3	0.41633	1.8	1.24576	7.6150
.	.	2	4	0.38873	2.8	1.47275	13.9110
.	.	2	5	0.49889	3.4	1.53868	15.8890
.	.	2	6	0.42687	2.4	0.90492	10.8500
.	.	2	7	0.55777	3.0	1.61384	11.8020
.	.	2	8	0.51208	2.2	1.24798	8.7400
.	.	2	9	0.47610	2.4	1.70418	8.8120
.	.	2	10	0.44845	2.3	1.52344	8.1580
.	.	2	11	0.53748	2.0	1.45770	5.9140
.	.	3	1	0.39581	2.3	1.39975	6.2690
.	.	3	2	0.42295	1.7	1.05151	5.8230
.	.	3	3	0.45826	1.9	1.37349	8.3060
.	.	3	4	0.54160	2.4	1.80440	12.8210
.	.	3	5	0.50000	2.5	1.71044	11.4120
.	.	3	6	0.36667	2.3	0.67322	11.4300
.	.	3	7	0.41633	2.2	1.66171	6.7690
.	.	3	8	0.39581	1.7	1.30359	5.5060
.	.	3	9	0.40139	1.5	1.03102	4.2260
.	.	3	10	0.52068	2.6	1.79204	11.5320
.	.	3	11	0.58119	2.4	1.26594	8.8414
.	.	4	1	0.23333	1.9	1.04897	5.9140
.	.	4	2	0.31447	1.9	1.08905	6.3280
.	.	4	3	1.07961	3.1	1.46921	6.4610
.	.	4	4	0.52599	3.1	1.62925	12.7270
.	.	4	5	0.36667	2.7	1.75190	13.2220
.	.	4	6	0.55877	2.3	1.37495	9.2531
.	.	4	7	0.39581	1.7	1.92626	5.7880
.	.	4	8	0.47258	2.3	1.35003	9.0970

----------------------------------- Effect=FARMERS*REGION ------------------------------------

(continued)

Season	Fungi	farmers	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of INCIDENCES	
.	.	4	9	0.29059	1.8	0.36316	8.5220
.	.	4	10	0.44721	2.0	1.13839	10.8770
.	.	4	11	0.48990	2.2	2.14517	8.4360
.	.	5	1	0.44845	2.3	1.69636	8.8710
.	.	5	2	0.51640	2.0	1.55147	7.1480
.	.	5	3	0.42687	2.4	1.50277	8.3040
.	.	5	4	0.42817	2.5	1.06241	15.0400
.	.	5	5	0.79512	2.9	2.26384	11.0110
.	.	5	6	0.41633	1.8	1.89125	7.0520
.	.	5	7	0.63333	3.3	2.03755	13.8230
.	.	5	8	0.52599	2.1	1.22424	6.4360
.	.	5	9	0.45338	2.5	1.51705	10.4790
.	.	5	10	0.44222	2.2	1.51854	7.4660
.	.	5	11	0.49554	2.3	2.14573	10.1529

Table 4: Means breakdown for short rains of 2008 and long rain season of 2009 continues

------------------------------------- Effect=FUNGI*FARMERS -------------------------------------

Season	Fungi	farmers	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of INCIDENCES	
.	1	1	.	0.26560	3.86364	1.12238	11.0000
.	1	2	.	0.24215	3.36364	1.07844	11.5909
.	1	3	.	0.38159	2.81818	0.85654	10.9545
.	1	4	.	0.33151	2.68182	0.84171	11.4091
.	1	5	.	0.32733	2.50000	1.00143	12.5909
.	2	1	.	0.26243	2.90909	1.02426	10.1468
.	2	2	.	0.29823	2.63636	0.97016	10.2409
.	2	3	.	0.28902	2.13636	0.99186	9.2395
.	2	4	.	0.51968	2.31818	1.26503	7.2073
.	2	5	.	0.22964	1.72727	1.34335	8.2218
.	3	1	.	0.21754	2.22727	0.85990	10.5745
.	3	2	.	0.39139	2.68182	0.81187	11.3232
.	3	3	.	0.30669	2.54545	1.11279	8.4882
.	3	4	.	0.26262	2.22727	1.18077	8.4973
.	3	5	.	0.28213	2.31818	1.15438	9.8159
.	4	1	.	0.20735	1.77273	1.29306	8.4220
.	4	2	.	0.24877	1.86364	1.17758	9.0058
.	4	3	.	0.26634	1.68182	1.05914	7.0755
.	4	4	.	0.26262	2.22727	0.91670	9.0650
.	4	5	.	0.46861	2.54545	1.31990	8.2131
.	5	1	.	0.11266	1.22727	1.13858	6.8205
.	5	2	.	0.24215	1.63636	1.25133	7.8736
.	5	3	.	0.17094	1.50000	1.21799	6.4856
.	5	4	.	0.30797	1.90909	1.02026	7.7419
.	5	5	.	0.34999	2.86364	1.22796	9.2414

------------------------------------- Effect=FUNGI*REGION -------------------------------------

Season	Fungi	farmers	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of INCIDENCES	
.	1	.	1	0.48189	3.1	0.93155	9.7000
.	1	.	2	0.53748	3.0	1.02686	10.1000
.	1	.	3	0.53748	3.0	1.05198	10.2000
.	1	.	4	0.52068	3.6	1.36789	15.4000

.	1	.	5	0.55877	3.7	1.48361	15.3000
.	1	.	6	0.42295	2.7	1.57233	10.5000
.	1	.	7	0.39441	3.0	1.56347	13.0000
.	1	.	8	0.52599	2.9	1.43914	9.6000
.	1	.	9	0.54671	2.9	1.08985	10.1000
.	1	.	10	0.44222	2.8	1.23873	11.7000
.	1	.	11	0.46667	2.8	1.87972	11.0000
.	2	.	1	0.31447	2.1	1.57096	6.3490
.	2	.	2	0.29059	1.8	1.46658	7.1910
.	2	.	3	1.07290	2.8	1.36868	6.9730
.	2	.	4	0.37118	2.6	1.21324	14.0210
.	2	.	5	0.40139	2.5	2.24906	11.3210
.	2	.	6	0.43333	2.1	1.41126	9.6010
.	2	.	7	0.40139	2.5	2.01117	9.7430
.	2	.	8	0.41633	1.8	1.30848	6.6090
.	2	.	9	0.34801	1.9	1.30803	8.4280
.	2	.	10	0.52068	2.6	1.76108	8.6200
.	2	.	11	0.58595	3.1	1.68509	10.2680
.	3	.	1	0.25820	2.0	1.26482	7.0890
.	3	.	2	0.29814	2.0	1.49491	7.5350
.	3	.	3	0.40689	1.9	1.44709	7.4100
.	3	.	4	0.36515	3.0	1.81775	13.0750
.	3	.	5	0.60461	2.9	1.85951	13.1260
.	3	.	6	0.49554	2.3	1.31846	9.7510
.	3	.	7	0.61464	3.0	1.69086	11.4550
.	3	.	8	0.31447	2.1	1.17055	8.3920
.	3	.	9	0.34801	2.1	0.91040	8.9880
.	3	.	10	0.42687	2.6	0.95740	10.7610
.	3	.	11	0.52175	2.5	1.87876	9.5560
.	4	.	1	0.26667	1.6	1.31589	7.0410
.	4	.	2	0.42295	1.7	1.35702	6.7978
.	4	.	3	0.41633	1.8	1.15211	8.1180
.	4	.	4	0.49554	2.7	1.81938	13.0992
.	4	.	5	0.65320	2.4	1.80424	12.0730
.	4	.	6	0.36515	2.0	1.55305	8.5117
.	4	.	7	0.71570	2.7	2.36945	7.7210
.	4	.	8	0.49441	2.0	1.33686	6.7140
.	4	.	9	0.22361	1.5	1.64063	6.2940
.	4	.	10	0.27689	1.9	1.81480	7.3550
.	4	.	11	0.45826	1.9	1.62731	8.1944
.	5	.	1	0.30551	1.6	1.39938	5.9142

Table 4: Means breakdown for short rains of 2008 and long rain season of 2009 continues

.	5	.	2	0.48189	1.9	1.48183	6.0190
.	5	.	3	0.36667	1.7	1.47860	6.3980
.	5	.	4	0.36515	2.0	1.19127	13.2670
.	5	.	5	0.47258	2.7	1.75267	11.8150
.	5	.	6	0.50442	1.9	1.26940	8.9671
.	5	.	7	0.29059	1.8	2.16584	8.4120

------------------------------------ Effect=FUNGI*REGION --------------------------------------

(continued)

Season	Fungi	farmers	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of INCIDENCES
.	5	.	8	0.42687	1.6	1.51766	6.2150
.	5	.	9	0.46667	1.8	1.52239	4.2070
.	5	.	10	0.42687	1.6	1.61618	8.0070
.	5	.	11	0.40139	1.5	1.77779	4.7374

------------------------------------ Effect=SEASON*FARMERS --------------------------------------

Season	Fungi	farmers	Region	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of INCIDENCES
1	.	1	.	0.14040	1.90909	0.50695	6.8670
1	.	2	.	0.12818	1.80000	0.34699	7.9289
1	.	3	.	0.11273	1.50909	0.42574	6.4964
1	.	4	.	0.21927	1.80000	0.47458	6.6104
1	.	5	.	0.11376	1.65455	0.49708	6.7880
2	.	1	.	0.20046	2.89091	0.72961	11.9185
2	.	2	.	0.21997	3.07273	0.82569	12.0849
2	.	3	.	0.21860	2.76364	0.79769	10.4009
2	.	4	.	0.20304	2.74545	0.73968	10.9578
2	.	5	.	0.25033	3.12727	0.83786	12.4453

------------------------------------- Effect=SEASON*FUNGI --------------------------------------

Season	Fungi	farmers	Region	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of INCIDENCES
1	1	.	.	0.15364	2.12727	0.28966	8.4000
1	2	.	.	0.21203	1.83636	0.46161	6.6338

1	3	.	.	0.11515	1.78182	0.47434	6.9647
1	4	.	.	0.11840	1.54545	0.49233	6.4487
1	5	.	.	0.09878	1.38182	0.48601	6.2434
2	1	.	.	0.17593	3.96364	0.57295	14.6182
2	2	.	.	0.19834	2.85455	0.78723	11.3887
2	3	.	.	0.20677	3.01818	0.60905	12.5149
2	4	.	.	0.23192	2.49091	0.83309	10.2638
2	5	.	.	0.20995	2.27273	0.89393	9.0218

------------------------------------ Effect=SEASON*REGION ------------------------------------

Season	Fungi	farmers		Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	INCIDENCES
1	.	.	1	0.16852	1.72	0.65034	4.98488
1	.	.	2	0.17436	1.52	0.57446	6.00992

------------------------------------ Effect=SEASON*REGION ------------------------------------

(continued)

Season	Fungi	farmers		Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	INCIDENCES
1	.	.	3	0.44602	1.84	0.60269	5.5312
1	.	.	4	0.21970	2.04	0.63116	9.8125
1	.	.	5	0.19562	2.04	0.60799	9.5968
1	.	.	6	0.17205	1.64	0.41634	8.1315
1	.	.	7	0.21197	1.96	0.87056	6.8568
1	.	.	8	0.15406	1.48	0.48243	6.0896
1	.	.	9	0.19044	1.64	0.59839	6.0228
1	.	.	10	0.17321	1.60	0.60970	6.5668
1	.	.	11	0.16330	1.60	0.63022	6.7167
2	.	.	1	0.26508	2.44	0.77423	9.4524
2	.	.	2	0.30485	2.64	1.02878	9.0472

2	.	.	3	0.31559	2.64	0.79547	10.1084
2	.	.	4	0.25897	3.52	0.25776	17.7324
2	.	.	5	0.38678	3.64	1.23992	15.8572
2	.	.	6	0.31770	2.76	1.11841	10.8008
2	.	.	7	0.36185	3.24	1.28312	13.2756
2	.	.	8	0.33025	2.68	1.06041	8.9224
2	.	.	9	0.30044	2.44	1.05464	9.1840
2	.	.	10	0.28868	3.00	0.97970	12.0104
2	.	.	11	0.36661	3.12	1.42186	10.7856

Table 4: Means breakdown for short rains of 2008 and long rain season of 2009 continues

-------------------------------- Effect=FUNGI*FARMERS*REGION ----------------------------------

Season	Fungi	farmers	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of INCIDENCES	
.	1	1	1	1.0	4.0	2.5	9.5
.	1	1	2	0.5	4.5	2.5	10.5
.	1	1	3	1.0	4.0	3.0	10.0
.	1	1	4	1.0	4.0	4.5	15.5
.	1	1	5	0.0	5.0	4.0	15.0
.	1	1	6	1.0	2.0	5.0	5.0
.	1	1	7	0.0	4.0	4.0	14.0
.	1	1	8	2.0	3.0	7.0	7.0
.	1	1	9	1.0	4.0	2.5	9.5
.	1	1	10	0.5	3.5	3.0	11.0
.	1	1	11	0.5	4.5	4.0	14.0
.	1	2	1	0.0	3.0	3.0	9.0
.	1	2	2	0.5	2.5	3.5	12.5
.	1	2	3	2.0	3.0	3.5	9.5
.	1	2	4	1.0	4.0	5.0	15.0
.	1	2	5	1.0	4.0	5.0	17.0
.	1	2	6	0.5	3.5	3.0	12.0
.	1	2	7	0.5	3.5	3.5	14.5
.	1	2	8	0.0	4.0	3.0	11.0
.	1	2	9	0.5	4.5	3.0	12.0
.	1	2	10	0.0	3.0	2.5	11.5
.	1	2	11	1.0	2.0	3.5	3.5

-------------------------------- Effect=FUNGI*FARMERS*REGION ----------------------------------
(continued)

Season	Fungi	farmers	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of INCIDENCES	I
.	1	3	1	1.0	4.0	2.000	10.000
.	1	3	2	2.0	3.0	1.500	8.500
.	1	3	3	1.5	2.5	4.000	10.000
.	1	3	4	2.0	3.0	4.000	15.000
.	1	3	5	2.0	3.0	4.000	14.000
.	1	3	6	0.5	1.5	2.500	12.500

.	1	3	7	1.0	2.0	3.000		10.000
.	1	3	8	1.5	3.5	2.000		9.000
.	1	3	9	2.0	3.0	2.000		7.000
.	1	3	10	1.5	2.5	4.500		13.500
.	1	3	11	2.0	3.0	3.000		11.000
.	1	4	1	0.5	1.5	1.500		8.500
.	1	4	2	1.0	2.0	1.000	9.000	
.	1	4	3	1.5	3.5	2.000	10.000	
.	1	4	4	1.0	4.0	3.000	15.000	
.	1	4	5	2.0	3.0	3.500	15.500	
.	1	4	6	1.0	3.0	3.500	11.500	
.	1	4	7	1.5	3.5	4.500	10.500	
.	1	4	8	1.5	2.5	3.500	11.500	
.	1	4	9	0.5	1.5	1.500	9.500	
.	1	4	10	2.0	3.0	4.000	12.000	
.	1	4	11	0.0	2.0	4.500	12.500	
.	1	5	1	2.0	3.0	3.500	11.500	
.	1	5	2	2.0	3.0	4.000	10.000	
.	1	5	3	1.0	2.0	2.500	11.500	
.	1	5	4	2.0	3.0	3.500	16.500	
.	1	5	5	1.5	3.5	5.000	15.000	
.	1	5	6	1.5	3.5	4.500	11.500	
.	1	5	7	0.0	2.0	5.000	16.000	
.	1	5	8	0.5	1.5	2.500	9.500	
.	1	5	9	0.5	1.5	3.500	12.500	
.	1	5	10	1.0	2.0	3.500	10.500	
.	1	5	11	0.5	2.5	5.000	14.000	
.	2	1	1	0.0	2.0	1.725	8.525	
.	2	1	2	0.0	3.0	2.125	9.125	
.	2	1	3	1.0	3.0	2.220	9.120	
.	2	1	4	0.0	3.0	4.250	14.200	
.	2	1	5	1.5	3.5	3.345	13.845	
.	2	1	6	2.0	3.0	1.785	11.535	
.	2	1	7	1.0	4.0	3.280	13.030	
.	2	1	8	0.5	2.5	3.310	8.810	
.	2	1	9	1.0	2.0	5.125	5.125	
.	2	1	10	0.5	3.5	2.400	10.050	
.	2	1	11	1.5	2.5	8.250	8.250	
.	2	2	1	1.0	3.0	2.675	7.675	
.	2	2	2	0.5	1.5	3.050	11.050	
.	2	2	3	1.0	2.0	3.145	8.145	
.	2	2	4	1.0	2.0	4.310	13.810	
.	2	2	5	0.0	3.0	4.650	16.250	
.	2	2	6	1.0	3.0	3.450	10.450	

Table 4: Means breakdown for short rains of 2008 and long rain season of 2009 continues

--------------------------------- Effect=FUNGI*FARMERS*REGION ------------------------------

(continued)

Season	Fungi	farmers	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of SEVERITY	INCIDENCES
.	2	2	7	0.5	1.5	5.250	5.250
.	2	2	8	2.0	3.0	2.400	9.400
.	2	2	9	0.5	3.5	2.295	10.895
.	2	2	10	1.5	3.5	1.780	10.780
.	2	2	11	2.0	3.0	2.945	8.945
.	2	3	1	0.0	3.0	1.950	8.950
.	2	3	2	1.0	2.0	0.900	6.900

.	2	3	3	0.5	1.5		2.560	8.430
.	2	3	4	1.5	2.5		3.265	13.965
.	2	3	5	0.5	1.5		3.395	13.395
.	2	3	6	0.5	1.5		1.660	11.660
.	2	3	7	1.5	2.5		6.485	6.485
.	2	3	8	0.5	1.5		1.560	7.560
.	2	3	9	0.5	1.5	1.210	5.910	
.	2	3	10	2.0	3.0	8.115	8.115	
.	2	3	11	2.0	3.0	1.965	10.265	
.	2	4	1	0.0	1.0	0.000	0.000	
.	2	4	2	0.0	1.0	0.000	0.000	
.	2	4	3	5.5	6.5	1.170	9.170	
.	2	4	4	0.0	3.0	2.580	13.680	
.	2	4	5	1.0	3.0	8.615	8.615	
.	2	4	6	0.5	1.5	3.750	3.750	
.	2	4	7	0.0	2.0	4.180	9.180	
.	2	4	8	0.0	1.0	3.880	3.880	
.	2	4	9	0.0	1.0	0.680	8.570	
.	2	4	10	1.0	2.0	3.505	11.005	
.	2	4	11	1.5	3.5	3.930	11.430	
.	2	5	1	0.5	1.5	6.595	6.595	
.	2	5	2	0.5	1.5	2.980	8.880	
.	2	5	3	0.0	1.0	0.000	0.000	
.	2	5	4	1.5	2.5	3.450	14.450	
.	2	5	5	0.5	1.5	4.500	4.500	
.	2	5	6	0.5	1.5	3.710	10.610	
.	2	5	7	0.5	2.5	4.120	14.770	
.	2	5	8	0.0	1.0	3.395	3.395	
.	2	5	9	0.5	1.5	3.140	11.640	
.	2	5	10	0.0	1.0	3.150	3.150	
.	2	5	11	1.5	3.5	4.450	12.450	
.	3	1	1	0.5	1.5	1.410	8.910	
.	3	1	2	0.5	1.5	5.780	5.780	
.	3	1	3	0.0	1.0	2.215	9.015	
.	3	1	4	0.5	3.5	3.660	14.240	
.	3	1	5	1.0	2.0	3.225	13.225	
.	3	1	6	1.0	3.0	2.075	11.375	
.	3	1	7	1.0	2.0	3.150	13.150	
.	3	1	8	0.0	2.0	2.660	8.640	
.	3	1	9	0.0	2.0	1.725	8.725	
.	3	1	10	0.5	2.5	2.230	10.330	
.	3	1	11	0.5	3.5	2.960	12.930	
.	3	2	1	1.0	2.0	2.290	8.270	

Table 4: Means breakdown for short rains of 2008 and long rain season of 2009 continues

--------------------------------- Effect=FUNGI*FARMERS*REGION -------------------------------

(continued)

Season		Fungi	farmers	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of INCIDENCES
.	3	2	2	1.0	3.0	2.8700	11.6300
.	3	2	3	0.0	2.0	2.7450	8.7050
.	3	2	4	0.0	3.0	4.1850	14.1650
.	3	2	5	2.5	4.5	4.3000	16.0600
.	3	2	6	1.5	2.5	2.1850	11.1550
.	3	2	7	2.5	4.5	2.7400	13.6100
.	3	2	8	0.0	1.0	2.2500	10.1000
.	3	2	9	0.5	1.5	3.2250	10.2250

.	3	2	10	1.5	2.5	1.2550	11.0350
.	3	2	11	2.0	3.0	2.8500	9.6000
.	3	3	1	0.5	1.5	0.5250	0.5250
.	3	3	2	0.5	1.5	3.3900	3.3900
.	3	3	3	0.5	1.5	3.1100	8.9900
.	3	3	4	1.5	3.5	3.6250	13.7250
.	3	3	5	1.0	4.0	3.4200	13.1200
.	3	3	6	1.0	4.0	1.9750	11.3750
.	3	3	7	0.5	3.5	2.2450	9.1150
.	3	3	8	0.5	1.5	4.6950	4.6950
.	3	3	9	0.0	1.0	1.3600	6.0100
.	3	3	10	1.0	4.0	3.9250	12.4650
.	3	3	11	0.0	2.0	2.4000	9.9600
.	3	4	1	0.5	2.5	0.7800	7.5600
.	3	4	2	0.5	2.5	0.1850	8.1650
.	3	4	3	0.0	1.0	0.0000	0.0000
.	3	4	4	1.5	2.5	8.1800	8.1800
.	3	4	5	0.0	3.0	2.9300	14.4300
.	3	4	6	0.0	1.0	1.9050	11.4050
.	3	4	7	0.0	1.0	6.6600	6.6600
.	3	4	8	0.0	3.0	2.3750	10.2650
.	3	4	9	1.0	3.0	0.8450	8.7650
.	3	4	10	1.0	2.0	2.8700	10.7300
.	3	4	11	2.0	3.0	7.3100	7.3100
.	3	5	1	0.5	2.5	2.5100	10.1800
.	3	5	2	0.5	1.5	2.9300	8.7100
.	3	5	3	1.0	4.0	1.3700	10.3400
.	3	5	4	0.5	2.5	2.6150	15.0650
.	3	5	5	0.0	1.0	8.7950	8.7950
.	3	5	6	0.0	1.0	3.4450	3.4450
.	3	5	7	1.0	4.0	3.8800	14.7400
.	3	5	8	1.0	3.0	1.2900	8.2600
.	3	5	9	1.0	3.0	2.4250	11.2150
.	3	5	10	1.0	2.0	2.3650	9.2450
.	3	5	11	0.0	1.0	7.9800	7.9800
.	4	1	1	0.0	1.0	4.5500	4.5500
.	4	1	2	0.5	1.5	5.3050	5.3050
.	4	1	3	0.0	1.0	5.3050	5.3050
.	4	1	4	1.5	2.5	4.4340	15.1860
.	4	1	5	0.0	2.0	2.5300	13.3900
.	4	1	6	1.0	2.0	1.3365	11.2735
.	4	1	7	1.0	2.0	7.9750	7.9750

Table 4: Means breakdown for short rains of 2008 and long rain season of 2009 continues

-------------------------------- Effect=FUNGI*FARMERS*REGION ------------------------------
(continued)

Season		Fungi	farmers	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of INCIDENCES
.	4	1	8	0.0	2.0	2.9200	8.6900
.	4	1	9	0.0	1.0	3.4950	3.4950
.	4	1	10	0.5	1.5	5.0450	5.0450
.	4	1	11	1.0	3.0	2.5725	12.4275
.	4	2	1	0.0	1.0	5.3450	5.3450
.	4	2	2	2.0	3.0	2.4510	11.2390
.	4	2	3	0.0	1.0	2.3350	8.2750
.	4	2	4	0.5	2.5	4.1900	13.4200

.	4	2	5	0.5	2.5		4.6100	15.0600
.	4	2	6	1.0	2.0		2.2050	10.4150
.	4	2	7	0.5	3.5		2.6350	13.0550
.	4	2	8	0.0	1.0		3.6600	3.6600
.	4	2	9	0.5	1.5		2.7100	10.9400
.	4	2	10	0.5	1.5		3.5750	3.5750
.	4	2	11	0.0	1.0	4.0800	4.0800	
.	4	3	1	0.5	1.5	1.2300	8.4200	
.	4	3	2	0.0	1.0	1.1850	7.4350	
.	4	3	3	2.0	3.0	3.2200	8.4700	
.	4	3	4	0.0	1.0	8.3350	8.3350	
.	4	3	5	0.0	1.0	4.4500	4.4500	
.	4	3	6	0.5	2.5	1.7350	10.9450	
.	4	3	7	0.0	1.0	3.1050	3.1050	
.	4	3	8	0.0	1.0	3.1600	3.1600	
.	4	3	9	0.0	1.0	2.2100	2.2100	
.	4	3	10	0.5	2.5	3.6950	11.8850	
.	4	3	11	2.0	3.0	2.1650	9.4150	
.	4	4	1	0.5	2.5	0.6300	6.9500	
.	4	4	2	1.0	2.0	0.1300	7.4500	
.	4	4	3	0.0	2.0	1.0850	8.4950	
.	4	4	4	0.0	5.0	2.0300	13.5500	
.	4	4	5	0.0	2.0	2.7200	13.9500	
.	4	4	6	1.5	2.5	2.6950	9.9250	
.	4	4	7	0.0	1.0	0.0000	0.0000	
.	4	4	8	1.0	2.0	2.6900	10.0300	
.	4	4	9	0.0	2.0	0.7250	7.9750	
.	4	4	10	1.0	2.0	3.2200	10.4500	
.	4	4	11	0.5	1.5	3.7100	10.9400	
.	4	5	1	1.0	2.0	2.7100	9.9400	
.	4	5	2	0.0	1.0	2.5600	2.5600	
.	4	5	3	1.0	2.0	1.6350	10.0450	
.	4	5	4	0.5	2.5	2.6750	15.0050	
.	4	5	5	3.5	4.5	4.1550	13.5150	
.	4	5	6	0.0	1.0	0.0000	0.0000	
.	4	5	7	2.0	6.0	4.1800	14.4700	
.	4	5	8	2.0	4.0	1.6400	8.0300	
.	4	5	9	1.0	2.0	6.8500	6.8500	
.	4	5	10	1.0	2.0	5.8200	5.8200	
.	4	5	11	0.0	1.0	4.1095	4.1095	
.	5	1	1	0.0	1.0	0.4740	8.7960	
.	5	1	2	0.0	1.0	4.0000	4.0000	

Table 4: Means breakdown for short rains of 2008 and long rain season of 2009 continues

--------------------------------- Effect=FUNGI*FARMERS*REGION -------------------------------

(continued)

Season	Fungi	farmers	Region	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of SEVERITY	INCIDENCES
.	5	1	3	0.0	1.0		1.6250	8.6250
.	5	1	4	0.5	2.5		4.5900	12.6900
.	5	1	5	0.0	1.0		5.0450	5.0450
.	5	1	6	0.0	1.0		4.5450	4.5450
.	5	1	7	0.0	2.0		2.6900	12.5900
.	5	1	8	0.0	1.0		5.6150	5.6150
.	5	1	9	0.0	1.0		3.0450	3.0450
.	5	1	10	0.0	1.0		5.6250	5.6250
.	5	1	11	0.0	1.0		4.4500	4.4500
.	5	2	1	0.0	1.0		4.6250	4.6250
.	5	2	2	1.5	2.5		2.6900	10.5900

.	5	2	3	0.0	1.0		3.4500	3.4500
.	5	2	4	1.5	2.5		4.1100	13.1600
.	5	2	5	1.0	3.0		4.1750	15.0750
.	5	2	6	0.0	1.0		2.0400	10.2300
.	5	2	7	1.0	2.0		2.6950	12.5950
.	5	2	8	1.0	2.0		1.7400	9.5400
.	5	2	9	0.0	1.0	0.0000	0.0000	
.	5	2	10	0.0	1.0	3.9000	3.9000	
.	5	2	11	0.0	1.0	3.4450	3.4450	
.	5	3	1	0.5	1.5	3.4500	3.4500	
.	5	3	2	0.0	1.0	2.8900	2.8900	
.	5	3	3	0.0	1.0	5.6400	5.6400	
.	5	3	4	1.0	2.0	3.1900	13.0800	
.	5	3	5	0.0	3.0	3.1850	12.0950	
.	5	3	6	0.0	2.0	1.5700	10.6700	
.	5	3	7	1.0	2.0	5.1400	5.1400	
.	5	3	8	0.0	1.0	3.1150	3.1150	
.	5	3	9	0.0	1.0	0.0000	0.0000	
.	5	3	10	0.0	1.0	3.5750	11.6950	
.	5	3	11	0.0	1.0	3.5670	3.5670	
.	5	4	1	0.0	2.0	0.6300	6.5600	
.	5	4	2	1.0	2.0	0.1350	7.0250	
.	5	4	3	1.5	2.5	4.6400	4.6400	
.	5	4	4	0.0	1.0	2.2550	13.2250	
.	5	4	5	0.5	2.5	2.6650	13.6150	
.	5	4	6	2.5	3.5	2.6955	9.6855	
.	5	4	7	0.0	1.0	2.6000	2.6000	
.	5	4	8	2.0	3.0	2.4700	9.8100	
.	5	4	9	0.5	1.5	0.3800	7.8000	
.	5	4	10	0.0	1.0	3.0800	10.2000	
.	5	4	11	0.0	1.0	0.0000	0.0000	
.	5	5	1	1.5	2.5	6.1400	6.1400	
.	5	5	2	2.0	3.0	5.5900	5.5900	
.	5	5	3	0.0	3.0	1.6450	9.6350	
.	5	5	4	1.0	2.0	3.0700	14.1800	
.	5	5	5	2.0	4.0	4.0350	13.2450	
.	5	5	6	1.0	2.0	3.5850	9.7050	
.	5	5	7	1.0	2.0	9.1350	9.1350	
.	5	5	8	0.0	1.0	2.9950	2.9950	
.	5	5	9	0.5	4.5	3.0700	10.1900	
.	5	5	10	1.0	4.0	2.6650	8.6150	
.	5	5	11	1.5	3.5	4.0250	12.2250	

Table 4: Means breakdown for short rains of 2008 and long rain season of 2009 continues

--------------------------------- Effect=SEASON*FARMERS*REGION ---------------------------

Season	Fungi	farmers	Region	Std. Error of	Mean of SEVERITY	Std. Error of SEVERITY	Mean of INCIDENCES
1	.	1	1	0.40000	1.6	1.50421	5.9244
1	.	1	2	0.63246	2.0	1.88680	4.6000
1	.	1	3	0.40000	1.6	1.38550	5.5400
1	.	1	4	0.40000	2.4	0.52370	10.0764
1	.	1	5	0.73485	2.2	0.19965	10.4900
1	.	1	6	0.40000	1.6	0.17958	9.6154
1	.	1	7	0.58310	2.2	1.98303	7.9300
1	.	1	8	0.24495	1.6	1.41051	3.4500
1	.	1	9	0.40000	1.6	1.36534	5.4160
1	.	1	10	0.44721	2.0	1.94062	4.7500

1	.	1	11	0.58310	2.2		1.94688	7.7450
1	.	2	1	0.40000	1.6		1.39815	3.3960
1	.	2	2	0.37417	1.8		0.22472	8.4896
1	.	2	3	0.20000	1.2		0.30060	5.9600
1	.	2	4	0.44721	2.0		0.19265	9.5520
1	.	2	5	0.24495	2.4		0.28856	11.3420
1	.	2	6	0.58310	1.8	0.36371	8.2740	
1	.	2	7	0.37417	2.2	0.19314	10.5380	
1	.	2	8	0.60000	1.6	0.18718	7.5940	
1	.	2	9	0.63246	2.0	1.67528	6.5660	
1	.	2	10	0.37417	1.8	0.47119	8.5460	
1	.	2	11	0.40000	1.4	0.34729	6.9600	
1	.	3	1	0.44721	2.0	1.46732	5.8180	
1	.	3	2	0.20000	1.2	0.23066	6.3620	
1	.	3	3	0.00000	1.0	1.15745	4.6000	
1	.	3	4	0.40000	1.6	2.09405	8.3380	
1	.	3	5	0.48990	1.8	0.24981	9.5020	
1	.	3	6	0.44721	2.0	0.19304	9.5420	
1	.	3	7	0.60000	1.6	1.64499	4.0160	
1	.	3	8	0.24495	1.4	1.28831	5.1100	
1	.	3	9	0.00000	1.0	0.94304	3.7540	
1	.	3	10	0.48990	1.8	1.69967	6.7700	
1	.	3	11	0.20000	1.2	0.22129	7.6488	
1	.	4	1	0.24495	1.6	1.31460	5.2060	
1	.	4	2	0.40000	1.6	1.52394	6.0380	
1	.	4	3	2.11187	3.6	1.91445	4.6820	
1	.	4	4	0.74833	2.6	2.28661	9.1180	
1	.	4	5	0.37417	2.2	2.29056	9.1360	
1	.	4	6	0.24495	1.4	0.44673	7.8440	

Table 4: Means breakdown for short rains of 2008 and long rain season of 2009 continues

(continued)

Season		Fungi	farmers	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of SEVERITY	INCIDENCES
1	.	4	7	0.24495	1.4		1.33327	3.2400
1	.	4	8	0.40000	1.4		0.13841	7.6660
1	.	4	9	0.24495	1.4		0.15088	7.6960
1	.	4	10	0.00000	1.0		0.17148	7.5420
1	.	4	11	0.24495	1.6		1.86000	4.5460
1	.	5	1	0.48990	1.8		1.87376	4.5800
1	.	5	2	0.00000	1.0		1.15032	4.5600
1	.	5	3	0.48990	1.8		1.72872	6.8740
1	.	5	4	0.40000	1.6		0.39377	11.9780
1	.	5	5	0.24495	1.6		1.88590	7.5140
1	.	5	6	0.24495	1.4		1.35475	5.3820
1	.	5	7	0.50990	2.4		2.14334	8.5600
1	.	5	8	0.24495	1.4		0.19304	6.6280
1	.	5	9	0.48990	2.2		1.70239	6.6820
1	.	5	10	0.40000	1.4		1.32045	5.2260
1	.	5	11	0.24495	1.6		1.67967	6.6838
2	.	1	1	0.73485	2.2		0.51629	10.1880
2	.	1	2	0.67823	2.6		2.35377	9.2840
2	.	1	3	0.87178	2.4		0.47298	11.2860
2	.	1	4	0.37417	3.8		0.51200	18.6500
2	.	1	5	0.80000	3.2		3.46735	13.7120
2	.	1	6	0.80000	2.8		3.21854	7.8760
2	.	1	7	0.50990	3.4		0.44888	16.3680

2	.	1	8	0.67823	2.6	0.51166	12.0520
2	.	1	9	0.74833	2.4	2.68707	6.5400
2	.	1	10	0.58310	2.8	0.65963	12.0700
2	.	1	11	0.67823	3.6	3.30584	13.0780
2	.	2	1	0.60000	2.4	0.43876	10.5700
2	.	2	2	0.73485	3.2	0.46806	14.3140
2	.	2	3	0.74833	2.4	2.35026	9.2700
2	.	2	4	0.40000	3.6	0.47209	18.2700
2	.	2	5	0.74833	4.4	0.48273	20.4360
2	.	2	6	0.54772	3.0	0.48454	13.4260
2	.	2	7	0.96954	3.8	3.29910	13.0660
2	.	2	8	0.80000	2.8	2.51332	9.8860
2	.	2	9	0.73485	2.8	2.78212	11.0580
2	.	2	10	0.80000	2.8	3.18538	7.7700
2	.	2	11	0.97980	2.6	2.98234	4.8680
2	.	3	1	0.67823	2.6	2.56167	6.7200
2	.	3	2	0.80000	2.2	2.18565	5.2840
2	.	3	3	0.73485	2.8	0.53122	12.0120
2	.	3	4	0.91652	3.2	0.46664	17.3040
2	.	3	5	0.80000	3.2	3.35839	13.3220
2	.	3	6	0.60000	2.6	0.46900	13.3180
2	.	3	7	0.48990	2.8	2.43523	9.5220
2	.	3	8	0.77460	2.0	2.43083	5.9020
2	.	3	9	0.77460	2.0	1.94493	4.6980
2	.	3	10	0.81240	3.4	0.47340	16.2940
2	.	3	11	0.87178	3.6	2.54001	10.0340
2	.	4	1	0.37417	2.2	1.72415	6.6220

(continued)

Season		Fungi	farmers	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of INCIDENCES
2	.	4	2	0.48990	2.2	1.72416	6.6180
2	.	4	3	0.81240	2.6	2.11332	8.2400
2	.	4	4	0.74833	3.6	0.45164	16.3360
2	.	4	5	0.58310	3.2	0.46559	17.3080
2	.	4	6	0.96954	3.2	2.70460	10.6622
2	.	4	7	0.77460	2.0	3.41663	8.3360
2	.	4	8	0.66332	3.2	2.67556	10.5280
2	.	4	9	0.48990	2.2	0.47914	9.3480
2	.	4	10	0.63246	3.0	0.49105	14.2120
2	.	4	11	0.91652	2.8	3.11163	12.3260
2	.	5	1	0.73485	2.8	0.48176	13.1620
2	.	5	2	0.83666	3.0	2.48187	9.7360
2	.	5	3	0.63246	3.0	2.48023	9.7340
2	.	5	4	0.50990	3.4	0.48607	18.1020
2	.	5	5	1.39284	4.2	3.65941	14.5080
2	.	5	6	0.80000	2.2	3.58692	8.7220
2	.	5	7	1.06771	4.2	0.48862	19.0860
2	.	5	8	0.96954	2.8	2.58625	6.2440
2	.	5	9	0.80000	2.8	0.49974	14.2760
2	.	5	10	0.63246	3.0	2.47475	9.7060
2	.	5	11	0.89443	3.0	3.44674	13.6220

Table 4: Means breakdown for short rains of 2008 and long rain season of 2009 continues

-------------------------------- Effect=SEASON*FUNGI*FARMERS -----------------------------

Std. Error of | Mean of | Std. Error of | Mean of

Season	Fungi	farmers	Region	SEVERITY	SEVERITY	INCIDENCES	
1	1	1	.	0.30424	3.27273	0.93861	8.09091
1	1	2	.	0.25062	3.09091	0.57352	8.72727
1	1	3	.	0.19498	1.27273	0.55596	8.00000
1	1	4	.	0.20730	1.54545	0.56187	8.45455
1	1	5	.	0.15746	1.45455	0.61925	8.72727
1	2	1	.	0.25062	2.09091	1.11138	6.70909
1	2	2	.	0.22636	1.81818	0.65200	7.92727
1	2	3	.	0.19498	1.27273	1.10160	6.23364
1	2	4	.	0.96638	2.54545	1.17222	5.65909
1	2	5	.	0.15746	1.45455	1.10742	6.64000
1	3	1	.	0.23706	1.72727	0.90609	7.74818
1	3	2	.	0.20730	1.54545	0.59465	8.51455
1	3	3	.	0.31492	2.09091	1.06620	6.31636
1	3	4	.	0.24393	1.63636	1.34104	5.40273
1	3	5	.	0.28459	1.90909	1.17309	6.84182
1	4	1	.	0.14084	1.27273	1.49198	4.92400
1	4	2	.	0.20730	1.45455	0.86347	7.62709
1	4	3	.	0.24393	1.36364	0.76771	6.29000
1	4	4	.	0.35675	2.00000	0.89204	7.28000
1	4	5	.	0.30963	1.63636	1.31691	6.12264
1	5	1	.	0.12197	1.18182	1.08089	6.86291

-------------------------------- Effect=SEASON*FUNGI*FARMERS ----------------------------
(continued)

			Std. Error of	Mean of	Std. Error of	Mean of	
Season	Fungi	farmers	Region	SEVERITY	SEVERITY	INCIDENCES	
1	5	2	.	0.09091	1.09091	1.08333	6.8482
1	5	3	.	0.24730	1.54545	1.15402	5.6422
1	5	4	.	0.19498	1.27273	1.07859	6.2555
1	5	5	.	0.32525	1.81818	1.17859	5.6082
2	1	1	.	0.36590	4.45455	1.64844	13.9091
2	1	2	.	0.41060	3.63636	1.70754	14.4545
2	1	3	.	0.30963	4.36364	1.01314	13.9091
2	1	4	.	0.40041	3.81818	0.95606	14.3636
2	1	5	.	0.45455	3.54545	0.91814	16.4545
2	2	1	.	0.30424	3.72727	0.89863	13.5845
2	2	2	.	0.43408	3.45455	1.56760	12.5545
2	2	3	.	0.40452	3.00000	1.05418	12.2455
2	2	4	.	0.43598	2.09091	2.20631	8.7555
2	2	5	.	0.42640	2.00000	2.41919	9.8036
2	3	1	.	0.30424	2.72727	0.82882	13.4009
2	3	2	.	0.58493	3.81818	0.91491	14.1318
2	3	3	.	0.50452	3.00000	1.76655	10.6600

2	3	4	.	0.40041	2.81818		1.46359	11.5918
2	3	5	.	0.46887	2.72727		1.56579	12.7900
2	4	1	.	0.33278	2.27273		1.53270	11.9200
2	4	2	.	0.42834	2.27273	2.16757	10.3845	
2	4	3	.	0.46710	2.00000	1.99967	7.8609	
2	4	4	.	0.38996	2.45455	1.44792	10.8500	
2	4	5	.	0.81312	3.45455	2.16995	10.3036	
2	5	1	.	0.19498	1.27273	2.06786	6.7782	
2	5	2	.	0.42251	2.18182	2.27872	8.8991	
2	5	3	.	0.24730	1.45455	2.18097	7.3291	
2	5	4	.	0.52853	2.54545	1.66334	9.2283	
2	5	5	.	0.43598	3.90909	1.51790	12.8745	

---------------------------------- Effect=SEASON*FUNGI*REGION -------------------------------

Season	Fungi	farmers	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of SEVERITY	INCIDENCES
1	1	.	1	0.48990	2.2	0.37417	7.20
1	1	.	2	0.63246	2.0	0.50990	7.60
1	1	.	3	0.40000	1.6	0.58310	7.20
1	1	.	4	0.48990	2.2	0.50990	11.40
1	1	.	5	0.74833	2.4	0.44721	11.00
1	1	.	6	0.50990	2.4	0.58310	8.80
1	1	.	7	0.50990	2.4	1.04881	9.00
1	1	.	8	0.58310	1.8	1.51658	6.00
1	1	.	9	0.58310	2.2	0.74833	7.60
1	1	.	10	0.48990	1.8	0.37417	8.20
1	1	.	11	0.50990	2.4	0.50990	8.40
1	2	.	1	0.37417	1.8	1.57404	3.76
1	2	.	2	0.40000	1.6	1.39800	5.38

Table 4: Means breakdown for short rains of 2008 and long rain season of 2009 continues

---------------------------------- Effect=SEASON*FUNGI*REGION -------------------------------
(continued)

Season	Fungi	farmers	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of SEVERITY	INCIDENCES
1	2	.	3	2.15870	3.4	1.38290	5.1540
1	2	.	4	0.48990	1.8	0.31145	10.4500
1	2	.	5	0.31623	2.0	2.09724	8.2200
1	2	.	6	0.24495	1.6	0.68037	8.2300
1	2	.	7	0.31623	2.0	2.07332	7.1800
1	2	.	8	0.24495	1.4	0.39441	6.6100
1	2	.	9	0.40000	1.6	1.64701	5.9380
1	2	.	10	0.40000	1.6	1.58149	6.0900
1	2	.	11	0.24495	1.4	1.54162	5.9600

1	3	.	1	0.40000	1.6	1.42812	5.5860
1	3	.	2	0.24495	1.6	1.55075	5.8600
1	3	.	3	0.40000	1.6	1.48887	5.5220
1	3	.	4	0.40000	2.4	2.20062	8.6220
1	3	.	5	0.44721	2.0	2.18547	8.5920
1	3	.	6	0.40000	1.6	0.48869	8.8120
1	3	.	7	0.58310	2.2	2.06520	7.7200
1	3	.	8	0.37417	1.8	1.47636	5.7380
1	3	.	9	0.24495	1.6	0.69091	7.0720
1	3	.	10	0.40000	1.6	0.47302	8.2320
1	3	.	11	0.40000	1.6	2.05199	4.8560
1	4	.	1	0.40000	1.6	1.70120	4.1480
1	4	.	2	0.40000	1.4	1.50134	5.4956
1	4	.	3	0.20000	1.2	1.45901	5.4020
1	4	.	4	0.73485	2.2	2.25043	8.7664
1	4	.	5	0.24495	1.6	0.44422	10.1600
1	4	.	6	0.40000	1.4	1.78876	6.9174
1	4	.	7	0.63246	2.0	2.32473	5.3840
1	4	.	8	0.24495	1.4	0.30606	6.6280
1	4	.	9	0.20000	1.2	1.48455	5.3780
1	4	.	10	0.40000	1.6	1.85190	4.5140
1	4	.	11	0.24495	1.4	0.47791	8.1428
1	5	.	1	0.24495	1.4	1.76846	4.2304
1	5	.	2	0.00000	1.0	1.48394	5.7140
1	5	.	3	0.40000	1.4	1.79744	4.3780
1	5	.	4	0.40000	1.6	0.57196	9.8240
1	5	.	5	0.37417	2.2	0.42024	10.0120
1	5	.	6	0.20000	1.2	0.58893	7.8980
1	5	.	7	0.20000	1.2	2.21427	5.0000
1	5	.	8	0.00000	1.0	1.40881	5.4720
1	5	.	9	0.60000	1.6	1.69882	4.1260
1	5	.	10	0.40000	1.4	1.49645	5.7980
1	5	.	11	0.20000	1.2	1.59805	6.2248
2	1	.	1	0.63246	4.0	0.80000	12.2000
2	1	.	2	0.63246	4.0	1.16619	12.6000
2	1	.	3	0.40000	4.4	0.37417	13.2000
2	1	.	4	0.00000	5.0	0.40000	19.4000
2	1	.	5	0.00000	5.0	0.67823	19.6000
2	1	.	6	0.70711	3.0	3.05614	12.2000
2	1	.	7	0.50990	3.6	1.37840	17.0000
2	1	.	8	0.54772	4.0	0.73485	13.2000

Table 4: Means breakdown for short rains of 2008 and long rain season of 2009 continues

---------------------------------- Effect=SEASON*FUNGI*REGION --------------------------------

(continued)

Season	Fungi	farmers	Region	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of SEVERITY INCIDENCES
2	1	.	9	0.87178	3.6	1.28841	12.6000
2	1	.	10	0.37417	3.8	0.80000	15.2000
2	1	.	11	0.80000	3.2	3.50143	13.6000
2	2	.	1	0.50990	2.4	2.29708	8.9380
2	2	.	2	0.44721	2.0	2.46670	9.0020
2	2	.	3	0.58310	2.2	2.20521	8.7920
2	2	.	4	0.24495	3.4	0.38827	17.5920
2	2	.	5	0.70711	3.0	3.68180	14.4220
2	2	.	6	0.81240	2.6	2.74948	10.9720
2	2	.	7	0.70711	3.0	3.25861	12.3060

2	2	.	8	0.80000	2.2		2.74755	6.6080
2	2	.	9	0.58310	2.2		1.37350	10.9180
2	2	.	10	0.74833	3.6		2.87312	11.1500
2	2	.	11	0.20000	4.8		1.05914	14.5760
2	3	.	1	0.24495	2.4		2.00746	8.5920
2	3	.	2	0.50990	2.4		2.49975	9.2100
2	3	.	3	0.73485	2.2	2.32901	9.2980	
2	3	.	4	0.50990	3.6	0.33415	17.5280	
2	3	.	5	1.01980	3.8	0.71075	17.6600	
2	3	.	6	0.83666	3.0	2.67260	10.6900	
2	3	.	7	1.01980	3.8	1.27492	15.1900	
2	3	.	8	0.50990	2.4	0.68140	11.0460	
2	3	.	9	0.60000	2.6	1.19033	10.9040	
2	3	.	10	0.40000	3.6	0.83849	13.2900	
2	3	.	11	0.81240	3.4	0.79254	14.2560	
2	4	.	1	0.40000	1.6	0.84456	9.9340	
2	4	.	2	0.77460	2.0	2.27705	8.1000	
2	4	.	3	0.74833	2.4	0.39505	10.8340	
2	4	.	4	0.66332	3.2	0.66675	17.4320	
2	4	.	5	1.24097	3.2	3.55269	13.9860	
2	4	.	6	0.50990	2.6	2.52653	10.1060	
2	4	.	7	1.28841	3.4	4.13875	10.0580	
2	4	.	8	0.92736	2.6	2.81868	6.8000	
2	4	.	9	0.37417	1.8	3.08044	7.2100	
2	4	.	10	0.37417	2.2	2.71211	10.1960	
2	4	.	11	0.87178	2.4	3.41860	8.2460	
2	5	.	1	0.58310	1.8	2.06569	7.5980	
2	5	.	2	0.80000	2.8	2.76271	6.3240	
2	5	.	3	0.63246	2.0	2.13710	8.4180	
2	5	.	4	0.60000	2.4	0.36308	16.7100	
2	5	.	5	0.86023	3.2	3.46719	13.6180	
2	5	.	6	0.92736	2.6	2.51652	10.0362	
2	5	.	7	0.40000	2.4	3.22257	11.8240	
2	5	.	8	0.80000	2.2	2.84676	6.9580	
2	5	.	9	0.77460	2.0	2.74595	4.2880	
2	5	.	10	0.80000	1.8	2.65988	10.2160	
2	5	.	11	0.80000	1.8	3.25000	3.2500	

Appendix 3: Disease severity and incidences of maize ear rot causing pathogens in Nyanza regions during short rains of 2008

Table 5: Anova for severity and incidences of maize ear rot causing pathogens in Nyanza regions during short rains of 2008

Dependent Variable: severity

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	114	157.1709091	1.3786922	1.26	0.0856
Error	160	174.4509091	1.0903182		
Corrected Total	274	331.6218182			

R-Square	Coeff Var	Root MSE	severity Mean
0.473946	60.19923	1.044183	1.734545

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Fungi	4	17.98545455	4.49636364	4.12	0.0033
Region	10	10.34181818	1.03418182	0.95	0.4907
farmers	4	5.29454545	1.32363636	1.21	0.3070
Fungi*Region	40	24.09454545	0.60236364	0.55	0.9852
Fungi*farmers	16	57.06909091	3.56681818	3.27	<.0001
farmers*Region	40	42.38545455	1.05963636	0.97	0.5253

Dependent Variable: incidences

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	114	1682.578135	14.759457	1.63	0.0023
Error	160	1451.548991	9.072181		
Corrected Total	274	3134.127126			

R-Square	Coeff Var	Root MSE	incidences Mean
0.536857	43.41233	3.012006	6.938135

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Fungi	4	162.3902095	40.5975524	4.47	0.0019
Region	10	629.0516200	62.9051620	6.93	<.0001
farmers	4	72.1433117	18.0358279	1.99	0.0988
Fungi*Region	40	178.7158441	4.4678961	0.49	0.9950
Fungi*farmers	16	95.0929855	5.9433116	0.66	0.8340
farmers*Region	40	545.1841639	13.6296041	1.50	0.0411

Table 6: LSD tests for severity and incidences of maize ear rot causing pathogens in Nyanza during short rains of 2008

NOTE: 1. This test controls the Type I comparison wise error rate, not the experiment wise error rate.
2. Fungi 1, 2, 3, 4, 5 are Diplodia (*Stenocarpella spp*), Giberella, Nigrospora, Fusarium, and other fungi respectively; Regions 1, 2, 3, 4, 5, 6, 7, 8, 9, are Kombewa, Kasipul, Kabondo, Sakwa, Imbo , Rangwe, Asego, Awendo, Rongo, Madiany, and Asembo, and Madiany respectively.

LSD tests for Severity in Fungi, Regions, and farmers

Alpha	0.05
Error Degrees of Freedom	160
Error Mean Square	1.090318
Critical Value of t	1.97490
Least Significant Difference	0.3932

Means with the same letter are not significantly different.

t Grouping		Mean	N	Fungi
	A	2.1273	55	1
	A			
B	A	1.8364	55	2
B	A			
B	A	1.7818	55	3
B				
B	C	1.5455	55	4
	C			
	C	1.3818	55	5

Alpha	0.05
Error Degrees of Freedom	160
Error Mean Square	1.090318
Critical Value of t	1.97490
Least Significant Difference	0.5833

Means with the same letter are not significantly different.

t Grouping	Mean	N	Region
A	2.0400	25	5
A			
A	2.0400	25	4
A			
A	1.9600	25	7
A			
A	1.8400	25	3
A			
A	1.7200	25	1
A			
A	1.6400	25	6
A			
A	1.6400	25	9
A			
A	1.6000	25	10
A			
A	1.6000	25	11
A			
A	1.5200	25	2
A			
A	1.4800	25	8

Table 6: LSD tests for incidences of maize ear rot causing pathogens in Nyanza during short rains of 2008 continues

Alpha	0.05
Error Degrees of Freedom	160
Error Mean Square	1.090318
Critical Value of t	1.97490
Least Significant Difference	0.3932

Means with the same letter are not significantly different.

t Grouping		Mean	N	farmers
	A	1.9091	55	1
	A			
B	A	1.8000	55	2
B	A			
B	A	1.8000	55	4
B	A			
B	A	1.6545	55	5
B				
B		1.5091	55	3

LSD tests for incidences in Fungi, Regions, and farmers

Alpha	0.05
Error Degrees of Freedom	160
Error Mean Square	9.072181
Critical Value of t	1.97490
Least Significant Difference	1.1343

Means with the same letter are not significantly different.

t Grouping	Mean	N	Fungi
A	8.4000	55	1
B	6.9647	55	3
B			
B	6.6338	55	2
B			
B	6.4487	55	4
B			
B	6.2434	55	5

Alpha	0.05
Error Degrees of Freedom	160
Error Mean Square	9.072181
Critical Value of t	1.97490
Least Significant Difference	1.6825

Means with the same letter are not significantly different.

t Grouping		Mean	N	Region
	A	9.8125	25	4
	A			
	A	9.5968	25	5
	A			
B	A	8.1315	25	6
B				
B	C	6.8568	25	7
B	C			
B	C	6.7167	25	11

t Grouping			Mean	N	farmers
B	C				
B	C	D	6.5668	25	10
	C	D			
	C	D	6.0896	25	8
	C	D			
	C	D	6.0228	25	9
	C	D			
	C	D	6.0099	25	2
	C	D			
	C	D	5.5312	25	3
		D			
		D	4.9849	25	1

Table 6: LSD tests for incidences of maize ear rot causing pathogens in Nyanza during short rains of 2008 continues

Alpha	0.05
Error Degrees of Freedom	160
Error Mean Square	9.072181
Critical Value of t	1.97490
Least Significant Difference	1.1343

Means with the same letter are not significantly different.

t Grouping		Mean	N	farmers
	A	7.9289	55	2
	A			
B	A	6.8670	55	1
B				
B		6.7880	55	5
B				
B		6.6104	55	4
B				
B		6.4964	55	3

Table 7: Correlation analysis of short rains season of 2008

5 Variables: Fungi farmers Region severity incidences

Simple Statistics

Variable	N	Mean	Std Dev	Sum	Minimum	Maximum	Label
Fungi	275	3.00000	1.41679	825.00000	1.00000	5.00000	Fungi
farmers	275	3.00000	1.41679	825.00000	1.00000	5.00000	farmers
Region	275	6.00000	3.16804	1650	1.00000	11.00000	Region
severity	275	1.73455	1.10014	477.00000	1.00000	12.00000	severity
incidences	275	6.93813	3.38207	1908	0	13.00000	incidences

Pearson Correlation Coefficients, N = 275
Prob > |r| under H0: Rho=0

	Fungi	farmers	Region	severity	incidences
Fungi	1.00000	0.00000	0.00000	-0.22947	-0.18844
Fungi		1.0000	1.0000	0.0001	0.0017
farmers	0.00000	1.00000	0.00000	-0.06556	-0.06186
farmers	1.0000		1.0000	0.2786	0.3067

Region	0.00000	0.00000	1.00000	-0.05445	0.01853
Region	1.0000	1.0000		0.3684	0.7597
severity	-0.22947	-0.06556	-0.05445	1.00000	0.35649
severity	0.0001	0.2786	0.3684		<.0001
incidences	-0.18844	-0.06186	0.01853	0.35649	1.00000
incidences	0.0017	0.3067	0.7597	<.0001	

Table 8: Means breakdown for short rains season of 2008

-- Effect=FARMERS --

Season	Fungi	farmers	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of INCIDENCES	INCIDENCES
.	.	1	.	0.14040	1.90909	0.50695	6.86702
.	.	2	.	0.12818	1.80000	0.34699	7.92887
.	.	3	.	0.11273	1.50909	0.42574	6.49644
.	.	4	.	0.21927	1.80000	0.47458	6.61036
.	.	5	.	0.11376	1.65455	0.49708	6.78798

-- Effect=FUNGI --

Season	Fungi	farmers	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of INCIDENCES	INCIDENCES
.	1	.	.	0.15364	2.12727	0.28966	8.40000
.	2	.	.	0.21203	1.83636	0.46161	6.63382
.	3	.	.	0.11515	1.78182	0.47434	6.96473
.	4	.	.	0.11840	1.54545	0.49233	6.44875
.	5	.	.	0.09878	1.38182	0.48601	6.24338

Table 8: Means breakdown for short rains season of 2008 continues

-- Effect=Overall --

Season	Fungi	farmers	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of INCIDENCES	INCIDENCES
.	.	.	.	0.066341	1.73455	0.20395	6.93813

-- Effect=REGION --

Season	Fungi	farmers	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of INCIDENCES	INCIDENCES
.	.	.	1	0.16852	1.72	0.65034	4.98488
.	.	.	2	0.17436	1.52	0.57446	6.00992
.	.	.	3	0.44602	1.84	0.60269	5.53120
.	.	.	4	0.21970	2.04	0.63116	9.81248
.	.	.	5	0.19562	2.04	0.60799	9.59680
.	.	.	6	0.17205	1.64	0.41634	8.13148
.	.	.	7	0.21197	1.96	0.87056	6.85680
.	.	.	8	0.15406	1.48	0.48243	6.08960
.	.	.	9	0.19044	1.64	0.59839	6.02280
.	.	.	10	0.17321	1.60	0.60970	6.56680
.	.	.	11	0.16330	1.60	0.63022	6.71672

-- Effect=SEASON --

Season	Fungi	farmers	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of INCIDENCES	INCIDENCES
1	.	.	.	0.066341	1.73455	0.20395	6.93813

------------------------------------ Effect=FARMERS*REGION ------------------------------------

Season	Fungi	farmers	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of INCIDENCES	INCIDENCES
.	.	1	1	0.40000	1.6	1.50421	5.9244
.	.	1	2	0.63246	2.0	1.88680	4.6000
.	.	1	3	0.40000	1.6	1.38550	5.5400
.	.	1	4	0.40000	2.4	0.52370	10.0764
.	.	1	5	0.73485	2.2	0.19965	10.4900
.	.	1	6	0.40000	1.6	0.17958	9.6154
.	.	1	7	0.58310	2.2	1.98303	7.9300
.	.	1	8	0.24495	1.6	1.41051	3.4500
.	.	1	9	0.40000	1.6	1.36534	5.4160
.	.	1	10	0.44721	2.0	1.94062	4.7500
.	.	1	11	0.58310	2.2	1.94688	7.7450
.	.	2	1	0.40000	1.6	1.39815	3.3960
.	.	2	2	0.37417	1.8	0.22472	8.4896
.	.	2	3	0.20000	1.2	0.30060	5.9600
.	.	2	4	0.44721	2.0	0.19265	9.5520
.	.	2	5	0.24495	2.4	0.28856	11.3420
.	.	2	6	0.58310	1.8	0.36371	8.2740
.	.	2	7	0.37417	2.2	0.19314	10.5380
.	.	2	8	0.60000	1.6	0.18718	7.5940
.	.	2	9	0.63246	2.0	1.67528	6.5660
.	.	2	10	0.37417	1.8	0.47119	8.5460
.	.	2	11	0.40000	1.4	0.34729	6.9600
.	.	3	1	0.44721	2.0	1.46732	5.8180
.	.	3	2	0.20000	1.2	0.23066	6.3620
.	.	3	3	0.00000	1.0	1.15745	4.6000
.	.	3	4	0.40000	1.6	2.09405	8.3380
.	.	3	5	0.48990	1.8	0.24981	9.5020
.	.	3	6	0.44721	2.0	0.19304	9.5420
.	.	3	7	0.60000	1.6	1.64499	4.0160
.	.	3	8	0.24495	1.4	1.28831	5.1100
.	.	3	9	0.00000	1.0	0.94304	3.7540
.	.	3	10	0.48990	1.8	1.69967	6.7700
.	.	3	11	0.20000	1.2	0.22129	7.6488
.	.	4	1	0.24495	1.6	1.31460	5.2060
.	.	4	2	0.40000	1.6	1.52394	6.0380
.	.	4	3	2.11187	3.6	1.91445	4.6820
.	.	4	4	0.74833	2.6	2.28661	9.1180
.	.	4	5	0.37417	2.2	2.29056	9.1360
.	.	4	6	0.24495	1.4	0.44673	7.8440
.	.	4	7	0.24495	1.4	1.33327	3.2400
.	.	4	8	0.40000	1.4	0.13841	7.6660
.	.	4	9	0.24495	1.4	0.15088	7.6960

Table 8: Means breakdown for short rains season of 2008 continues

------------------------------------ Effect=FARMERS*REGION ------------------------------------
(continued)

Std. Error Std. Error

			of	Mean of	of	Mean of	
Season	Fungi	farmers	Region	SEVERITY	SEVERITY	INCIDENCES	INCIDENCES
.	.	4	10	0.00000	1.0	0.17148	7.5420
.	.	4	11	0.24495	1.6	1.86000	4.5460
.	.	5	1	0.48990	1.8	1.87376	4.5800
.	.	5	2	0.00000	1.0	1.15032	4.5600
.	.	5	3	0.48990	1.8	1.72872	6.8740
.	.	5	4	0.40000	1.6	0.39377	11.9780
.	.	5	5	0.24495	1.6	1.88590	7.5140
.	.	5	6	0.24495	1.4	1.35475	5.3820
.	.	5	7	0.50990	2.4	2.14334	8.5600
.	.	5	8	0.24495	1.4	0.19304	6.6280
.	.	5	9	0.48990	2.2	1.70239	6.6820
.	.	5	10	0.40000	1.4	1.32045	5.2260
.	.	5	11	0.24495	1.6	1.67967	6.6838

------------------------------------ Effect=FUNGI*FARMERS ------------------------------------

			Std. Error of	Mean of	Std. Error of	Mean of	
Season	Fungi	farmers	Region	SEVERITY	SEVERITY	INCIDENCES	INCIDENCES
.	1	1	.	0.30424	3.27273	0.93861	8.09091
.	1	2	.	0.25062	3.09091	0.57352	8.72727
.	1	3	.	0.19498	1.27273	0.55596	8.00000
.	1	4	.	0.20730	1.54545	0.56187	8.45455
.	1	5	.	0.15746	1.45455	0.61925	8.72727
.	2	1	.	0.25062	2.09091	1.11138	6.70909
.	2	2	.	0.22636	1.81818	0.65200	7.92727
.	2	3	.	0.19498	1.27273	1.10160	6.23364
.	2	4	.	0.96638	2.54545	1.17222	5.65909
.	2	5	.	0.15746	1.45455	1.10742	6.64000
.	3	1	.	0.23706	1.72727	0.90609	7.74818
.	3	2	.	0.20730	1.54545	0.59465	8.51455
.	3	3	.	0.31492	2.09091	1.06620	6.31636
.	3	4	.	0.24393	1.63636	1.34104	5.40273
.	3	5	.	0.28459	1.90909	1.17309	6.84182
.	4	1	.	0.14084	1.27273	1.49198	4.92400
.	4	2	.	0.20730	1.45455	0.86347	7.62709
.	4	3	.	0.24393	1.36364	0.76771	6.29000
.	4	4	.	0.35675	2.00000	0.89204	7.28000
.	4	5	.	0.30963	1.63636	1.31691	6.12264
.	5	1	.	0.12197	1.18182	1.08089	6.86291
.	5	2	.	0.09091	1.09091	1.08333	6.84818
.	5	3	.	0.24730	1.54545	1.15402	5.64218
.	5	4	.	0.19498	1.27273	1.07859	6.25545
.	5	5	.	0.32525	1.81818	1.17859	5.60818

Table 8: Means breakdown for short rains season of 2008 continues

------------------------------------ Effect=FUNGI*REGION -------------------------------------

			Std. Error of	Mean of	Std. Error of	Mean of	
Season	Fungi	farmers	Region	SEVERITY	SEVERITY	INCIDENCES	INCIDENCES
.	1	.	1	0.48990	2.2	0.37417	7.2000
.	1	.	2	0.63246	2.0	0.50990	7.6000
.	1	.	3	0.40000	1.6	0.58310	7.2000
.	1	.	4	0.48990	2.2	0.50990	11.4000
.	1	.	5	0.74833	2.4	0.44721	11.0000
.	1	.	6	0.50990	2.4	0.58310	8.8000

.	1	.	7	0.50990	2.4	1.04881	9.0000
.	1	.	8	0.58310	1.8	1.51658	6.0000
.	1	.	9	0.58310	2.2	0.74833	7.6000
.	1	.	10	0.48990	1.8	0.37417	8.2000
.	1	.	11	0.50990	2.4	0.50990	8.4000
.	2	.	1	0.37417	1.8	1.57404	3.7600
.	2	.	2	0.40000	1.6	1.39800	5.3800
.	2	.	3	2.15870	3.4	1.38290	5.1540
.	2	.	4	0.48990	1.8	0.31145	10.4500
.	2	.	5	0.31623	2.0	2.09724	8.2200
.	2	.	6	0.24495	1.6	0.68037	8.2300
.	2	.	7	0.31623	2.0	2.07332	7.1800
.	2	.	8	0.24495	1.4	0.39441	6.6100
.	2	.	9	0.40000	1.6	1.64701	5.9380
.	2	.	10	0.40000	1.6	1.58149	6.0900
.	2	.	11	0.24495	1.4	1.54162	5.9600
.	3	.	1	0.40000	1.6	1.42812	5.5860
.	3	.	2	0.24495	1.6	1.55075	5.8600
.	3	.	3	0.40000	1.6	1.48887	5.5220
.	3	.	4	0.40000	2.4	2.20062	8.6220
.	3	.	5	0.44721	2.0	2.18547	8.5920
.	3	.	6	0.40000	1.6	0.48869	8.8120
.	3	.	7	0.58310	2.2	2.06520	7.7200
.	3	.	8	0.37417	1.8	1.47636	5.7380
.	3	.	9	0.24495	1.6	0.69091	7.0720
.	3	.	10	0.40000	1.6	0.47302	8.2320
.	3	.	11	0.40000	1.6	2.05199	4.8560
.	4	.	1	0.40000	1.6	1.70120	4.1480
.	4	.	2	0.40000	1.4	1.50134	5.4956
.	4	.	3	0.20000	1.2	1.45901	5.4020
.	4	.	4	0.73485	2.2	2.25043	8.7664
.	4	.	5	0.24495	1.6	0.44422	10.1600
.	4	.	6	0.40000	1.4	1.78876	6.9174
.	4	.	7	0.63246	2.0	2.32473	5.3840
.	4	.	8	0.24495	1.4	0.30606	6.6280
.	4	.	9	0.20000	1.2	1.48455	5.3780
.	4	.	10	0.40000	1.6	1.85190	4.5140
.	4	.	11	0.24495	1.4	0.47791	8.1428
.	5	.	1	0.24495	1.4	1.76846	4.2304
.	5	.	2	0.00000	1.0	1.48394	5.7140
.	5	.	3	0.40000	1.4	1.79744	4.3780
.	5	.	4	0.40000	1.6	0.57196	9.8240
.	5	.	5	0.37417	2.2	0.42024	10.0120
.	5	.	6	0.20000	1.2	0.58893	7.8980
.	5	.	7	0.20000	1.2	2.21427	5.0000

------------------------------------- Effect=FUNGI*REGION --------------------------------------

(continued)

Season	Fungi	farmers	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of INCIDENCES	INCIDENCES
.	5	.	8	0.0	1.0	1.40881	5.4720
.	5	.	9	0.6	1.6	1.69882	4.1260
.	5	.	10	0.4	1.4	1.49645	5.7980
.	5	.	11	0.2	1.2	1.59805	6.2248

------------------------------------ Effect=SEASON*FARMERS -------------------------------------

Season	Fungi	farmers	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of INCIDENCES	INCIDENCES

1	.	1	.	0.14040	1.90909	0.50695	6.86702
1	.	2	.	0.12818	1.80000	0.34699	7.92887
1	.	3	.	0.11273	1.50909	0.42574	6.49644
1	.	4	.	0.21927	1.80000	0.47458	6.61036
1	.	5	.	0.11376	1.65455	0.49708	6.78798

------------------------------------ Effect=SEASON*FUNGI ------------------------------------

Season	Fungi	farmers	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of INCIDENCES	INCIDENCES
1	1	.	.	0.15364	2.12727	0.28966	8.40000
1	2	.	.	0.21203	1.83636	0.46161	6.63382
1	3	.	.	0.11515	1.78182	0.47434	6.96473
1	4	.	.	0.11840	1.54545	0.49233	6.44875
1	5	.	.	0.09878	1.38182	0.48601	6.24338

Table 8: Means breakdown for short rains season of 2008 continues

------------------------------------ Effect=SEASON*REGION ------------------------------------

Season	Fungi	farmers	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of INCIDENCES	INCIDENCES
1	.	.	1	0.16852	1.72	0.65034	4.98488
1	.	.	2	0.17436	1.52	0.57446	6.00992
1	.	.	3	0.44602	1.84	0.60269	5.53120
1	.	.	4	0.21970	2.04	0.63116	9.81248
1	.	.	5	0.19562	2.04	0.60799	9.59680
1	.	.	6	0.17205	1.64	0.41634	8.13148
1	.	.	7	0.21197	1.96	0.87056	6.85680
1	.	.	8	0.15406	1.48	0.48243	6.08960
1	.	.	9	0.19044	1.64	0.59839	6.02280
1	.	.	10	0.17321	1.60	0.60970	6.56680
1	.	.	11	0.16330	1.60	0.63022	6.71672

-------------------------------- Effect=SEASON*FARMERS*REGION --------------------------

Season	Fungi	farmers	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of INCIDENCES	INCIDENCES
1	.	1	1	0.40000	1.6	1.50421	5.9244
1	.	1	2	0.63246	2.0	1.88680	4.6000
1	.	1	3	0.40000	1.6	1.38550	5.5400
1	.	1	4	0.40000	2.4	0.52370	10.0764
1	.	1	5	0.73485	2.2	0.19965	10.4900
1	.	1	6	0.40000	1.6	0.17958	9.6154
1	.	1	7	0.58310	2.2	1.98303	7.9300
1	.	1	8	0.24495	1.6	1.41051	3.4500
1	.	1	9	0.40000	1.6	1.36534	5.4160
1	.	1	10	0.44721	2.0	1.94062	4.7500
1	.	1	11	0.58310	2.2	1.94688	7.7450
1	.	2	1	0.40000	1.6	1.39815	3.3960
1	.	2	2	0.37417	1.8	0.22472	8.4896
1	.	2	3	0.20000	1.2	0.30060	5.9600
1	.	2	4	0.44721	2.0	0.19265	9.5520
1	.	2	5	0.24495	2.4	0.28856	11.3420
1	.	2	6	0.58310	1.8	0.36371	8.2740
1	.	2	7	0.37417	2.2	0.19314	10.5380

-------------------------------- Effect=SEASON*FARMERS*REGION --------------------------
(continued)

Std. Error   Std. Error
of   Mean of   of   Mean of

Season	Fungi	farmers	Region	SEVERITY	SEVERITY	INCIDENCES	INCIDENCES
1	.	2	8	0.60000	1.6	0.18718	7.5940
1	.	2	9	0.63246	2.0	1.67528	6.5660
1	.	2	10	0.37417	1.8	0.47119	8.5460
1	.	2	11	0.40000	1.4	0.34729	6.9600
1	.	3	1	0.44721	2.0	1.46732	5.8180
1	.	3	2	0.20000	1.2	0.23066	6.3620
1	.	3	3	0.00000	1.0	1.15745	4.6000
1	.	3	4	0.40000	1.6	2.09405	8.3380
1	.	3	5	0.48990	1.8	0.24981	9.5020
1	.	3	6	0.44721	2.0	0.19304	9.5420
1	.	3	7	0.60000	1.6	1.64499	4.0160
1	.	3	8	0.24495	1.4	1.28831	5.1100
1	.	3	9	0.00000	1.0	0.94304	3.7540
1	.	3	10	0.48990	1.8	1.69967	6.7700
1	.	3	11	0.20000	1.2	0.22129	7.6488
1	.	4	1	0.24495	1.6	1.31460	5.2060
1	.	4	2	0.40000	1.6	1.52394	6.0380
1	.	4	3	2.11187	3.6	1.91445	4.6820
1	.	4	4	0.74833	2.6	2.28661	9.1180
1	.	4	5	0.37417	2.2	2.29056	9.1360
1	.	4	6	0.24495	1.4	0.44673	7.8440
1	.	4	7	0.24495	1.4	1.33327	3.2400
1	.	4	8	0.40000	1.4	0.13841	7.6660
1	.	4	9	0.24495	1.4	0.15088	7.6960
1	.	4	10	0.00000	1.0	0.17148	7.5420
1	.	4	11	0.24495	1.6	1.86000	4.5460
1	.	5	1	0.48990	1.8	1.87376	4.5800
1	.	5	2	0.00000	1.0	1.15032	4.5600
1	.	5	3	0.48990	1.8	1.72872	6.8740
1	.	5	4	0.40000	1.6	0.39377	11.9780
1	.	5	5	0.24495	1.6	1.88590	7.5140
1	.	5	6	0.24495	1.4	1.35475	5.3820
1	.	5	7	0.50990	2.4	2.14334	8.5600
1	.	5	8	0.24495	1.4	0.19304	6.6280
1	.	5	9	0.48990	2.2	1.70239	6.6820
1	.	5	10	0.40000	1.4	1.32045	5.2260
1	.	5	11	0.24495	1.6	1.67967	6.6838

Table 8: Means breakdown for short rains season of 2008 continues

--------------------------------- Effect=SEASON*FUNGI*FARMERS ------------------------------

Season	Fungi	farmers	Region	Std. Error of SEVERITY	Mean of SEVERITY	Std. Error of INCIDENCES	Mean of INCIDENCES
1	1	1	.	0.30424	3.27273	0.93861	8.09091
1	1	2	.	0.25062	3.09091	0.57352	8.72727
1	1	3	.	0.19498	1.27273	0.55596	8.00000
1	1	4	.	0.20730	1.54545	0.56187	8.45455
1	1	5	.	0.15746	1.45455	0.61925	8.72727

--------------------------------- Effect=SEASON*FUNGI*FARMERS ------------------------------
(continued)

Season	Fungi	farmers	Region	Std. Error of SEVERITY	Mean of SEVERITY	Std. Error of INCIDENCES	Mean of INCIDENCES
1	2	1	.	0.25062	2.09091	1.11138	6.70909
1	2	2	.	0.22636	1.81818	0.65200	7.92727
1	2	3	.	0.19498	1.27273	1.10160	6.23364

1	2	4	.	0.96638	2.54545	1.17222	5.65909
1	2	5	.	0.15746	1.45455	1.10742	6.64000
1	3	1	.	0.23706	1.72727	0.90609	7.74818
1	3	2	.	0.20730	1.54545	0.59465	8.51455
1	3	3	.	0.31492	2.09091	1.06620	6.31636
1	3	4	.	0.24393	1.63636	1.34104	5.40273
1	3	5	.	0.28459	1.90909	1.17309	6.84182
1	4	1	.	0.14084	1.27273	1.49198	4.92400
1	4	2	.	0.20730	1.45455	0.86347	7.62709
1	4	3	.	0.24393	1.36364	0.76771	6.29000
1	4	4	.	0.35675	2.00000	0.89204	7.28000
1	4	5	.	0.30963	1.63636	1.31691	6.12264
1	5	1	.	0.12197	1.18182	1.08089	6.86291
1	5	2	.	0.09091	1.09091	1.08333	6.84818
1	5	3	.	0.24730	1.54545	1.15402	5.64218
1	5	4	.	0.19498	1.27273	1.07859	6.25545
1	5	5	.	0.32525	1.81818	1.17859	5.60818

---------------------------------- Effect=SEASON*FUNGI*REGION --------------------------------

Season	Fungi		farmers	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of INCIDENCES / INCIDENCES
1	1	.	1	0.48990	2.2	0.37417	7.200
1	1	.	2	0.63246	2.0	0.50990	7.600
1	1	.	3	0.40000	1.6	0.58310	7.200
1	1	.	4	0.48990	2.2	0.50990	11.400
1	1	.	5	0.74833	2.4	0.44721	11.000
1	1	.	6	0.50990	2.4	0.58310	8.800
1	1	.	7	0.50990	2.4	1.04881	9.000
1	1	.	8	0.58310	1.8	1.51658	6.000
1	1	.	9	0.58310	2.2	0.74833	7.600
1	1	.	10	0.48990	1.8	0.37417	8.200
1	1	.	11	0.50990	2.4	0.50990	8.400
1	2	.	1	0.37417	1.8	1.57404	3.760
1	2	.	2	0.40000	1.6	1.39800	5.380
1	2	.	3	2.15870	3.4	1.38290	5.154
1	2	.	4	0.48990	1.8	0.31145	10.450
1	2	.	5	0.31623	2.0	2.09724	8.220
1	2	.	6	0.24495	1.6	0.68037	8.230
1	2	.	7	0.31623	2.0	2.07332	7.180
1	2	.	8	0.24495	1.4	0.39441	6.610
1	2	.	9	0.40000	1.6	1.64701	5.938
1	2	.	10	0.40000	1.6	1.58149	6.090
1	2	.	11	0.24495	1.4	1.54162	5.960

Table 8: Means breakdown for short rains season of 2008 continues

---------------------------------- Effect=SEASON*FUNGI*REGION --------------------------------
(continued)

Season	Fungi		farmers	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of INCIDENCES / INCIDENCES
1	3	.	1	0.40000	1.6	1.42812	5.5860
1	3	.	2	0.24495	1.6	1.55075	5.8600
1	3	.	3	0.40000	1.6	1.48887	5.5220
1	3	.	4	0.40000	2.4	2.20062	8.6220
1	3	.	5	0.44721	2.0	2.18547	8.5920
1	3	.	6	0.40000	1.6	0.48869	8.8120

1	3	.	7	0.58310	2.2	2.06520	7.7200
1	3	.	8	0.37417	1.8	1.47636	5.7380
1	3	.	9	0.24495	1.6	0.69091	7.0720
1	3	.	10	0.40000	1.6	0.47302	8.2320
1	3	.	11	0.40000	1.6	2.05199	4.8560
1	4	.	1	0.40000	1.6	1.70120	4.1480
1	4	.	2	0.40000	1.4	1.50134	5.4956
1	4	.	3	0.20000	1.2	1.45901	5.4020
1	4	.	4	0.73485	2.2	2.25043	8.7664
1	4	.	5	0.24495	1.6	0.44422	10.1600
1	4	.	6	0.40000	1.4	1.78876	6.9174
1	4	.	7	0.63246	2.0	2.32473	5.3840
1	4	.	8	0.24495	1.4	0.30606	6.6280
1	4	.	9	0.20000	1.2	1.48455	5.3780
1	4	.	10	0.40000	1.6	1.85190	4.5140
1	4	.	11	0.24495	1.4	0.47791	8.1428
1	5	.	1	0.24495	1.4	1.76846	4.2304
1	5	.	2	0.00000	1.0	1.48394	5.7140
1	5	.	3	0.40000	1.4	1.79744	4.3780
1	5	.	4	0.40000	1.6	0.57196	9.8240
1	5	.	5	0.37417	2.2	0.42024	10.0120
1	5	.	6	0.20000	1.2	0.58893	7.8980
1	5	.	7	0.20000	1.2	2.21427	5.0000
1	5	.	8	0.00000	1.0	1.40881	5.4720
1	5	.	9	0.60000	1.6	1.69882	4.1260
1	5	.	10	0.40000	1.4	1.49645	5.7980
1	5	.	11	0.20000	1.2	1.59805	6.2248

Appendix 4: Disease severity and incidences of maize ear rot causing pathogens in Nyanza regions during long rains of 2009

Table 9: Anova for severity and incidences of maize ear rot causing pathogens in Nyanza during long rains season of 2009

Dependent Variable: severity

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	114	342.5309091	3.0046571	1.27	0.0798
Error	160	377.7090909	2.3606818		
Corrected Total	274	720.2400000			

R-Square	Coeff Var	Root MSE	severity Mean
0.475579	52.61819	1.536451	2.920000

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Fungi	4	93.8400000	23.4600000	9.94	<.0001
Region	10	43.2000000	4.3200000	1.83	0.0593
farmers	4	6.7127273	1.6781818	0.71	0.5856
Fungi*Region	40	60.4000000	1.5100000	0.64	0.9507
Fungi*farmers	16	100.0509091	6.2531818	2.65	0.0010
farmers*Region	40	38.3272727	0.9581818	0.41	0.9994

Dependent Variable: incidences

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	114	6327.307752	55.502700	2.92	<.0001
Error	160	3037.474374	18.984215		
Corrected Total	274	9364.782127			

R-Square	Coeff Var	Root MSE	incidences Mean
0.675649	37.68620	4.357088	11.56149

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Fungi	4	1012.880689	253.220172	13.34	<.0001
Region	10	2158.804543	215.880454	11.37	<.0001
farmers	4	159.163060	39.790765	2.10	0.0838
Fungi*Region	40	552.089365	13.802234	0.73	0.8811
Fungi*farmers	16	503.870128	31.491883	1.66	0.0598
farmers*Region	40	1940.499967	48.512499	2.56	<.0001

Table 10: LSD tests for severity and incidences of maize ear rot causing pathogens in Nyanza during long rains season of 2009

NOTE: 1. This test controls the Type I comparison wise error rate, not the experiment wise error rate.
2. Fungi 1, 2, 3, 4, 5 are Diplodia (*Stenocarpella spp*), Giberella, Nigrospora, Fusarium, and other fungi respectively; Regions 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 are Kombewa, Kasipul, Kabondo, Sakwa, Imbo, Rangwe, Asego, Awendo, Rongo, Madiany, and Asembo, and Madiany respectively

LSD tests for severity in Fungi, Regions, and farmers

Alpha	0.05
Error Degrees of Freedom	160
Error Mean Square	2.360682
Critical Value of t	1.97490
Least Significant Difference	0.5786

Means with the same letter are not significantly different

t Grouping	Mean	N	Fungi
A	3.9636	55	1
B	3.0182	55	3
B			
B	2.8545	55	2
B			
C B	2.4909	55	4
C			
C	2.2727	55	5

Alpha	0.05
Error Degrees of Freedom	160
Error Mean Square	2.360682
Critical Value of t	1.97490
Least Significant Difference	0.8582

Means with the same letter are not significantly different.

t Grouping	Mean	N	Region
A	3.6400	25	5
A			
B A	3.5200	25	4
B A			
B A C	3.2400	25	7
B A C			
B A C	3.1200	25	11
B A C			
B A C	3.0000	25	10
B C			
B C	2.7600	25	6
B C			
B C	2.6800	25	8
C			
C	2.6400	25	3
C			
C	2.6400	25	2
C			
C	2.4400	25	1
C			
C	2.4400	25	9

Alpha	0.05
Error Degrees of Freedom	160
Error Mean Square	2.360682
Critical Value of t	1.97490
Least Significant Difference	0.5786

Means with the same letter are not significantly different.

t Grouping	Mean	N	farmers
A	3.1273	55	5
A	3.0727	55	2
A	2.8909	55	1
A	2.7636	55	3

A 2.7455 55 4

LSD tests for incidences in Fungi, Regions, and farmers continues

Alpha 0.05
Error Degrees of Freedom 160
Error Mean Square 18.98421
Critical Value of t 1.97490
Least Significant Difference 1.6409

Means with the same letter are not significantly different.

t Grouping		Mean	N	Fungi
	A	14.6182	55	1
	B	12.5149	55	3
	B			
C	B	11.3887	55	2
C				
C	D	10.2638	55	4
	D			
	D	9.0218	55	5

Alpha 0.05
Error Degrees of Freedom 160
Error Mean Square 18.98421
Critical Value of t 1.97490
Least Significant Difference 2.4338

Means with the same letter are not significantly different.

t Grouping		Mean	N	Region
	A	17.732	25	4
	A	15.857	25	5
	B	13.276	25	7
	B			
C	B	12.010	25	10
C				
C	D	10.801	25	6
C	D			
C	D	10.786	25	11
C	D			
C	D	10.108	25	3
	D			
	D	9.452	25	1
	D			
	D	9.184	25	9
	D			
	D	9.047	25	2
	D			
	D	8.922	25	8

Alpha 0.05
Error Degrees of Freedom 160
Error Mean Square 18.98421
Critical Value of t 1.97490
Least Significant Difference 1.6409

Means with the same letter are not significantly different.

t Grouping	Mean	N	farmers
A	12.4453	55	5
A			
A	12.0849	55	2

	A			
B	A	11.9185	55	1
B	A			
B	A	10.9578	55	4
B				
B		10.4009	55	3

Table 11: Correlation analysis of long rains season of 2009

5 Variables: Fungi farmers Region severity incidences

Simple Statistics

Variable	N	Mean	Std Dev	Sum	Minimum	Maximum	Label
Fungi	275	3.00000	1.41679	825.00000	1.00000	5.00000	Fungi
farmers	275	3.00000	1.41679	825.00000	1.00000	5.00000	farmers
Region	275	6.00000	3.16804	1650	1.00000	11.00000	Region
severity	275	2.92000	1.62130	803.00000	1.00000	8.00000	severity
incidences	275	11.56149	5.84620	3179	0	22.00000	incidences

Pearson Correlation Coefficients, N = 275
Prob > |r| under H0: Rho=0

	Fungi	farmers	Region	severity	incidences
Fungi	1.00000	0.00000	0.00000	-0.32730	-0.29851
Fungi		1.0000	1.0000	<.0001	<.0001
farmers	0.00000	1.00000	0.00000	0.01271	-0.00178
farmers	1.0000		1.0000	0.8338	0.9765
Region	0.00000	0.00000	1.00000	0.03837	-0.02195
Region	1.0000	1.0000		0.5263	0.7170
severity	-0.32730	0.01271	0.03837	1.00000	0.59028
severity	<.0001	0.8338	0.5263		<.0001
incidences	-0.29851	-0.00178	-0.02195	0.59028	1.00000
incidences	<.0001	0.9765	0.7170	<.0001	

Table 12: Means breakdown for long rains season of 2009

--------------------------------------- Effect=FARMERS --

Fungi	farmers	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	INCIDENCES	INCIDENCES
.	1	.	0.20046	2.89091	0.72961	11.9185
.	2	.	0.21997	3.07273	0.82569	12.0849
.	3	.	0.21860	2.76364	0.79769	10.4009
.	4	.	0.20304	2.74545	0.73968	10.9578
.	5	.	0.25033	3.12727	0.83786	12.4453

-- Effect=FUNGI --

Fungi	farmers	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	INCIDENCES	INCIDENCES
1	.	.	0.17593	3.96364	0.57295	14.6182
2	.	.	0.19834	2.85455	0.78723	11.3887
3	.	.	0.20677	3.01818	0.60905	12.5149
4	.	.	0.23192	2.49091	0.83309	10.2638
5	.	.	0.20995	2.27273	0.89393	9.0218

--------------------------------------- Effect=Overall --

Std. Error Std. Error

Fungi	farmers	of Region	Mean of SEVERITY	of SEVERITY	Mean of INCIDENCES	INCIDENCES
.	.	.	0.097768	2.92	0.35254	11.5615
.	.	1	0.26508	2.44	0.77423	9.4524
.	.	2	0.30485	2.64	1.02878	9.0472
.	.	3	0.31559	2.64	0.79547	10.1084
.	.	4	0.25897	3.52	0.25776	17.7324
.	.	5	0.38678	3.64	1.23992	15.8572
.	.	6	0.31770	2.76	1.11841	10.8008
.	.	7	0.36185	3.24	1.28312	13.2756
.	.	8	0.33025	2.68	1.06041	8.9224
.	.	9	0.30044	2.44	1.05464	9.1840
.	.	10	0.28868	3.00	0.97970	12.0104
.	.	11	0.36661	3.12	1.42186	10.7856

Table 12: Means breakdown for long rains season of 2009 continues

Fungi	farmers	Region	Std. Error of SEVERITY	Mean of SEVERITY	Std. Error of INCIDENCES	Mean of INCIDENCES
.	1	1	0.73485	2.2	0.51629	10.1880
.	1	2	0.67823	2.6	2.35377	9.2840
.	1	3	0.87178	2.4	0.47298	11.2860
.	1	4	0.37417	3.8	0.51200	18.6500
.	1	5	0.80000	3.2	3.46735	13.7120
.	1	6	0.80000	2.8	3.21854	7.8760
.	1	7	0.50990	3.4	0.44888	16.3680
.	1	8	0.67823	2.6	0.51166	12.0520
.	1	9	0.74833	2.4	2.68707	6.5400
.	1	10	0.58310	2.8	0.65963	12.0700
.	1	11	0.67823	3.6	3.30584	13.0780
.	2	1	0.60000	2.4	0.43876	10.5700
.	2	2	0.73485	3.2	0.46806	14.3140
.	2	3	0.74833	2.4	2.35026	9.2700
.	2	4	0.40000	3.6	0.47209	18.2700
.	2	5	0.74833	4.4	0.48273	20.4360
.	2	6	0.54772	3.0	0.48454	13.4260
.	2	7	0.96954	3.8	3.29910	13.0660
.	2	8	0.80000	2.8	2.51332	9.8860
.	2	9	0.73485	2.8	2.78212	11.0580
.	2	10	0.80000	2.8	3.18538	7.7700
.	2	11	0.97980	2.6	2.98234	4.8680
.	3	1	0.67823	2.6	2.56167	6.7200
.	3	2	0.80000	2.2	2.18565	5.2840
.	3	3	0.73485	2.8	0.53122	12.0120
.	3	4	0.91652	3.2	0.46664	17.3040
.	3	5	0.80000	3.2	3.35839	13.3220
.	3	6	0.60000	2.6	0.46900	13.3180
.	3	7	0.48990	2.8	2.43523	9.5220
.	3	8	0.77460	2.0	2.43083	5.9020
.	3	9	0.77460	2.0	1.94493	4.6980
.	3	10	0.81240	3.4	0.47340	16.2940
.	3	11	0.87178	3.6	2.54001	10.0340
.	4	1	0.37417	2.2	1.72415	6.6220
.	4	2	0.48990	2.2	1.72416	6.6180
.	4	3	0.81240	2.6	2.11332	8.2400
.	4	4	0.74833	3.6	0.45164	16.3360
.	4	5	0.58310	3.2	0.46559	17.3080
.	4	6	0.96954	3.2	2.70460	10.6622

.	4	7	0.77460	2.0	3.41663	8.3360
.	4	8	0.66332	3.2	2.67556	10.5280
.	4	9	0.48990	2.2	0.47914	9.3480
.	4	10	0.63246	3.0	0.49105	14.2120
.	4	11	0.91652	2.8	3.11163	12.3260
.	5	1	0.73485	2.8	0.48176	13.1620
.	5	2	0.83666	3.0	2.48187	9.7360
.	5	3	0.63246	3.0	2.48023	9.7340
.	5	4	0.50990	3.4	0.48607	18.1020
.	5	5	1.39284	4.2	3.65941	14.5080
.	5	6	0.80000	2.2	3.58692	8.7220
.	5	7	1.06771	4.2	0.48862	19.0860
.	5	8	0.96954	2.8	2.58625	6.244
.	5	9	0.80000	2.8	0.49974	14.276
.	5	10	0.63246	3.0	2.47475	9.706

Fungi	farmers	Region	Std. Error of SEVERITY	Mean of SEVERITY	Std. Error of INCIDENCES	Mean of INCIDENCES
1	1	.	0.36590	4.45455	1.64844	13.9091
1	2	.	0.41060	3.63636	1.70754	14.4545
1	3	.	0.30963	4.36364	1.01314	13.9091
1	4	.	0.40041	3.81818	0.95606	14.3636
1	5	.	0.45455	3.54545	0.91814	16.4545
2	1	.	0.30424	3.72727	0.89863	13.5845
2	2	.	0.43408	3.45455	1.56760	12.5545
2	3	.	0.40452	3.00000	1.05418	12.2455
2	4	.	0.43598	2.09091	2.20631	8.7555
2	5	.	0.42640	2.00000	2.41919	9.8036
3	1	.	0.30424	2.72727	0.82882	13.4009
3	2	.	0.58493	3.81818	0.91491	14.1318
3	3	.	0.50452	3.00000	1.76655	10.6600
3	4	.	0.40041	2.81818	1.46359	11.5918
3	5	.	0.46887	2.72727	1.56579	12.7900
4	1	.	0.33278	2.27273	1.53270	11.9200
4	2	.	0.42834	2.27273	2.16757	10.3845
4	3	.	0.46710	2.00000	1.99967	7.8609
4	4	.	0.38996	2.45455	1.44792	10.8500
4	5	.	0.81312	3.45455	2.16995	10.3036
5	1	.	0.19498	1.27273	2.06786	6.7782
5	2	.	0.42251	2.18182	2.27872	8.8991
5	3	.	0.24730	1.45455	2.18097	7.3291
5	4	.	0.52853	2.54545	1.66334	9.2283
5	5	.	0.43598	3.90909	1.51790	12.8745

Table 12: Means breakdown for long rains season of 2009 continues

------------------------------------- Effect=FUNGI*REGION ---------------------------------------

Fungi	farmers	Region	Std. Error of SEVERITY	Mean of SEVERITY	Std. Error of INCIDENCES	Mean of INCIDENCES
1	.	1	0.63246	4.0	0.80000	12.2
1	.	2	0.63246	4.0	1.16619	12.6
1	.	3	0.40000	4.4	0.37417	13.2
1	.	4	0.00000	5.0	0.40000	19.4
1	.	5	0.00000	5.0	0.67823	19.6

------------------------------------- Effect=FUNGI*REGION --------------------------------------

(continued)

Std. Error Std. Error

of Mean of of Mean of

Fungi	farmers	Region	SEVERITY	SEVERITY	INCIDENCES	INCIDENCES
1	.	6	0.70711	3.0	3.05614	12.2000
1	.	7	0.50990	3.6	1.37840	17.0000
1	.	8	0.54772	4.0	0.73485	13.2000
1	.	9	0.87178	3.6	1.28841	12.6000
1	.	10	0.37417	3.8	0.80000	15.2000
1	.	11	0.80000	3.2	3.50143	13.6000
2	.	1	0.50990	2.4	2.29708	8.9380
2	.	2	0.44721	2.0	2.46670	9.0020
2	.	3	0.58310	2.2	2.20521	8.7920
2	.	4	0.24495	3.4	0.38827	17.5920
2	.	5	0.70711	3.0	3.68180	14.4220
2	.	6	0.81240	2.6	2.74948	10.9720
2	.	7	0.70711	3.0	3.25861	12.3060
2	.	8	0.80000	2.2	2.74755	6.6080
2	.	9	0.58310	2.2	1.37350	10.9180
2	.	10	0.74833	3.6	2.87312	11.1500
2	.	11	0.20000	4.8	1.05914	14.5760
3	.	1	0.24495	2.4	2.00746	8.5920
3	.	2	0.50990	2.4	2.49975	9.2100
3	.	3	0.73485	2.2	2.32901	9.2980
3	.	4	0.50990	3.6	0.33415	17.5280
3	.	5	1.01980	3.8	0.71075	17.6600
3	.	6	0.83666	3.0	2.67260	10.6900
3	.	7	1.01980	3.8	1.27492	15.1900
3	.	8	0.50990	2.4	0.68140	11.0460
3	.	9	0.60000	2.6	1.19033	10.9040
3	.	10	0.40000	3.6	0.83849	13.2900
3	.	11	0.81240	3.4	0.79254	14.2560
4	.	1	0.40000	1.6	0.84456	9.9340
4	.	2	0.77460	2.0	2.27705	8.1000
4	.	3	0.74833	2.4	0.39505	10.8340
4	.	4	0.66332	3.2	0.66675	17.4320
4	.	5	1.24097	3.2	3.55269	13.9860
4	.	6	0.50990	2.6	2.52653	10.1060
4	.	7	1.28841	3.4	4.13875	10.0580
4	.	8	0.92736	2.6	2.81868	6.8000
4	.	9	0.37417	1.8	3.08044	7.2100
4	.	10	0.37417	2.2	2.71211	10.1960
4	.	11	0.87178	2.4	3.41860	8.2460
5	.	1	0.58310	1.8	2.06569	7.5980
5	.	2	0.80000	2.8	2.76271	6.3240
5	.	3	0.63246	2.0	2.13710	8.4180
5	.	4	0.60000	2.4	0.36308	16.7100
5	.	5	0.86023	3.2	3.46719	13.6180
5	.	6	0.92736	2.6	2.51652	10.0362
5	.	7	0.40000	2.4	3.22257	11.8240
5	.	8	0.80000	2.2	2.84676	6.9580
5	.	9	0.77460	2.0	2.74595	4.2880
5	.	10	0.80000	1.8	2.65988	10.2160
5	.	11	0.80000	1.8	3.25000	3.2500

Appendix 5: Disease severity and incidences of maize ear rot causing pathogens in Maseno area during short rains season of 2008 and long rains season of 2009

Table 13: Anova for severity and incidences of maize ear rot causing pathogens in Maseno area during short rains 2008 and long rains season of 2009

Dependent Variable: severity

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	33	26.58000000	0.80545455	1.70	0.1311
Error	16	7.60000000	0.47500000		
Corrected Total	49	34.18000000			

R-Square	Coeff Var	Root MSE	severity Mean
0.777648	43.62041	0.689202	1.580000

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Fungi	4	7.48000000	1.87000000	3.94	0.0207
Season	1	4.50000000	4.50000000	9.47	0.0072
farmers	4	4.28000000	1.07000000	2.25	0.1089
Fungi*Season	4	1.80000000	0.45000000	0.95	0.4623
Fungi*farmers	16	7.92000000	0.49500000	1.04	0.4676
farmers*Season	4	0.60000000	0.15000000	0.32	0.8632

Dependent Variable: incidences

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	33	392.0520488	11.8803651	9.08	<.0001
Error	16	20.9334217	1.3083389		
Corrected Total	49	412.9854705			

R-Square	Coeff Var	Root MSE	incidences Mean
0.949312	19.64156	1.143826	5.823500

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Fungi	4	67.2153134	16.8038284	12.84	<.0001
Season	1	54.4905362	54.4905362	41.65	<.0001
farmers	4	126.0708376	31.5177094	24.09	<.0001
Fungi*Season	4	11.3136577	2.8284144	2.16	0.1200
Fungi*farmers	16	115.1637780	7.1977361	5.50	0.0007
farmers*Season	4	17.7979259	4.4494815	3.40	0.0340

Table 14: LSD tests for severity and incidences of maize ear rot causing pathogens in Maseno area during short rains of 2008 and long rains season of 2009

NOTE: 1. This test controls the Type I comparison wise error rate, not the experiment wise error rate.
2. Fungi 1, 2, 3, 4, 5 are Diplodia (*Stenocarpella spp*), Giberella, Nigrospora, Fusarium, and other fungi respectively; seasons 1, 2 are short rains of 2008 and long rains of 2009 respectively.

LSD tests for severity in Fungi, and farmers

Alpha	0.05
Error Degrees of Freedom	16
Error Mean Square	0.475
Critical Value of t	2.11991
Least Significant Difference	0.6534

Means with the same letter are not significantly different.

t Grouping	Mean	N	Fungi
A	2.2000	10	1

```
      A
 B    A      1.7000     10    2
 B
 B    C      1.5000     10    3
 B    C
 B    C      1.5000     10    4
      C
      C      1.0000     10    5
```

LSD tests for severity in Fungi, season, and farmers continues

```
Alpha                          0.05
Error Degrees of Freedom          16
Error Mean Square              0.475
Critical Value of t          2.11991
Least Significant Difference  0.6534
```

Means with the same letter are not significantly different.

```
t Grouping        Mean      N    farmers
     A        1.9000     10    4
     A
     A        1.8000     10    2
     A
B    A        1.7000     10    1
B    A
B    A        1.4000     10    5
B
B             1.1000     10    3
```

```
Alpha                          0.05
Error Degrees of Freedom          16
Error Mean Square              0.475
Critical Value of t          2.11991
Least Significant Difference  0.4132
```

Means with the same letter are not significantly different.

```
t Grouping        Mean      N    Season

     A        1.8800     25    2

     B        1.2800     25    1
```

LSD tests for incidences in Fungi, season, and farmers

```
Alpha                          0.05
Error Degrees of Freedom          16
Error Mean Square           1.308339
Critical Value of t          2.11991
Least Significant Difference  1.0844
```

Means with the same letter are not significantly different.

```
t Grouping        Mean      N    Fungi

     A        7.7000     10    1

     B        6.4913     10    3

     C        5.3239     10    4
     C
     C        5.2563     10    2
     C
     C        4.3460     10    5
```

Alpha 0.05
Error Degrees of Freedom 16
Error Mean Square 1.308339
Critical Value of t 2.11991
Least Significant Difference 1.0844

Means with the same letter are not significantly different.

t Grouping		Mean	N	farmers
	A	7.9596	10	2
	A			
	A	7.3630	10	4
	B	5.3273	10	1
	B			
C	B	4.6660	10	5
C				
C		3.8016	10	3

Alpha 0.05
Error Degrees of Freedom 16
Error Mean Square 1.308339
Critical Value of t 2.11991
Least Significant Difference 0.6858

Means with the same letter are not significantly different.

t Grouping	Mean	N	Season
A	6.8674	25	2
B	4.7796	25	1

Table 15: Correlation analysis for short rains of 2008 and long rains seasons of 2009

5 Variables: Season Fungi farmers severity incidences

Variable	N	Mean	Std Dev	Sum	Minimum	Maximum	Label
Season	50	1.50000	0.50508	75.00000	1.00000	2.00000	Season
Fungi	50	3.00000	1.42857	150.00000	1.00000	5.00000	Fungi
farmers	50	3.00000	1.42857	150.00000	1.00000	5.00000	farmers
severity	50	1.58000	0.83520	79.00000	1.00000	4.00000	severity
incidences	50	5.82350	2.90315	291.17500	0	11.00000	incidences

Pearson Correlation Coefficients, N = 50
Prob > |r| under H0: Rho=0

	Season	Fungi	farmers	severity	incidences
Season	1.00000	0.00000	0.00000	0.36284	0.36324
Season		1.0000	1.0000	0.0096	0.0095
Fungi	0.00000	1.00000	0.00000	-0.44472	-0.32676
Fungi	1.0000		1.0000	0.0012	0.0206
farmers	0.00000	0.00000	1.00000	-0.08552	-0.09444
farmers	1.0000	1.0000		0.5548	0.5142
severity	0.36284	-0.44472	-0.08552	1.00000	0.57793
severity	0.0096	0.0012	0.5548		<.0001
incidences	0.36324	-0.32676	-0.09444	0.57793	1.00000

incidences	0.0095	0.0206	0.5142	<.0001

Table 16: Means breakdown for short rains of 2008 and long short rains season of 2009

Effect=FARMERS

Fungi	farmers	Season	Std. Error of SEVERITY	Mean of SEVERITY	Std. Error of INCIDENCES	Mean of INCIDENCES
.	1	.	0.30000	1.7	0.93784	5.3273
.	2	.	0.24944	1.8	0.53265	7.9596
.	3	.	0.10000	1.1	0.69024	3.8016
.	4	.	0.27689	1.9	0.93638	7.3630
.	5	.	0.30551	1.4	0.81942	4.6660

Effect=FUNGI

Fungi	farmers	Season	Std. Error of SEVERITY	Mean of SEVERITY	Std. Error of INCIDENCES	Mean of INCIDENCES
1	.	.	0.35901	2.2	0.65064	7.7000
2	.	.	0.26034	1.7	1.04320	5.2563
3	.	.	0.22361	1.5	0.51411	6.4913
4	.	.	0.22361	1.5	1.00341	5.3239
5	.	.	0.00000	1.0	1.02915	4.3460

Effect=Overall

Fungi	farmers	Season	Std. Error of SEVERITY	Mean of SEVERITY	Std. Error of INCIDENCES	Mean of INCIDENCES
.	.	.	0.11811	1.58	0.41057	5.8235

Effect=SEASON

Fungi	farmers	Season	Std. Error of SEVERITY	Mean of SEVERITY	Std. Error of INCIDENCES	Mean of INCIDENCES
.	.	1	0.09165	1.28	0.50908	4.77956
.	.	2	0.20265	1.88	0.58166	6.86744

Effect=FARMERS*SEASON

Fungi	farmers	Season	Std. Error of SEVERITY	Mean of SEVERITY	Std. Error of INCIDENCES	Mean of INCIDENCES
.	1	1	0.24495	1.4	1.17986	4.7166
.	1	2	0.54772	2.0	1.54253	5.9380
.	2	1	0.24495	1.4	0.21630	6.5332
.	2	2	0.37417	2.2	0.46109	9.3860
.	3	1	0.00000	1.0	1.14546	2.7740
.	3	2	0.20000	1.2	0.55124	4.8292
.	4	1	0.24495	1.6	1.36262	5.436
.	4	2	0.48990	2.2	0.48187	9.290
.	5	1	0.00000	1.0	1.12027	4.438
.	5	2	0.58310	1.8	1.31929	4.894

Table 16: Means breakdown for short rains of 2008 and long short rains season of 2009 continues

Effect=FUNGI*FARMERS

Fungi	farmers	Season	Std. Error of SEVERITY	Mean of SEVERITY	Std. Error of INCIDENCES	Mean of INCIDENCES
1	1	.	1.0	3.0	1.5000	7.5000
1	2	.	0.5	2.5	2.0000	9.0000
1	3	.	0.5	1.5	1.0000	6.0000

1	4	.	0.5	1.5	2.0000	9.0000
1	5	.	1.5	2.5	1.0000	7.0000
2	1	.	0.0	2.0	0.7400	6.4900
2	2	.	1.0	2.0	1.6250	7.6250
2	3	.	0.0	1.0	0.0615	4.0615
2	4	.	0.5	2.5	1.2150	8.1050
2	5	.	0.0	1.0	0.0000	0.0000
3	1	.	0.5	1.5	0.4750	6.3750
3	2	.	0.5	1.5	1.0000	7.7900
3	3	.	0.0	1.0	0.3735	4.4965
3	4	.	0.5	2.5	1.2450	8.1150
3	5	.	0.0	1.0	0.0700	5.6800
4	1	.	0.0	1.0	0.3385	6.2715
4	2	.	0.0	2.0	1.3770	8.2330
4	3	.	0.0	1.0	2.3250	2.3250
4	4	.	1.0	2.0	4.2900	4.2900
4	5	.	0.5	1.5	0.1800	5.5000
5	1	.	0.0	1.0	0.0000	0.0000
5	2	.	0.0	1.0	1.1300	7.1500
5	3	.	0.0	1.0	2.1250	2.1250
5	4	.	0.0	1.0	0.8850	7.3050
5	5	.	0.0	1.0	0.0300	5.1500

------------------------------------ Effect=FUNGI*SEASON --------------------------------------

Fungi	farmers	Season	Std. Error of Mean of SEVERITY	Mean of SEVERITY	Std. Error of SEVERITY	Mean of INCIDENCES
1	.	1	0.24495	1.6	0.37417	6.2000
1	.	2	0.58310	2.8	0.80000	9.2000
2	.	1	0.24495	1.4	1.22517	4.5280
2	.	2	0.44721	2.0	1.76946	5.9846
3	.	1	0.20000	1.2	0.36905	6.0360
3	.	2	0.37417	1.8	0.97445	6.9466
4	.	1	0.20000	1.2	1.49867	3.6218
4	.	2	0.37417	1.8	0.91439	7.0260
5	.	1	0.00000	1.0	1.44915	3.5120
5	.	2	0.00000	1.0	1.52262	5.1800

Appendix 6: Disease severity and incidences of maize ear rot causing pathogens in Maseno area during short rains of 2008

Table 17: Anova for severity and incidences of maize ear rot causing pathogens in Maseno area during short rains of 2008

Dependent Variable: severity

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	8	2.48000000	0.31000000	1.94	0.1238

Error	16	2.56000000	0.16000000			
Corrected Total	24	5.04000000				

R-Square	Coeff Var	Root MSE	severity Mean
0.492063	31.25000	0.400000	1.280000

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Fungi	4	1.04000000	0.26000000	1.62	0.2165
farmers	4	1.44000000	0.36000000	2.25	0.1092

Dependent Variable: incidences

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	8	71.2787755	8.9098469	1.69	0.1762
Error	16	84.2202046	5.2637628		
Corrected Total	24	155.4989802			

R-Square	Coeff Var	Root MSE	incidences Mean
0.458387	48.00210	2.294289	4.779560

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Fungi	4	33.03345136	8.25836284	1.57	0.2305
farmers	4	38.24532416	9.56133104	1.82	0.1750

Table 18: LSD tests for severity and incidences of maize ear rot causing pathogens in Maseno area during short rains of 2008

NOTE: 1. This test controls the Type I comparison wise error rate, not the experiment wise error rate.
2. Fungi 1, 2, 3, 4, 5 are Diplodia (*Stenocarpella spp*), Giberella, Nigrospora, Fusarium, and other fungi respectively;

LSD tests for severity in Fungi, and farmers

Alpha	0.05
Error Degrees of Freedom	16
Error Mean Square	0.16
Critical Value of t	2.11991
Least Significant Difference	0.5363

Means with the same letter are not significantly different.

t Grouping		Mean	N	Fungi
	A	1.6000	5	1
	A			
B	A	1.4000	5	2
B	A			
B	A	1.2000	5	3
B	A			
B	A	1.2000	5	4
B				
B		1.0000	5	5

Alpha	0.05
Error Degrees of Freedom	16
Error Mean Square	0.16
Critical Value of t	2.11991
Least Significant Difference	0.5363

Means with the same letter are not significantly different.

t Grouping	Mean	N	farmers
A	1.6000	5	4

A			
B A	1.4000	5	1
B A			
B A	1.4000	5	2
B			
B	1.0000	5	3
B			
B	1.0000	5	5

LSD tests for incidences in Fungi, and farmers

Alpha 0.05
Error Degrees of Freedom 16
Error Mean Square 5.263763
Critical Value of t 2.11991
Least Significant Difference 3.0761

Means with the same letter are not significantly different.

t Grouping	Mean	N	Fungi
A	6.200	5	1
A			
A	6.036	5	3
A			
A	4.528	5	2
A			
A	3.622	5	4
A	3.512	5	5

Alpha 0.05
Error Degrees of Freedom 16
Error Mean Square 5.263763
Critical Value of t 2.11991
Least Significant Difference 3.0761

Means with the same letter are not significantly different.

t Grouping	Mean	N	farmers
A	6.533	5	2
B A	5.436	5	4
B A			
B A	4.717	5	1
B A			
B A	4.438	5	5
B			
B	2.774	5	3

Table 19: Correlation analysis of short rains of 2008 in Maseno area

4 Variables: Fungi farmers severity incidences

Variable	N	Mean	Std Dev	Sum	Minimum	Maximum	Label
Fungi	25	3.00000	1.44338	75.00000	1.00000	5.00000	Fungi
farmers	25	3.00000	1.44338	75.00000	1.00000	5.00000	farmers
severity	25	1.28000	0.45826	32.00000	1.00000	2.00000	severity
incidences	25	4.77956	2.54541	119.48900	0	7.00000	incidences

Pearson Correlation Coefficients, N = 25
Prob > |r| under H0: Rho=0

	Fungi	farmers	severity	incidences
Fungi	1.00000	0.00000	-0.44096	-0.35623
Fungi		1.0000	0.0274	0.0805

farmers	0.00000	1.00000	-0.18898	-0.09381
farmers	1.0000		0.3656	0.6556
severity	-0.44096	-0.18898	1.00000	0.46112
severity	0.0274	0.3656		0.0203
incidences	-0.35623	-0.09381	0.46112	1.00000
incidences	0.0805	0.6556	0.0203	

Table 20: Means breakdown for short rains of 2008 in Maseno area

--------------------------------------- Effect=FARMERS ---------------------------------------

Season	Fungi	farmers	Region	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of SEVERITY INCIDENCES
.	.	1	.	0.24495	1.4	1.17986	4.7166
.	.	2	.	0.24495	1.4	0.21630	6.5332
.	.	3	.	0.00000	1.0	1.14546	2.7740
.	.	4	.	0.24495	1.6	1.36262	5.4360
.	.	5	.	0.00000	1.0	1.12027	4.4380

-- Effect=FUNGI --

Season	Fungi	farmers	Region	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of SEVERITY INCIDENCES
.	1	.	.	0.24495	1.6	0.37417	6.2000
.	2	.	.	0.24495	1.4	1.22517	4.5280
.	3	.	.	0.20000	1.2	0.36905	6.0360
.	4	.	.	0.20000	1.2	1.49867	3.6218
.	5	.	.	0.00000	1.0	1.44915	3.5120

--------------------------------------- Effect=Overall ---------------------------------------

Season	Fungi	farmers	Region	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of SEVERITY INCIDENCES
.	.	.	.	0.091652	1.28	0.50908	4.77956

--------------------------------------- Effect=REGION --

Season	Fungi	farmers	Region	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of SEVERITY INCIDENCES
.	.	.	1	0.091652	1.28	0.50908	4.77956

-- Effect=SEASON ---

Season	Fungi	farmers	Region	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of SEVERITY INCIDENCES
1	.	.	.	0.091652	1.28	0.50908	4.77956

----------------------------------- Effect=FARMERS*REGION ------------------------------------

Season	Fungi	farmers	Region	Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of SEVERITY INCIDENCES
.	.	1	1	0.24495	1.4	1.17986	4.7166
.	.	2	1	0.24495	1.4	0.21630	6.5332
.	.	3	1	0.00000	1.0	1.14546	2.7740
.	.	4	1	0.24495	1.6	1.36262	5.4360
.	.	5	1	0.00000	1.0	1.12027	4.4380

------------------------------------ Effect=FUNGI*REGION -------------------------------------

Std. Error Std. Error

of Mean of of Mean of

Season	Fungi	farmers	Region	SEVERITY	SEVERITY	INCIDENCES	
.	1	.	1	0.24495	1.6	0.37417	6.2000
.	2	.	1	0.24495	1.4	1.22517	4.5280
.	3	.	1	0.20000	1.2	0.36905	6.0360
.	4	.	1	0.20000	1.2	1.49867	3.6218
.	5	.	1	0.00000	1.0	1.44915	3.5120

Table 20: Means breakdown for short rains of 2008 in Maseno area continues

------------------------------------ Effect=SEASON*FARMERS -------------------------------------

Season	Fungi	farmers		Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of SEVERITY INCIDENCES
1	.	1	.	0.24495	1.4	1.17986	4.7166
1	.	2	.	0.24495	1.4	0.21630	6.5332
1	.	3	.	0.00000	1.0	1.14546	2.7740
1	.	4	.	0.24495	1.6	1.36262	5.4360
1	.	5	.	0.00000	1.0	1.12027	4.4380

------------------------------------- Effect=SEASON*FUNGI --------------------------------------

Season	Fungi	farmers		Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of SEVERITY INCIDENCES
1	1	.	.	0.24495	1.6	0.37417	6.2000
1	2	.	.	0.24495	1.4	1.22517	4.5280
1	3	.	.	0.20000	1.2	0.36905	6.0360
1	4	.	.	0.20000	1.2	1.49867	3.6218
1	5	.	.	0.00000	1.0	1.44915	3.5120

------------------------------------- Effect=SEASON*REGION -------------------------------------

Season	Fungi	farmers		Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of SEVERITY INCIDENCES
1	.	.	1	0.091652	1.28	0.50908	4.77956

--------------------------------- Effect=SEASON*FARMERS*REGION ---------------------------

Season	Fungi	farmers		Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of SEVERITY INCIDENCES
1	.	1	1	0.24495	1.4	1.17986	4.7166
1	.	2	1	0.24495	1.4	0.21630	6.5332
1	.	3	1	0.00000	1.0	1.14546	2.7740
1	.	4	1	0.24495	1.6	1.36262	5.4360
1	.	5	1	0.00000	1.0	1.12027	4.4380

---------------------------------- Effect=SEASON*FUNGI*REGION -------------------------------

Season	Fungi	farmers		Std. Error of Region	Mean of SEVERITY	Std. Error of SEVERITY	Mean of SEVERITY INCIDENCES
1	1	.	1	0.24495	1.6	0.37417	6.2000
1	2	.	1	0.24495	1.4	1.22517	4.5280
1	3	.	1	0.20000	1.2	0.36905	6.0360
1	4	.	1	0.20000	1.2	1.49867	3.6218
1	5	.	1	0.00000	1.0	1.44915	3.5120

Appendix 7: Disease severity and incidences of maize ear rot causing pathogens in Maseno area during long rains of 2009

Table 21: Anova for severity and incidences of maize ear rot causing pathogens in Maseno area during long rains season of 2009

Dependent Variable: severity

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	24	40.88000000	1.70333333	9.46	<.0001
Error	25	4.50000000	0.18000000		
Corrected Total	49	45.38000000			

R-Square	Coeff Var	Root MSE	severity Mean
0.900837	23.31121	0.424264	1.820000

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Fungi	4	11.68000000	2.92000000	16.22	<.0001
farmers	4	6.88000000	1.72000000	9.56	<.0001
Fungi*farmers	16	22.32000000	1.39500000	7.75	<.0001

Dependent Variable: incidences

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	24	416.4421483	17.3517562	216.90	<.0001
Error	25	2.0000000	0.0800000		
Corrected Total	49	418.4421483			

R-Square	Coeff Var	Root MSE	incidences Mean
0.995220	4.094755	0.282843	6.907440

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Fungi	4	100.6412795	25.1603199	314.50	<.0001
farmers	4	207.8491187	51.9622797	649.53	<.0001
Fungi*farmers	16	107.9517501	6.7469844	84.34	<.0001

Table 22: LSD tests for severity and incidences of maize ear rot causing pathogens in Maseno area during long rains season of 2009

NOTE: 1. This test controls the Type I comparison wise error rate, not the experiment wise error rate.
2. Fungi 1, 2, 3, 4, 5 are Diplodia (*Stenocarpella spp*), Giberella, Nigrospora, Fusarium, and other fungi respectively;

LSD tests for severity in Fungi, and farmers

Alpha	0.05
Error Degrees of Freedom	25
Error Mean Square	0.18
Critical Value of t	2.05954
Least Significant Difference	0.3908

Means with the same letter are not significantly different.

t Grouping	Mean	N	Fungi
A	2.5000	10	1
B	2.0000	10	2
B			
B	1.8000	10	3
B			
B	1.8000	10	4
C	1.0000	10	5

Alpha 0.05
Error Degrees of Freedom 25
Error Mean Square 0.18
Critical Value of t 2.05954
Least Significant Difference 0.3908

Means with the same letter are not significantly different.

t Grouping	Mean	N	farmers
A	2.2000	10	2
A			
A	2.2000	10	4
B	1.8000	10	5
B			
B	1.7000	10	1
C	1.2000	10	3

LSD tests for incidences in Fungi, and farmers

Alpha 0.05
Error Degrees of Freedom 25
Error Mean Square 0.08
Critical Value of t 2.05954
Least Significant Difference 0.2605

Means with the same letter are not significantly different.

t Grouping	Mean	N	Fungi
A	9.4000	10	1
B	7.0260	10	4
B			
B	6.9466	10	3
C	5.9846	10	2
D	5.1800	10	5

Alpha 0.05
Error Degrees of Freedom 25
Error Mean Square 0.08
Critical Value of t 2.05954
Least Significant Difference 0.2605

Means with the same letter are not significantly different.

t Grouping	Mean	N	farmers
A	9.3860	10	2
A	9.2900	10	4
B	6.1380	10	1
C	4.8940	10	5
C			
C	4.8292	10	3

Table 23: Correlation analysis of long rains season of 2009 in Maseno area

4 Variables: Fungi farmers severity incidences

Variable	N	Mean	Std Dev	Sum	Minimum	Maximum	Label
Fungi	50	3.00000	1.42857	150.00000	1.00000	5.00000	Fungi
farmers	50	3.00000	1.42857	150.00000	1.00000	5.00000	farmers

severity	50	1.82000	0.96235	91.00000	1.00000	4.00000	severity
incidences	50	6.90744	2.92227	345.37200	0	11.00000	incidences

Pearson Correlation Coefficients, N = 50
Prob > |r| under H0: Rho=0

	Fungi	farmers	severity	incidences
Fungi	1.00000	0.00000	-0.47503	-0.36169
Fungi		1.0000	0.0005	0.0099
farmers	0.00000	1.00000	0.02969	-0.12632
farmers	1.0000		0.8378	0.3820
severity	-0.47503	0.02969	1.00000	0.52362
severity	0.0005	0.8378		<.0001
incidences	-0.36169	-0.12632	0.52362	1.00000
incidences	0.0099	0.3820	<.0001	

Table 24: Means breakdown for long rains season of 2009 in Maseno area

--------------------------------------- Effect=FARMERS ---------------------------------------

Fungi	farmers	Std. Error of SEVERITY	Mean of SEVERITY	Std. Error of SEVERITY	Mean of INCIDENCES
.	1	0.30000	1.7	1.11068	6.1380
.	2	0.24944	2.2	0.30739	9.3860
.	3	0.13333	1.2	0.36750	4.8292
.	4	0.32660	2.2	0.32125	9.2900
.	5	0.38873	1.8	0.87953	4.8940

-- Effect=FUNGI --

Fungi	farmers	Std. Error of SEVERITY	Mean of SEVERITY	Std. Error of SEVERITY	Mean of INCIDENCES
1	.	0.40139	2.5	0.56174	9.4000
2	.	0.29814	2.0	1.17964	5.9846
3	.	0.24944	1.8	0.64964	6.9466
4	.	0.24944	1.8	0.60959	7.0260
5	.	0.00000	1.0	1.01508	5.1800

--------------------------------------- Effect=Overall ---------------------------------------

Fungi	farmers	Std. Error of SEVERITY	Mean of SEVERITY	Std. Error of SEVERITY	Mean of INCIDENCES
.	.	0.13610	1.82	0.41327	6.90744

------------------------------------ Effect=FUNGI*FARMERS ------------------------------------

Fungi	farmers	Std. Error of SEVERITY	Mean of SEVERITY	Std. Error of SEVERITY	Mean of INCIDENCES
1	1	1.5	2.5	1	10.000
1	2	0.0	3.0	0	11.000
1	3	0.0	2.0	0	7.000
1	4	0.0	1.0	0	11.000
1	5	0.0	4.0	0	8.000
2	1	0.0	2.0	0	7.230
2	2	0.0	3.0	0	9.250
2	3	0.0	1.0	0	4.123
2	4	0.0	3.0	0	9.320
2	5	0.0	1.0	0	0.000
3	1	0.0	2.0	0	6.850
3	2	0.0	2.0	0	8.790

3	3	0.0	1.0	0	4.123
3	4	0.0	3.0	0	9.360
3	5	0.0	1.0	0	5.610
4	1	0.0	1.0	0	6.610

------------------------------------- Effect=FUNGI*FARMERS -------------------------------------

(continued)

Fungi	farmers	Std. Error of SEVERITY	Mean of SEVERITY	Std. Error of SEVERITY	Mean of INCIDENCES
4	2	0	2	0	9.61
4	3	0	1	0	4.65
4	4	0	3	0	8.58
4	5	0	2	0	5.68
5	1	0	1	0	0.00
5	2	0	1	0	8.28
5	3	0	1	0	4.25
5	4	0	1	0	8.19
5	5	0	1	0	5.18

Appendix 8: Disease severity, incidences and response of maize hybrids to Stenocarpella spp. in Maseno University Research farm during short rains seasons of 2008 and long rains season of 2009

Table 25: Anova for Disease severity, incidences and response of maize hybrids to *Stenocarpella spp.* in Maseno University Research farm during short rains seasons of 2008 and long rains season of 2009

Dependent Variable: Severity

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	35	28.32407407	0.80925926	2.82	0.0001
Error	72	20.66666667	0.28703704		
Corrected Total	107	48.99074074			

R-Square	Coeff Var	Root MSE	Severity__ Mean
0.578152	35.93907	0.535758	1.490741

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Maize_hybrid	8	7.74074074	0.96759259	3.37	0.0025
Rains_season	1	2.67592593	2.67592593	9.32	0.0032
Treatment	1	11.34259259	11.34259259	39.52	<.0001
Maize_hyb*Rains_seas	8	4.07407407	0.50925926	1.77	0.0963
Treatment*Maize_hybr	8	1.74074074	0.21759259	0.76	0.6404
Treatment*Rains_seas	1	0.00925926	0.00925926	0.03	0.8580
Treatm*Maize_*Rains_	8	0.74074074	0.09259259	0.32	0.9549

Dependent Variable: incidences

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	35	268.7405050	7.6783001	1.85	0.0140
Error	72	298.6666667	4.1481481		
Corrected Total	107	567.4071716			

R-Square	Coeff Var	Root MSE	incidences Mean
0.473629	41.97523	2.036700	4.852148

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Maize_hybrid	8	248.2962963	31.0370370	7.48	<.0001
Rains_season	1	5.8958774	5.8958774	1.42	0.2371
Treatment	1	9.4625280	9.4625280	2.28	0.1353
Maize_hyb*Rains_seas	8	4.2962963	0.5370370	0.13	0.9978
Treatment*Maize_hybr	8	0.0000000	0.0000000	0.00	1.0000
Treatment*Rains_seas	1	0.7895070	0.7895070	0.19	0.6639
Treatm*Maize_*Rains_	8	0.0000000	0.0000000	0.00	1.0000

Dependent Variable: Yield (Tonnes/ha)

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	35	6.65493285	0.19014094	1.85	0.0141
Error	72	7.40000000	0.10277778		
Corrected Total	107	14.05493285			

R-Square	Coeff Var	Root MSE	Yield__Tonnes_ha_ Mean
0.473494	29.75413	0.320590	1.077463

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Maize_hybrid	8	4.00518519	0.50064815	4.87	<.0001
Rains_season	1	0.29182404	0.29182404	2.84	0.0963
Treatment	1	1.98290700	1.98290700	19.29	<.0001
Maize_hyb*Rains_seas	8	0.32962963	0.04120370	0.40	0.9165
Treatment*Maize_hybr	8	0.00000000	0.00000000	0.00	1.0000
Treatment*Rains_seas	1	0.04538700	0.04538700	0.44	0.5085

Treatm*Maize_*Rains_	8	0.00000000	0.00000000	0.00	1.0000

Dependent Variable: Failed ears

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	35	701.879630	20.053704	1.16	0.2904
Error	72	1242.000000	17.250000		
Corrected Total	107	1943.879630			

R-Square	Coeff Var	Root MSE	Failed_ears Mean
0.361072	159.6291	4.153312	2.601852

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Maize_hybrid	8	259.9629630	32.4953704	1.88	0.0758
Rains_season	1	34.4537037	34.4537037	2.00	0.1619
Treatment	1	0.4537037	0.4537037	0.03	0.8716
Maize_hyb*Rains_seas	8	171.2962963	21.4120370	1.24	0.2881
Treatment*Maize_hybr	8	101.6296296	12.7037037	0.74	0.6590
Treatment*Rains_seas	1	18.7500000	18.7500000	1.09	0.3006
Treatm*Maize_*Rains_	8	115.3333333	14.4166667	0.84	0.5743

Table 25: Anova for Disease severity, incidences and responses of maize hybrids to *Stenocarpella spp.* in Maseno University Research farm during short rains seasons of 2008 and long rains season of 2009 continues

Dependent Variable: Plant stand

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	35	3461.666667	98.904762	161.84	<.0001
Error	72	44.000000	0.611111		
Corrected Total	107	3505.666667			

R-Square	Coeff Var	Root MSE	__Plant_stand_ Mean
0.987449	0.938709	0.781736	83.27778

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Maize_hybrid	8	1438.000000	179.750000	294.14	<.0001
Rains_season	1	1281.333333	1281.333333	2096.73	<.0001
Treatment	1	108.000000	108.000000	176.73	<.0001
Maize_hyb*Rains_seas	8	607.333333	75.916667	124.23	<.0001
Treatment*Maize_hybr	8	0.000000	0.000000	0.00	1.0000
Treatment*Rains_seas	1	27.000000	27.000000	44.18	<.0001
Treatm*Maize_*Rains_	8	0.000000	0.000000	0.00	1.0000

Dependent Variable: Days to silking

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	35	109.9629630	3.1417989	3.86	<.0001
Error	72	58.6666667	0.8148148		
Corrected Total	107	168.6296296			

R-Square	Coeff Var	Root MSE	Days_to_silking Mean
0.652098	1.230604	0.902671	73.35185

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Maize_hybrid	8	30.29629630	3.78703704	4.65	0.0001
Rains_season	1	31.14814815	31.14814815	38.23	<.0001
Treatment	1	0.00000000	0.00000000	0.00	1.0000
Maize_hyb*Rains_seas	8	48.51851852	6.06481481	7.44	<.0001
Treatment*Maize_hybr	8	0.00000000	0.00000000	0.00	1.0000
Treatment*Rains_seas	1	0.00000000	0.00000000	0.00	1.0000
Treatm*Maize_*Rains_	8	0.00000000	0.00000000	0.00	1.0000

Table 26: LSD tests for Disease severity, incidences and response of maize hybrids to *Stenocarpella spp.* in Maseno University Research farm during short rains seasons of 2008 and long rains season of 2009

NOTE: 1. This test controls the Type I comparison wise error rate, not the experiment wise error rate.
2. Maize hybrids 1, 2, 3, 4, 5, 6, 7, 8, 9 are EH10, EH13, EH14, EH15, EH16, H515, H516, H614D and P3253 respectively; seasons 1, 2 are short rains of 2008 and long rains of 2009 respectively; Treatments 1, 2 are innoculated and non-innoculated.

LSD tests for Severity

Alpha	0.05
Error Degrees of Freedom	72
Error Mean Square	0.287037
Critical Value of t	1.99346
Least Significant Difference	0.436

Means with the same letter are not significantly different.

t Grouping				Mean	N	Maize_ hybrid
		A		2.0000	12	2
B		A		1.7500	12	4
B		A	C	1.6667	12	3
B	D	A	C	1.5833	12	8
B	D		C	1.4167	12	9
B	D		C	1.4167	12	6
	D		C	1.2500	12	5
	D			1.1667	12	7
	D			1.1667	12	1

Table 26: LSD tests for Disease severity, incidences and response of maize hybrids to *Stenocarpella spp.* in Maseno University Research farm during short rains seasons of 2008 and long rains season of 2009 continues

LSD tests for Severity continues

Alpha	0.05
Error Degrees of Freedom	72
Error Mean Square	0.287037
Critical Value of t	1.99346
Least Significant Difference	0.2055

Means with the same letter are not significantly different.

t Grouping	Mean	N	Rains_ season
A	1.6481	54	2
B	1.3333	54	1

Alpha	0.05
Error Degrees of Freedom	72
Error Mean Square	0.287037
Critical Value of t	1.99346
Least Significant Difference	0.2055

Means with the same letter are not significantly different.

t Grouping	Mean	N	Treatment
A	1.8148	54	1
B	1.1667	54	2

LSD tests for incidences

Alpha	0.05
Error Degrees of Freedom	72
Error Mean Square	4.148148
Critical Value of t	1.99346
Least Significant Difference	1.6575

Means with the same letter are not significantly different.

t Grouping	Mean	N	Maize_ hybrid
A	6.8707	12	9

B	A	6.3707	12	6
B	A	6.0373	12	1
B	A	5.5373	12	7
B		5.2040	12	3
B	C	4.8707	12	4
D	C	3.3707	12	2
D	C	3.3707	12	5
D		2.0373	12	8

Alpha 0.05
Error Degrees of Freedom 72
Error Mean Square 4.148148
Critical Value of t 1.99346
Least Significant Difference 0.7814

Means with the same letter are not significantly different.

t Grouping	Mean	N	Rains_ season
A	5.0858	54	1
A	4.6185	54	2

Alpha 0.05
Error Degrees of Freedom 72
Error Mean Square 4.148148
Critical Value of t 1.99346
Least Significant Difference 0.7814

Means with the same letter are not significantly different.

t Grouping	Mean	N	Treatment
A	5.1481	54	1
A	4.5561	54	2

Table 26: LSD tests for Disease severity, incidences and response of maize hybrids to *Stenocarpella spp.* in Maseno University Research farm during short rains seasons of 2008 and long rains season of 2009 continues

---

LSD tests for Yield (Tonnes/ha)

Alpha 0.05
Error Degrees of Freedom 72
Error Mean Square 0.102778
Critical Value of t 1.99346
Least Significant Difference 0.2609

Means with the same letter are not significantly different.

t Grouping		Mean	N	Maize_ hybrid
	A	1.4145	12	1
B	A	1.2145	12	4
B		1.1478	12	3
B		1.1145	12	6
B		1.0978	12	2
B		1.0312	12	7
B		1.0145	12	9
B		1.0145	12	5
C		0.6478	12	8

Alpha 0.05
Error Degrees of Freedom 72
Error Mean Square 0.102778
Critical Value of t 1.99346
Least Significant Difference 0.123

Means with the same letter are not significantly different.

t Grouping	Mean	N	Rains_ season
A	1.12944	54	2
A	1.02548	54	1

Alpha 0.05
Error Degrees of Freedom 72
Error Mean Square 0.102778
Critical Value of t 1.99346
Least Significant Difference 0.123

Means with the same letter are not significantly different.

t Grouping	Mean	N	Treatment
A	1.21296	54	1
B	0.94196	54	2

LSD tests for Failed ears

Alpha 0.05
Error Degrees of Freedom 72
Error Mean Square 17.25
Critical Value of t 1.99346
Least Significant Difference 3.3801

Means with the same letter are not significantly different.

t Grouping	Mean	N	Maize_ hybrid
A	6.667	12	8
B A	3.417	12	6
B	2.500	12	3
B	2.250	12	5
B	2.000	12	7
B	1.917	12	4
B	1.917	12	9
B	1.500	12	2
B	1.250	12	1

Alpha 0.05
Error Degrees of Freedom 72
Error Mean Square 17.25
Critical Value of t 1.99346
Least Significant Difference 1.5934

Means with the same letter are not significantly different.

t Grouping	Mean	N	Rains season
A	3.1667	54	2
A	2.0370	54	1

Alpha 0.05
Error Degrees of Freedom 72
Error Mean Square 17.25
Critical Value of t 1.99346
Least Significant Difference 1.5934

Means with the same letter are not significantly different.

t Grouping	Mean	N	Treatment
A	2.6667	54	1
A	2.5370	54	2

Table 26: LSD tests for Disease severity, incidences and response of maize hybrids to *Stenocarpella spp.* in Maseno University Research farm during short rains seasons of 2008 and long rains season of 2009 continues

LSD tests for Plant stand

Alpha 0.05
Error Degrees of Freedom 72

Error Mean Square 0.611111
Critical Value of t 1.99346
Least Significant Difference 0.6362

Means with the same letter are not significantly different.

t Grouping	Mean	N	Maize_ hybrid
A	88.0000	12	5
B	86.6667	12	2
B	86.6667	12	8
C	85.5000	12	3
D	84.1667	12	1
E	82.3333	12	4
F	80.6667	12	7
G	77.8333	12	9
G	77.6667	12	6

Alpha 0.05
Error Degrees of Freedom 72
Error Mean Square 0.611111
Critical Value of t 1.99346
Least Significant Difference 0.2999

Means with the same letter are not significantly different.

t Grouping	Mean	N	Rains_ season
A	86.7222	54	2
B	79.8333	54	1

Alpha 0.05
Error Degrees of Freedom 72
Error Mean Square 0.611111
Critical Value of t 1.99346
Least Significant Difference 0.2999

Means with the same letter are not significantly different.

t Grouping	Mean	N	Treatment
A	84.2778	54	2
B	82.2778	54	1

LSD tests for Days to silking

Alpha 0.05
Error Degrees of Freedom 72
Error Mean Square 0.814815
Critical Value of t 1.99346
Least Significant Difference 0.7346

Means with the same letter are not significantly different.

t Grouping		Mean	N	Maize_ hybrid
	A	73.8333	12	6
B	A	73.6667	12	1
B	A	73.6667	12	5
B	A	73.6667	12	4
B	A	73.5000	12	3
B	A	73.5000	12	7
B	A	73.3333	12	9
B		73.0000	12	8
C		72.0000	12	2

Alpha 0.05
Error Degrees of Freedom 72

Error Mean Square 0.814815
Critical Value of t 1.99346
Least Significant Difference 0.3463
Means with the same letter are not significantly different.

t Grouping	Mean	N	Rains_ season
A	73.8889	54	1
B	72.8148	54	2

Table 26: LSD tests for Disease severity, incidences and response of maize hybrids to *Stenocarpella spp.* in Maseno University Research farm during short rains seasons of 2008 and long rains season of 2009 continues

LSD tests for Days to silking

Alpha 0.05
Error Degrees of Freedom 72
Error Mean Square 0.814815
Critical Value of t 1.99346
Least Significant Difference 0.3463
Means with the same letter are not significantly different.

t Grouping	Mean	N	Treatment
A	73.3519	54	1
A			
A	73.3519	54	2

Table 27: Correlation analysis for parameters under *Stenocarpella spp.* in Maseno University Research farm during short rains of 2008 and long rains of 2009

6 Variables: Treatment Maize hybrid Rains season Severity incidences Yield (Tonnes/ha)

Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
Treatment	108	1.50000	0.50233	162.00000	1.00000	2.00000
Maize_hybrid	108	5.00000	2.59403	540.00000	1.00000	9.00000
Rains_season	108	1.50000	0.50233	162.00000	1.00000	2.00000
Severity__	108	1.49074	0.67665	161.00000	1.00000	4.00000
incidences	108	4.85215	2.30280	524.03200	0.23700	12.00000
Yield__Tonnes_ha_	108	1.07746	0.36243	116.36600	0.28800	2.00000

Pearson Correlation Coefficients, N = 108
Prob > |r| under H0: Rho=0

	Treatment	Maize hybrid	Rains season	Severity	incidences	Yield (Tonnes/ ha)
Treatment	1.00000	0.00000	0.00000	-0.48117	-0.12914	-0.37561
Treatment		1.0000	1.0000	<.0001	0.1829	<.0001
Maize_hybrid	0.00000	1.00000	0.00000	-0.10117	0.02816	-0.39167
Maize hybrid	1.0000		1.0000	0.2975	0.7723	<.0001
Rains_season	0.00000	0.00000	1.00000	0.23371	-0.10194	0.14409
Rains season	1.0000	1.0000		0.0149	0.2938	0.1368
Severity__	-0.48117	-0.10117	0.23371	1.00000	-0.00019	0.17623
Severity	<.0001	0.2975	0.0149		0.9985	0.0681
incidences	-0.12914	0.02816	-0.10194	-0.00019	1.00000	0.20075
incidences	0.1829	0.7723	0.2938	0.9985		0.0372

Yield__Tonnes_ha_	-0.37561	-0.39167	0.14409	0.17623	0.20075	1.00000
Yield (Tonnes/ha)	<.0001	<.0001	0.1368	0.0681	0.0372	

Table 28: Means breakdown for parameters under *Stenocarpella spp.* in Maseno University Research farm during short rains of 2008 and long rains of 2009

------------------------------------ Effect=MAIZE_HYBRID ------------------------------------

Treatment	Maize hybrid	Rains season	Std. Error of SEVERITY__	Mean of SEVERITY__	Std. Error of Mean of INCIDENCES	Mean of INCIDENCES	Std. Error of Mean of YIELD__TONNES_HA_	YIELD__TONNES_HA_
.	1	.	0.11237	1.16667	0.85536	6.03733	0.11052	1.41450
.	2	.	0.24618	2.00000	0.25491	3.37067	0.05931	1.09783
.	3	.	0.18803	1.66667	0.30006	5.20400	0.12233	1.14783
.	4	.	0.17944	1.75000	0.22278	4.87067	0.07117	1.21450
.	5	.	0.13056	1.25000	0.52641	3.37067	0.10377	1.01450
.	6	.	0.14865	1.41667	0.55444	6.37067	0.10970	1.11450
.	7	.	0.11237	1.16667	0.23412	5.53733	0.07315	1.03117
.	8	.	0.28758	1.58333	0.30017	2.03733	0.06182	0.64783
.	9	.	0.19300	1.41667	0.86705	6.87067	0.09164	1.01450

Table 28: Means breakdown for parameters under *Stenocarpella spp.* in Maseno University Research farm during short rains of 2008 and long rains of 2009 continues

Treatment	Maize hybrid	Rains season	Std. Error of FAILED_ EARS	Mean of FAILED_ EARS	Std. Error of __PLANT_ STAND_	Mean of __PLANT_ STAND_	Std. Error of DAYS_TO_ SILKING	DAYS_TO_ SILKING
.	1	.	0.25000	1.25000	2.64814	84.1667	0.41439	73.6667
.	2	.	0.33710	1.50000	0.46602	86.6667	0.65134	72.0000
.	3	.	0.51493	2.50000	1.35680	85.5000	0.28868	73.5000
.	4	.	0.55675	1.91667	0.46602	82.3333	0.28427	73.6667
.	5	.	0.35086	2.25000	0.86164	88.0000	0.14213	73.6667
.	6	.	0.51432	3.41667	0.83787	77.6667	0.32177	73.8333
.	7	.	0.32567	2.00000	0.67794	80.6667	0.28868	73.5000
.	8	.	3.33788	6.66667	1.69819	86.6667	0.17408	73.0000
.	9	.	0.60875	1.91667	1.26031	77.8333	0.22473	73.3333

--------------------------------------- Effect=Overall ---------------------------------------

Treatment	Maize hybrid	Rains season	Std. Error of SEVERITY__	Mean of SEVERITY__	Std. Error of Mean of INCIDENCES	Mean of INCIDENCES	Std. Error of Mean of YIELD__TONNES_HA_	YIELD__TONNES_HA_
.	.	.	0.065111	1.49074	0.22159	4.85215	0.034875	1.07746

Treatment	Maize hybrid	Rains season	Std. Error of FAILED_ EARS	Mean of FAILED_ EARS	Std. Error of __PLANT_ STAND_	Mean of __PLANT_ STAND_	Std. Error of DAYS_TO_ SILKING	DAYS_TO_ SILKING
.	.	.	0.41014	2.60185	0.55078	83.2778	0.12080	73.3519

------------------------------------ Effect=RAINS_SEASON ------------------------------------

Std. Error
Std. Error Std. Error of Mean of
Maize Rains of Mean of of Mean of YIELD__TONNES_ YIELD__

Treatment	hybrid	season	SEVERITY__	SEVERITY__	INCIDENCES	INCIDENCES	HA_ TONNES_HA_	
.	.	1	0.06994	1.33333	0.34144	5.08580	0.052988	1.02548
.	.	2	0.10626	1.64815	0.28216	4.61850	0.044735	1.12944

Treatment	Maize hybrid	Rains season	Std. Error of FAILED_ EARS	Mean of FAILED_ EARS	Std. Error of __PLANT_ STAND_	Mean of __PLANT_ STAND_	DAYS_TO_ SILKING	DAYS_TO_ SILKING
.	.	1	0.22269	2.03704	0.57477	79.8333	0.12586	73.8889
.	.	2	0.78586	3.16667	0.66845	86.7222	0.17944	72.8148

-------------------------------------- Effect=TREATMENT ---------------------------------------

Treatment	Maize hybrid	Rains season	Std. Error of SEVERITY__	Mean of SEVERITY__	Std. Error of INCIDENCES	Mean of INCIDENCES	Std. Error of YIELD__TONNES_ HA_	YIELD__ TONNES_HA_
1	.	.	0.099172	1.81481	0.31100	5.14815	0.045484	1.21296
2	.	.	0.057614	1.16667	0.31341	4.55615	0.046360	0.94196

Treatment	Maize hybrid	Rains season	Std. Error of FAILED_ EARS	Mean of FAILED_ EARS	Std. Error of __PLANT_ STAND_	Mean of __PLANT_ STAND_	DAYS_TO_ SILKING	DAYS_TO_ SILKING
1	.	.	0.24083	2.66667	0.72704	82.2778	0.17164	73.3519
2	.	.	0.78806	2.53704	0.81152	84.2778	0.17164	73.3519

------------------------------- Effect=MAIZE_HYBRID*RAINS_SEASON -----------------------

Treatment	Maize hybrid	Rains season	Std. Error of SEVERITY__	Mean of SEVERITY__	Std. Error of INCIDENCES	Mean of INCIDENCES	Std. Error of YIELD__TONNES_ HA_	Mean of YIELD__ TONNES_HA_
.	1	1	0.16667	1.16667	1.38563	6.45617	0.13157	1.41067
.	1	2	0.16667	1.16667	1.10865	5.61850	0.19085	1.41833
.	2	1	0.22361	1.50000	0.37709	3.78950	0.09417	1.14400

Treatment	Maize hybrid	Rains season	Std. Error of FAILED_ EARS	Mean of FAILED_ EARS	Std. Error of __PLANT_ STAND_	Mean of __PLANT_ STAND_	DAYS_TO_ SILKING	DAYS_TO_ SILKING
.	1	1	0.30732	0.83333	0.42817	75.5000	0.00000	75.0000
.	1	2	0.33333	1.66667	0.79232	92.8333	0.21082	72.3333
.	2	1	0.33333	1.66667	0.30732	85.8333	0.36515	74.0000
.	2	2	0.34157	2.50000	0.27121	2.95183	0.07587	1.05167
.	3	1	0.22361	1.50000	0.56566	5.12283	0.16323	1.11067
.	3	2	0.30732	1.83333	0.27121	5.28517	0.19658	1.18500
.	4	1	0.21082	1.33333	0.37709	4.78950	0.07288	1.17733
.	4	2	0.16667	2.16667	0.27121	4.95183	0.12815	1.25167
.	5	1	0.16667	1.16667	0.73634	3.78950	0.18613	0.91067
.	5	2	0.21082	1.33333	0.77903	2.95183	0.09178	1.11833
.	6	1	0.22361	1.50000	0.97067	6.78950	0.19316	1.07733
.	6	2	0.21082	1.33333	0.58328	5.95183	0.12284	1.15167
.	7	1	0.00000	1.00000	0.37709	5.78950	0.08152	0.91067
.	7	2	0.21082	1.33333	0.27121	5.28517	0.10531	1.15167
.	8	1	0.21082	1.33333	0.56566	2.12283	0.07288	0.51067
.	8	2	0.54263	1.83333	0.27121	1.95183	0.06307	0.78500
.	9	1	0.34157	1.50000	1.52315	7.12283	0.16727	0.97733
.	9	2	0.21082	1.33333	0.98104	6.61850	0.09178	1.05167

Table 28: Means breakdown for parameters under *Stenocarpella spp.* in Maseno University Research farm during short rains of 2008 and long rains of 2009 continues

Std. Error Std. Error Std. Error

Treatment	Maize hybrid	Rains season	of FAILED_ EARS	Mean of FAILED_ EARS	of __PLANT_ STAND_	Mean of __PLANT_ STAND_	DAYS_TO_ SILKING	DAYS_TO_ SILKING
.	2	2	0.61464	1.3333	0.76376	87.5000	0.36515	70.0000
.	3	1	0.79232	2.8333	0.30732	81.1667	0.36515	74.0000
.	3	2	0.70317	2.1667	0.70317	89.8333	0.36515	73.0000
.	4	1	1.04616	1.8333	0.42817	81.5000	0.36515	74.0000
.	4	2	0.51640	2.0000	0.70317	83.1667	0.42164	73.3333
.	5	1	0.67082	2.5000	0.42817	85.5000	0.00000	74.0000
.	5	2	0.25820	2.0000	0.76376	90.5000	0.21082	73.3333
.	6	1	0.71492	2.6667	0.30732	75.1667	0.36515	74.0000
.	6	2	0.65405	4.1667	0.70317	80.1667	0.55777	73.6667
.	7	1	0.60093	1.8333	0.30732	78.8333	0.36515	74.0000
.	7	2	0.30732	2.1667	0.76376	82.5000	0.36515	73.0000
.	8	1	0.55777	2.6667	0.30732	81.1667	0.36515	73.0000
.	8	2	6.50470	10.6667	0.70317	92.1667	0.00000	73.0000
.	9	1	0.67082	1.5000	0.30732	73.8333	0.36515	73.0000
.	9	2	1.05409	2.3333	0.70317	81.8333	0.21082	73.6667

-------------------------------- Effect=TREATMENT*MAIZE_HYBRID ---------------------------

Treatment	Maize hybrid	Rains season	Std. Error of SEVERITY__	Mean of SEVERITY__	Std. Error of INCIDENCES	Mean of INCIDENCES	Std. Error of YIELD__TONNES_ HA_	YIELD__ TONNES_HA_
1	1	.	0.21082	1.33333	1.25610	6.33333	0.15221	1.55000
1	2	.	0.34157	2.50000	0.33333	3.66667	0.06667	1.23333
1	3	.	0.16667	2.16667	0.42817	5.50000	0.17013	1.28333
1	4	.	0.25820	2.00000	0.30732	5.16667	0.08466	1.35000
1	5	.	0.22361	1.50000	0.76012	3.66667	0.13844	1.15000
1	6	.	0.16667	1.83333	0.80277	6.66667	0.15000	1.25000
1	7	.	0.21082	1.33333	0.30732	5.83333	0.08433	1.16667
1	8	.	0.47726	1.83333	0.42164	2.33333	0.06009	0.78333
1	9	.	0.30732	1.83333	1.27584	7.16667	0.12042	1.15000
2	1	.	0.00000	1.00000	1.26745	5.74133	0.15241	1.27900
2	2	.	0.22361	1.50000	0.37384	3.07467	0.06072	0.96233
2	3	.	0.16667	1.16667	0.42164	4.90800	0.17191	1.01233
2	4	.	0.22361	1.50000	0.29815	4.57467	0.08818	1.07900
2	5	.	0.00000	1.00000	0.77873	3.07467	0.14446	0.87900
2	6	.	0.00000	1.00000	0.82042	6.07467	0.15202	0.97900
2	7	.	0.00000	1.00000	0.33420	5.24133	0.09533	0.89567
2	8	.	0.33333	1.33333	0.42852	1.74133	0.07655	0.51233
2	9	.	0.00000	1.00000	1.28259	6.57467	0.12292	0.87900

Treatment	Maize hybrid	Rains season	Std. Error of FAILED_ EARS	Mean of FAILED_ EARS	Std. Error of __PLANT_ STAND_	Mean of __PLANT_ STAND_	DAYS_TO_ SILKING	DAYS_TO_ SILKING
1	1	.	0.33333	1.66667	3.67348	83.1667	0.61464	73.6667
1	2	.	0.60093	1.83333	0.33333	85.6667	0.96609	72.0000
1	3	.	0.79232	2.83333	1.72723	84.5000	0.42817	73.5000
1	4	.	0.91894	2.33333	0.33333	81.3333	0.42164	73.6667
1	5	.	0.49441	2.66667	0.96609	87.0000	0.21082	73.6667
1	6	.	0.73030	4.00000	0.91894	76.6667	0.47726	73.8333
1	7	.	0.42817	2.50000	0.66667	79.6667	0.42817	73.5000
1	8	.	0.73030	4.00000	2.24598	85.6667	0.25820	73.0000
1	9	.	0.98036	2.16667	1.57938	76.8333	0.33333	73.3333
2	1	.	0.30732	0.83333	4.11839	85.1667	0.61464	73.6667
2	2	.	0.30732	1.16667	0.66667	87.6667	0.96609	72.0000
2	3	.	0.70317	2.16667	2.17179	86.5000	0.42817	73.5000

2	4	.	0.67082	1.50000	0.66667	83.3333	0.42164	73.6667
2	5	.	0.47726	1.83333	1.39044	89.0000	0.21082	73.6667
2	6	.	0.70317	2.83333	1.35810	78.6667	0.47726	73.8333
2	7	.	0.42817	1.50000	1.08525	81.6667	0.42817	73.5000
2	8	.	6.75607	9.33333	2.69155	87.6667	0.25820	73.0000
2	9	.	0.80277	1.66667	2.02347	78.8333	0.33333	73.3333

-------------------------------- Effect=TREATMENT*RAINS_SEASON ---------------------------

Treatment	Maize hybrid	Rains season	Std. Error of SEVERITY__	Mean of SEVERITY__	Std. Error of INCIDENCES	Mean of INCIDENCES	Std. Error of Mean of YIELD__TONNES_HA_	YIELD__TONNES_HA_
1	.	1	0.10675	1.66667	0.48574	5.29630	0.069191	1.18148
1	.	2	0.16436	1.96296	0.39585	5.00000	0.059756	1.24444
2	.	1	0.00000	1.00000	0.48574	4.87530	0.069191	0.86948
2	.	2	0.10675	1.33333	0.39585	4.23700	0.059756	1.01444

Table 28: Means breakdown for parameters under *Stenocarpella spp.* in Maseno University Research farm during short rains of 2008 and long rains of 2009 continues

Treatment	Maize hybrid	Rains season	Std. Error of FAILED_ EARS	Mean of FAILED_ EARS	Std. Error of __PLANT_ STAND_	Mean of __PLANT_ STAND_	Std. Error of DAYS_TO_ SILKING	Mean of DAYS_TO_ SILKING
1	.	1	0.32629	2.51852	0.81475	79.3333	0.17969	73.8889
1	.	2	0.35820	2.81481	0.90792	85.2222	0.25619	72.8148
2	.	1	0.27906	1.55556	0.81475	80.3333	0.17969	73.8889
2	.	2	1.54272	3.51852	0.90792	88.2222	0.25619	72.8148

-------------------------- Effect=TREATMENT*MAIZE_HYBRID*RAINS_SEASON --------

Treatment	Maize hybrid	Rains season	Std. Error of SEVERITY__	Mean of SEVERITY__	Std. Error of INCIDENCES	Mean of INCIDENCES	Std. Error of Mean of YIELD__TONNES_HA_	YIELD__TONNES_HA_
1	1	1	0.33333	1.33333	2.18581	6.66667	0.17638	1.56667
1	1	2	0.33333	1.33333	1.73205	6.00000	0.29059	1.53333
1	2	1	0.00000	2.00000	0.57735	4.00000	0.10000	1.30000
1	2	2	0.57735	3.00000	0.33333	3.33333	0.08819	1.16667
1	3	1	0.00000	2.00000	0.88192	5.33333	0.23333	1.26667
1	3	2	0.33333	2.33333	0.33333	5.66667	0.30000	1.30000
1	4	1	0.33333	1.66667	0.57735	5.00000	0.03333	1.33333
1	4	2	0.33333	2.33333	0.33333	5.33333	0.18559	1.36667
1	5	1	0.33333	1.33333	1.15470	4.00000	0.27285	1.06667
1	5	2	0.33333	1.66667	1.20185	3.33333	0.12019	1.23333

Treatment	Maize hybrid	Rains season	Std. Error of FAILED_ EARS	Mean of FAILED_ EARS	Std. Error of __PLANT_ STAND_	Mean of __PLANT_ STAND_	Std. Error of DAYS_TO_ SILKING	Mean of DAYS_TO_ SILKING
1	1	1	0.33333	1.33333	0.57735	75.0000	0.00000	75.0000
1	1	2	0.57735	2.00000	0.66667	91.3333	0.33333	72.3333
1	2	1	0.57735	2.00000	0.33333	85.3333	0.57735	74.0000
1	2	2	1.20185	1.66667	0.57735	86.0000	0.57735	70.0000
1	3	1	1.20185	3.33333	0.33333	80.6667	0.57735	74.0000
1	3	2	1.20185	2.33333	0.33333	88.3333	0.57735	73.0000
1	4	1	1.85592	2.33333	0.57735	81.0000	0.57735	74.0000
1	4	2	0.88192	2.33333	0.33333	81.6667	0.66667	73.3333
1	5	1	1.00000	3.00000	0.57735	85.0000	0.00000	74.0000

1	5	2	0.33333	2.33333	0.57735	89.0000	0.33333	73.3333

-------------------------- Effect=TREATMENT*MAIZE_HYBRID*RAINS_SEASON ---------
(continued)

Treatment	Maize hybrid	Rains season	Std. Error of SEVERITY__	Mean of SEVERITY__	Std. Error of INCIDENCES	Mean of INCIDENCES	Std. Error of YIELD__TONNES_HA_	Mean of YIELD__TONNES_HA_
1	6	1	0.00000	2.00000	1.52753	7.00000	0.28480	1.23333
1	6	2	0.33333	1.66667	0.88192	6.33333	0.17638	1.26667
1	7	1	0.00000	1.00000	0.57735	6.00000	0.06667	1.06667
1	7	2	0.33333	1.66667	0.33333	5.66667	0.14530	1.26667
1	8	1	0.33333	1.66667	0.88192	2.33333	0.03333	0.66667
1	8	2	1.00000	2.00000	0.33333	2.33333	0.05774	0.90000
1	9	1	0.57735	2.00000	2.40370	7.33333	0.24037	1.13333
1	9	2	0.33333	1.66667	1.52753	7.00000	0.12019	1.16667
2	1	1	0.00000	1.00000	2.18581	6.24567	0.17638	1.25467
2	1	2	0.00000	1.00000	1.73205	5.23700	0.29059	1.30333
2	2	1	0.00000	1.00000	0.57735	3.57900	0.10000	0.98800
2	2	2	0.00000	2.00000	0.33333	2.57033	0.08819	0.93667
2	3	1	0.00000	1.00000	0.88192	4.91233	0.23333	0.95467
2	3	2	0.33333	1.33333	0.33333	4.90367	0.30000	1.07000
2	4	1	0.00000	1.00000	0.57735	4.57900	0.03333	1.02133
2	4	2	0.00000	2.00000	0.33333	4.57033	0.18559	1.13667
2	5	1	0.00000	1.00000	1.15470	3.57900	0.27285	0.75467
2	5	2	0.00000	1.00000	1.20185	2.57033	0.12019	1.00333
2	6	1	0.00000	1.00000	1.52753	6.57900	0.28480	0.92133
2	6	2	0.00000	1.00000	0.88192	5.57033	0.17638	1.03667
2	7	1	0.00000	1.00000	0.57735	5.57900	0.06667	0.75467

Table 28: Means breakdown for parameters under *Stenocarpella spp.* in Maseno University Research farm during short rains of 2008 and long rains of 2009 continues

Treatment	Maize hybrid	Rains season	Std. Error of FAILED_ EARS	Mean of FAILED_ EARS	Std. Error of __PLANT_ STAND_	Mean of __PLANT_ STAND_	Std. Error of DAYS_TO_ SILKING	Mean of DAYS_TO_ SILKING
1	6	1	0.8819	3.3333	0.33333	74.6667	0.57735	74.0000
1	6	2	1.2019	4.6667	0.33333	78.6667	0.88192	73.6667
1	7	1	0.8819	2.3333	0.33333	78.3333	0.57735	74.0000
1	7	2	0.3333	2.6667	0.57735	81.0000	0.57735	73.0000
1	8	1	0.8819	3.3333	0.33333	80.6667	0.57735	73.0000
1	8	2	1.2019	4.6667	0.33333	90.6667	0.00000	73.0000
1	9	1	1.2019	1.6667	0.33333	73.3333	0.57735	73.0000
1	9	2	1.7638	2.6667	0.33333	80.3333	0.33333	73.6667
2	1	1	0.3333	0.3333	0.57735	76.0000	0.00000	75.0000
2	1	2	0.3333	1.3333	0.66667	94.3333	0.33333	72.3333
2	2	1	0.3333	1.3333	0.33333	86.3333	0.57735	74.0000
2	2	2	0.5774	1.0000	0.57735	89.0000	0.57735	70.0000
2	3	1	1.2019	2.3333	0.33333	81.6667	0.57735	74.0000
2	3	2	1.0000	2.0000	0.33333	91.3333	0.57735	73.0000
2	4	1	1.3333	1.3333	0.57735	82.0000	0.57735	74.0000
2	4	2	0.6667	1.6667	0.33333	84.6667	0.66667	73.3333
2	5	1	1.0000	2.0000	0.57735	86.0000	0.00000	74.0000
2	5	2	0.3333	1.6667	0.57735	92.0000	0.33333	73.3333
2	6	1	1.1547	2.0000	0.33333	75.6667	0.57735	74.0000
2	6	2	0.6667	3.6667	0.33333	81.6667	0.88192	73.6667
2	7	1	0.8819	1.3333	0.33333	79.3333	0.57735	74.0000

-------------------------- Effect=TREATMENT*MAIZE_HYBRID*RAINS_SEASON ---------

(continued)

Treatment	Maize hybrid	Rains season	Std. Error of SEVERITY__	Mean of SEVERITY__	Std. Error of INCIDENCES	Mean of INCIDENCES	Std. Error of Mean of YIELD__TONNES_HA_	Mean of YIELD__TONNES_HA_
2	7	2	0.00000	1.00000	0.33333	4.90367	0.14530	1.03667
2	8	1	0.00000	1.00000	0.88192	1.91233	0.03333	0.35467
2	8	2	0.66667	1.66667	0.33333	1.57033	0.05774	0.67000
2	9	1	0.00000	1.00000	2.40370	6.91233	0.24037	0.82133
2	9	2	0.00000	1.00000	1.52753	6.23700	0.12019	0.93667

Treatment	Maize hybrid	Rains season	Std. Error of FAILED_EARS	Mean of FAILED_EARS	Std. Error of __PLANT_STAND_	Mean of __PLANT_STAND_	Std. Error of DAYS_TO_SILKING	Mean of DAYS_TO_SILKING
2	7	2	0.3333	1.6667	0.57735	84.0000	0.57735	73.0000
2	8	1	0.5774	2.0000	0.33333	81.6667	0.57735	73.0000
2	8	2	13.1951	16.6667	0.33333	93.6667	0.00000	73.0000
2	9	1	0.8819	1.3333	0.33333	74.3333	0.57735	73.0000
2	9	2	1.5275	2.0000	0.33333	83.3333	0.33333	73.6667

Appendix 9: Disease severity, incidences and response of maize hybrids to Stenocarpella spp. in Maseno University Research farm during short rains seasons of 2008

Table 29: Anova for Disease severity, incidences and response of maize hybrids to *Stenocarpella spp.* in Maseno University Research farm during short rains seasons of 2008

Dependent Variable: Severity

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	16.31481481	0.95969499	2.16	0.0258
Error	36	16.00000000	0.44444444		
Corrected Total	53	32.31481481			

R-Square	Coeff Var	Root MSE	Severity__ Mean
0.504871	40.44944	0.666667	1.648148

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Maize_hybrid	8	10.14814815	1.26851852	2.85	0.0145
Treatment	1	5.35185185	5.35185185	12.04	0.0014
Treatment*Maize_hybr	8	0.81481481	0.10185185	0.23	0.9830

Dependent Variable: incidences

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	130.5259482	7.6779970	2.84	0.0042
Error	36	97.3333333	2.7037037		
Corrected Total	53	227.8592815			

R-Square	Coeff Var	Root MSE	incidences Mean
0.572836	35.60234	1.644294	4.618500

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Maize_hybrid	8	122.6666667	15.3333333	5.67	0.0001
Treatment	1	7.8592815	7.8592815	2.91	0.0968
Treatment*Maize_hybr	8	0.0000000	0.0000000	0.00	1.0000

Table 29: Anova for Disease severity, incidences and response of maize hybrids to *Stenocarpella spp.* in Maseno University Research farm during short rains seasons of 2008 continues

Dependent Variable: Yield (Tonnes/ha)

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	2.11415000	0.12436176	1.24	0.2857
Error	36	3.61333333	0.10037037		
Corrected Total	53	5.72748333			

R-Square	Coeff Var	Root MSE	Yield__Tonnes_ha_ Mean
0.369124	28.05032	0.316813	1.129444

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Maize_hybrid	8	1.40000000	0.17500000	1.74	0.1217
Treatment	1	0.71415000	0.71415000	7.12	0.0114
Treatment*Maize_hybr	8	0.00000000	0.00000000	0.00	1.0000

Dependent Variable: Failed ears

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	632.166667	37.186275	1.18	0.3279
Error	36	1135.333333	31.537037		
Corrected Total	53	1767.500000			

R-Square	Coeff Var	Root MSE	Failed_ears Mean
0.357661	177.3406	5.615785	3.166667

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Maize_hybrid	8	409.6666667	51.2083333	1.62	0.1524
Treatment	1	6.6851852	6.6851852	0.21	0.6480
Treatment*Maize_hybr	8	215.8148148	26.9768519	0.86	0.5618

Dependent Variable: Plant stand

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	1254.833333	73.813725	110.72	<.0001
Error	36	24.000000	0.666667		
Corrected Total	53	1278.833333			

R-Square	Coeff Var	Root MSE	__Plant_stand_ Mean
0.981233	0.941508	0.816497	86.72222

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Maize_hybrid	8	1133.333333	141.666667	212.50	<.0001
Treatment	1	121.500000	121.500000	182.25	<.0001
Treatment*Maize_hybr	8	0.000000	0.000000	0.00	1.0000

Dependent Variable: Days to silking

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	61.48148148	3.61655773	4.25	0.0001
Error	36	30.66666667	0.85185185		
Corrected Total	53	92.14814815			

R-Square	Coeff Var	Root MSE	Days_to_silking Mean
0.667203	1.267542	0.922958	72.81481

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Maize_hybrid	8	61.48148148	7.68518519	9.02	<.0001
Treatment	1	0.00000000	0.00000000	0.00	1.0000
Treatment*Maize_hybr	8	0.00000000	0.00000000	0.00	1.0000

Table 30: LSD tests for Disease severity, incidences and response of maize hybrids to *Stenocarpella spp.* in Maseno University Research farm during short rains seasons of 2008

NOTE: 1. This test controls the Type I comparison wise error rate, not the experiment wise error rate.
2. Maize hybrids 1, 2, 3, 4, 5, 6, 7, 8, 9 are EH10, EH13, EH14, EH15, EH16, H515, H516, H614D and P3253 respectively; Treatments 1, 2 are inoculated and non-innoculated

---

LSD tests for Severity

Alpha	0.05
Error Degrees of Freedom	36
Error Mean Square	0.444444
Critical Value of t	2.02809
Least Significant Difference	0.7806

Means with the same letter are not significantly different.

t Grouping		Mean	N	Maize_ hybrid
	A	2.5000	6	2
	A	2.1667	6	4
B	A	1.8333	6	3
B	A	1.8333	6	8
B		1.3333	6	9
B		1.3333	6	5
B		1.3333	6	7
B		1.3333	6	6
B		1.1667	6	1

Alpha	0.05
Error Degrees of Freedom	36
Error Mean Square	0.444444
Critical Value of t	2.02809
Least Significant Difference	0.368

Means with the same letter are not significantly different.

t Grouping	Mean	N	Treatments
A	1.9630	27	1
B	1.3333	27	2

LSD tests for incidences

Alpha 0.05
Error Degrees of Freedom 36
Error Mean Square 2.703704
Critical Value of t 2.02809
Least Significant Difference 1.9253

Means with the same letter are not significantly different

t Grouping	Mean	N	Maize_ hybrid
A	6.6185	6	9
A	5.9518	6	6
A	5.6185	6	1
A	5.2852	6	3
A	5.2852	6	7
A	4.9518	6	4
B	2.9518	6	2
B	2.9518	6	5
B	1.9518	6	8

Alpha 0.05
Error Degrees of Freedom 36
Error Mean Square 2.703704
Critical Value of t 2.02809
Least Significant Difference 0.9076

Means with the same letter are not significantly different.

t Grouping	Mean	N	Treatment
A	5.0000	27	1
A	4.2370	27	2

Table 30: LSD tests for Disease severity, incidences and response of maize hybrids to *Stenocarpella spp.* in Maseno University Research farm during short rains seasons of 2008 continues

LSD tests for Yield (Tonnes/ha)

Alpha 0.05
Error Degrees of Freedom 36
Error Mean Square 0.10037
Critical Value of t 2.02809
Least Significant Difference 0.371

Means with the same letter are not significantly different.

t Grouping	Mean	N	Maize_ hybrid
A	1.4183	6	1
A	1.2517	6	4
A	1.1850	6	3
B A	1.1517	6	6
B A	1.1517	6	7
B A	1.1183	6	5
B A	1.0517	6	2
B A	1.0517	6	9
B	0.7850	6	8

Alpha 0.05
Error Degrees of Freedom 36
Error Mean Square 0.10037
Critical Value of t 2.02809

Least Significant Difference 0.1749
Means with the same letter are not significantly different.

t Grouping	Mean	N	Treatment
A	1.24444	27	1
B	1.01444	27	2

LSD tests for Failed ears

Alpha 0.05
Error Degrees of Freedom 36
Error Mean Square 31.53704
Critical Value of t 2.02809
Least Significant Difference 6.5756
Means with the same letter are not significantly different.

t Grouping		Mean	N	Maize_ hybrid
	A	10.667	6	8
B	A	4.167	6	6
B		2.333	6	9
B		2.167	6	3
B		2.167	6	7
B		2.000	6	4
B		2.000	6	5
B		1.667	6	1
B		1.333	6	2

Alpha 0.05
Error Degrees of Freedom 36
Error Mean Square 31.53704
Critical Value of t 2.02809
Least Significant Difference 3.0998
Means with the same letter are not significantly different.

t Grouping	Mean	N	Treatment
A	3.519	27	2
A	2.815	27	1

LSD tests for Plant stand

Alpha 0.05
Error Degrees of Freedom 36
Error Mean Square 0.666667
Critical Value of t 2.02809
Least Significant Difference 0.9561
Means with the same letter are not significantly different.

t Grouping		Mean	N	Maize_ hybrid
	A	92.8333	6	1
	A	92.1667	6	8
	B	90.5000	6	5
	B	89.8333	6	3
	C	87.5000	6	2
	D	83.1667	6	4
E	D	82.5000	6	7
E		81.8333	6	9
	F	80.1667	6	6

Table 30: LSD tests for Disease severity, incidences and response of maize hybrids to *Stenocarpella spp.* in Maseno University Research farm during short rains seasons of 2008 continues

LSD tests for Plant stand continues

Alpha 0.05
Error Degrees of Freedom 36

Error Mean Square 0.666667
Critical Value of t 2.02809
Least Significant Difference 0.4507
Means with the same letter are not significantly different.

t Grouping	Mean	N	Treatment
A	88.2222	27	2
B	85.2222	27	1

LSD tests for Days to silking

Alpha 0.05
Error Degrees of Freedom 36
Error Mean Square 0.851852
Critical Value of t 2.02809
Least Significant Difference 1.0807
Means with the same letter are not significantly different.

t Grouping		Mean	N	Maize_ hybrid
	A	73.6667	6	9
	A	73.6667	6	6
B	A	73.3333	6	5
B	A	73.3333	6	4
B	A	73.0000	6	3
B	A	73.0000	6	8
B	A	73.0000	6	7
B		72.3333	6	1
C		70.0000	6	2

Alpha 0.05
Error Degrees of Freedom 36
Error Mean Square 0.851852
Critical Value of t 2.02809
Least Significant Difference 0.5095
Means with the same letter are not significantly different.

t Grouping	Mean	N	Treatment
A	72.8148	27	1
A	72.8148	27	2

Table 31: Correlation analysis for parameters under *Stenocarpella spp.* in Maseno University Research farm during short rains of 2008

5 Variables: Treatment Maize_hybrid Severity__ incidences Yield__Tonnes_ha_

Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
Treatment	54	1.50000	0.50469	81.00000	1.00000	2.00000
Maize_hybrid	54	5.00000	2.60623	270.00000	1.00000	9.00000
Severity__	54	1.64815	0.78084	89.00000	1.00000	4.00000
incidences	54	4.61850	2.07346	249.39900	0.23700	9.00000
Yield__Tonnes_ha_	54	1.12944	0.32873	60.99000	0.57000	2.00000

Pearson Correlation Coefficients, N = 54
Prob > |r| under H0: Rho=0

	Treatment	Maize_ hybrid	Severity__	incidences	Yield__ Tonnes_ ha_
Treatment	1.00000	0.00000	-0.40696	-0.18572	-0.35311
Treatment		1.0000	0.0023	0.1788	0.0088
Maize_hybrid	0.00000	1.00000	-0.17616	0.04190	-0.32153

Maize hybrid	1.0000		0.2026	0.7636	0.0178
Severity__	-0.40696	-0.17616	1.00000	-0.04096	-0.00004
Severity %	0.0023	0.2026		0.7687	0.9998
incidences	-0.18572	0.04190	-0.04096	1.00000	0.13201
incidences	0.1788	0.7636	0.7687		0.3413
Yield__Tonnes_ha_	-0.35311	-0.32153	-0.00004	0.13201	1.00000
Yield (Tonnes/ha)	0.0088	0.0178	0.9998	0.3413	

Table 32: Means breakdown for parameters under *Stenocarpella spp.* in Maseno University Research farm during short rains of 2008

------------------------------------ Effect=MAIZE_HYBRID --------------------------------------

Treatment	Maize hybrid	Std. Error of SEVERITY__	Mean of SEVERITY__	Std. Error of INCIDENCES	Mean of INCIDENCES	Std. Error of Mean of YIELD__TONNES_HA_	YIELD__TONNES_HA_
.	1	0.16667	1.16667	1.10865	5.61850	0.19085	1.41833
.	2	0.34157	2.50000	0.27121	2.95183	0.07587	1.05167
.	3	0.30732	1.83333	0.27121	5.28517	0.19658	1.18500
.	4	0.16667	2.16667	0.27121	4.95183	0.12815	1.25167
.	5	0.21082	1.33333	0.77903	2.95183	0.09178	1.11833
.	6	0.21082	1.33333	0.58328	5.95183	0.12284	1.15167
.	7	0.21082	1.33333	0.27121	5.28517	0.10531	1.15167
.	8	0.54263	1.83333	0.27121	1.95183	0.06307	0.78500
.	9	0.21082	1.33333	0.98104	6.61850	0.09178	1.05167

Treatment	Maize hybrid	Std. Error of FAILED_ EARS	Mean of FAILED_ EARS	Std. Error of __PLANT_ STAND_	Mean of __PLANT_ STAND_	Std. Error of DAYS_TO_ SILKING	Mean of DAYS_TO_ SILKING
.	1	0.33333	1.6667	0.79232	92.8333	0.21082	72.3333
.	2	0.61464	1.3333	0.76376	87.5000	0.36515	70.0000
.	3	0.70317	2.1667	0.70317	89.8333	0.36515	73.0000
.	4	0.51640	2.0000	0.70317	83.1667	0.42164	73.3333
.	5	0.25820	2.0000	0.76376	90.5000	0.21082	73.3333
.	6	0.65405	4.1667	0.70317	80.1667	0.55777	73.6667
.	7	0.30732	2.1667	0.76376	82.5000	0.36515	73.0000
.	8	6.50470	10.6667	0.70317	92.1667	0.00000	73.0000
.	9	1.05409	2.3333	0.70317	81.8333	0.21082	73.6667

--------------------------------------- Effect=Overall ---------------------------------------

Treatment	Maize hybrid	Std. Error of SEVERITY__	Mean of SEVERITY__	Std. Error of INCIDENCES	Mean of INCIDENCES	Std. Error of Mean of YIELD__TONNES_HA_	YIELD__TONNES_HA_
.	.	0.10626	1.64815	0.28216	4.6185	0.044735	1.12944

Treatment	Maize hybrid	Std. Error of FAILED_ EARS	Mean of FAILED_ EARS	Std. Error of __PLANT_ STAND_	Mean of __PLANT_ STAND_	Std. Error of DAYS_TO_ SILKING	Mean of DAYS_TO_ SILKING
.	.	0.78586	3.16667	0.66845	86.7222	0.17944	72.8148

-------------------------------------- Effect=TREATMENT --------------------------------------

Treatment	Maize hybrid	Std. Error of SEVERITY__	Mean of SEVERITY__	Std. Error of INCIDENCES	Mean of INCIDENCES	Std. Error of Mean of YIELD__TONNES_HA_	YIELD__TONNES_HA_

1	.	0.16436	1.96296	0.39585	5.000	0.059756	1.24444
2	.	0.10675	1.33333	0.39585	4.237	0.059756	1.01444

Treatment	Maize hybrid	Std. Error of FAILED_ EARS	Mean of FAILED_ EARS	Std. Error of __PLANT_ STAND_	Mean of __PLANT_ STAND_	Std. Error of DAYS_TO_ SILKING	Mean of DAYS_TO_ SILKING
1	.	0.35820	2.81481	0.90792	85.2222	0.25619	72.8148
2	.	1.54272	3.51852	0.90792	88.2222	0.25619	72.8148

-------------------------------- Effect=TREATMENT*MAIZE_HYBRID ---------------------------------

Treatment	Maize hybrid	Std. Error of SEVERITY__	Mean of SEVERITY__	Std. Error of INCIDENCES	Mean of INCIDENCES	Std. Error of YIELD__TONNES_HA_	Mean of YIELD__ TONNES_HA_
1	1	0.33333	1.33333	1.73205	6.00000	0.29059	1.53333
1	2	0.57735	3.00000	0.33333	3.33333	0.08819	1.16667
1	3	0.33333	2.33333	0.33333	5.66667	0.30000	1.30000
1	4	0.33333	2.33333	0.33333	5.33333	0.18559	1.36667
1	5	0.33333	1.66667	1.20185	3.33333	0.12019	1.23333
1	6	0.33333	1.66667	0.88192	6.33333	0.17638	1.26667
1	7	0.33333	1.66667	0.33333	5.66667	0.14530	1.26667
1	8	1.00000	2.00000	0.33333	2.33333	0.05774	0.90000
1	9	0.33333	1.66667	1.52753	7.00000	0.12019	1.16667
2	1	0.00000	1.00000	1.73205	5.23700	0.29059	1.30333
2	2	0.00000	2.00000	0.33333	2.57033	0.08819	0.93667
2	3	0.33333	1.33333	0.33333	4.90367	0.30000	1.07000

Treatment	Maize hybrid	Std. Error of FAILED_ EARS	Mean of FAILED_ EARS	Std. Error of __PLANT_ STAND_	Mean of __PLANT_ STAND_	Std. Error of DAYS_TO_ SILKING	Mean of DAYS_TO_ SILKING
1	1	0.57735	2.00000	0.66667	91.3333	0.33333	72.3333
1	2	1.20185	1.66667	0.57735	86.0000	0.57735	70.0000
1	3	1.20185	2.33333	0.33333	88.3333	0.57735	73.0000
1	4	0.88192	2.33333	0.33333	81.6667	0.66667	73.3333
1	5	0.33333	2.33333	0.57735	89.0000	0.33333	73.3333
1	6	1.20185	4.66667	0.33333	78.6667	0.88192	73.6667
1	7	0.33333	2.66667	0.57735	81.0000	0.57735	73.0000
1	8	1.20185	4.66667	0.33333	90.6667	0.00000	73.0000
1	9	1.76383	2.66667	0.33333	80.3333	0.33333	73.6667
2	1	0.33333	1.33333	0.66667	94.3333	0.33333	72.3333
2	2	0.57735	1.00000	0.57735	89.0000	0.57735	70.0000
2	3	1.00000	2.00000	0.33333	91.3333	0.57735	73.0000

Table 32: Means breakdown for parameters under *Stenocarpella spp.* in Maseno University Research farm during short rains of 2008 continues

-------------------------------- Effect=TREATMENT*MAIZE_HYBRID ---------------------------------
(continued)

Treatment	Maize hybrid	Std. Error of SEVERITY__	Mean of SEVERITY__	Std. Error of INCIDENCES	Mean of INCIDENCES	Std. Error of YIELD__TONNES_HA_	Mean of YIELD__ TONNES_HA_
2	4	0.00000	2.00000	0.33333	4.57033	0.18559	1.13667
2	5	0.00000	1.00000	1.20185	2.57033	0.12019	1.00333
2	6	0.00000	1.00000	0.88192	5.57033	0.17638	1.03667
2	7	0.00000	1.00000	0.33333	4.90367	0.14530	1.03667
2	8	0.66667	1.66667	0.33333	1.57033	0.05774	0.67000
2	9	0.00000	1.00000	1.52753	6.23700	0.12019	0.93667

Std. Error Std. Error Std. Error
of Mean of of Mean of of Mean of

Treatment	Maize hybrid	FAILED_ EARS	FAILED_ EARS	__PLANT_ STAND_	__PLANT_ STAND_	DAYS_TO_ SILKING
2	4	0.6667	1.6667	0.33333	84.6667	0.66667	73.3333
2	5	0.3333	1.6667	0.57735	92.0000	0.33333	73.3333
2	6	0.6667	3.6667	0.33333	81.6667	0.88192	73.6667
2	7	0.3333	1.6667	0.57735	84.0000	0.57735	73.0000
2	8	13.1951	16.6667	0.33333	93.6667	0.00000	73.0000
2	9	1.5275	2.0000	0.33333	83.3333	0.33333	73.6667

Appendix 10: Disease severity, incidences and response of maize hybrids to Stenocarpella spp. in Maseno University Research farm during long rain seasons of 2009

Table 33: Anova for Disease severity, incidences and response of maize hybrids to *Stenocarpella spp.* in Maseno University Research farm during long rains season of 2009

Dependent Variable: Severity

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	9.33333333	0.54901961	4.24	0.0001
Error	36	4.66666667	0.12962963		
Corrected Total	53	14.00000000			

R-Square	Coeff Var	Root MSE	Severity__ Mean
0.666667	27.00309	0.360041	1.333333

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Maize_hybrid	8	1.66666667	0.20833333	1.61	0.1572
Treatment	1	6.00000000	6.00000000	46.29	<.0001
Treatment*Maize_hybr	8	1.66666667	0.20833333	1.61	0.1572

Dependent Variable: incidences

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	132.3186794	7.7834517	1.39	0.1975
Error	36	201.3333333	5.5925926		
Corrected Total	53	333.6520128			

R-Square	Coeff Var	Root MSE	incidences Mean
0.396577	46.49943	2.364866	5.085796

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Maize_hybrid	8	129.9259259	16.2407407	2.90	0.0132
Treatment	1	2.3927535	2.3927535	0.43	0.5172
Treatment*Maize_hybr	8	0.0000000	0.0000000	0.00	1.0000

Dependent Variable: Yield (Tonnes/ha)

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	4.24895881	0.24993875	2.38	0.0143
Error	36	3.78666667	0.10518519		
Corrected Total	53	8.03562548			

R-Square	Coeff Var	Root MSE	Yield__Tonnes_ha_ Mean
0.528765	31.62638	0.324323	1.025481

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Maize_hybrid	8	2.93481481	0.36685185	3.49	0.0045
Treatment	1	1.31414400	1.31414400	12.49	0.0011
Treatment*Maize_hybr	8	0.00000000	0.00000000	0.00	1.0000

Dependent Variable: Failed ears

Sum of

Source	DF	Squares	Mean Square	F Value	Pr > F
Model	17	35.2592593	2.0740741	0.70	0.7820
Error	36	106.6666667	2.9629630		
Corrected Total	53	141.9259259			

R-Square	Coeff Var	Root MSE	Failed_ears Mean
0.248434	84.50145	1.721326	2.037037

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Maize_hybrid	8	21.59259259	2.69907407	0.91	0.5185
Treatment	1	12.51851852	12.51851852	4.22	0.0471
Treatment*Maize_hybr	8	1.14814815	0.14351852	0.05	0.9999

Table 33: Anova for Disease severity, incidences and response of maize hybrids to *Stenocarpella spp.* in Maseno University Research farm during long rains season of 2009 continues

Dependent Variable: Plant stand

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	925.5000000	54.4411765	97.99	<.0001
Error	36	20.0000000	0.5555556		
Corrected Total	53	945.5000000			

R-Square	Coeff Var	Root MSE	__Plant_stand_ Mean
0.978847	0.933640	0.745356	79.83333

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Maize_hybrid	8	912.0000000	114.0000000	205.20	<.0001
Treatment	1	13.5000000	13.5000000	24.30	<.0001
Treatment*Maize_hybr	8	0.0000000	0.0000000	0.00	1.0000

Dependent Variable: Days to silking

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	17.33333333	1.01960784	1.31	0.2408
Error	36	28.00000000	0.77777778		
Corrected Total	53	45.33333333			

R-Square	Coeff Var	Root MSE	Days_to_silking Mean
0.382353	1.193572	0.881917	73.88889

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Maize_hybrid	8	17.33333333	2.16666667	2.79	0.0165
Treatment	1	0.00000000	0.00000000	0.00	1.0000
Treatment*Maize_hybr	8	0.00000000	0.00000000	0.00	1.0000

Table 34: LSD tests for Disease severity, incidences and response of maize hybrids to *Stenocarpella spp.* in Maseno University Research farm during long rains seasons of 2009

NOTE: 1. This test controls the Type I comparison wise error rate, not the experiment wise error rate.
2. Maize hybrids 1, 2, 3, 4, 5, 6, 7, 8, 9 are EH10, EH13, EH14, EH15, EH16, H515, H516, H614D and P3253 respectively; Treatments 1, 2 are inoculated and non-innoculated respectively.

LSD tests for Severity

Alpha	0.05
Error Degrees of Freedom	36
Error Mean Square	0.12963
Critical Value of t	2.02809
Least Significant Difference	0.4216

Means with the same letter are not significantly different.

t Grouping	Mean	N	Maize_ hybrid
A	1.5000	6	9
A	1.5000	6	2
A	1.5000	6	3
A	1.5000	6	6
B A	1.3333	6	4

B	A	1.3333	6	8
B	A	1.1667	6	5
B	A	1.1667	6	1
B		1.0000	6	7

Alpha 0.05
Error Degrees of Freedom 36
Error Mean Square 0.12963
Critical Value of t 2.02809
Least Significant Difference 0.1987
Means with the same letter are not significantly different.

t Grouping	Mean	N	Treatment
A	1.66667	27	1
B	1.00000	27	2

Table 34: LSD tests for Disease severity, incidences and response of maize hybrids to *Stenocarpella spp.* in Maseno University Research farm during long rains seasons of 2009 continues

LSD tests for incidences

Alpha 0.05
Error Degrees of Freedom 36
Error Mean Square 5.592593
Critical Value of t 2.02809
Least Significant Difference 2.7691
Means with the same letter are not significantly different.

t Grouping			Mean	N	Maize_ hybrid
	A		7.123	6	9
	A		6.790	6	6
B	A		6.456	6	1
B	A		5.790	6	7
B	A		5.123	6	3
B	A	C	4.790	6	4
B		C	3.790	6	2
B		C	3.790	6	5
		C	2.123	6	8

Alpha 0.05
Error Degrees of Freedom 36
Error Mean Square 5.592593
Critical Value of t 2.02809
Least Significant Difference 1.3054

Means with the same letter are not significantly different.

t Grouping	Mean	N	Treatment
A	5.2963	27	1
A	4.8753	27	2

LSD tests for Yield (Tonnes/ha)

Alpha 0.05
Error Degrees of Freedom 36
Error Mean Square 0.105185
Critical Value of t 2.02809
Least Significant Difference 0.3798
Means with the same letter are not significantly different.

t Grouping		Mean	N	Maize_ hybrid
	A	1.4107	6	1
B	A	1.1773	6	4
B	A	1.1440	6	2

B A	1.1107	6	3
B A	1.0773	6	6
B	0.9773	6	9
B	0.9107	6	7
B	0.9107	6	5
C	0.5107	6	8

Alpha 0.05
Error Degrees of Freedom 36
Error Mean Square 0.105185
Critical Value of t 2.02809
Least Significant Difference 0.179

Means with the same letter are not significantly different.

t Grouping	Mean	N	Treatment
A	1.18148	27	1
B	0.86948	27	2

LSD tests for Failed ears

Alpha 0.05
Error Degrees of Freedom 36
Error Mean Square 2.962963
Critical Value of t 2.02809
Least Significant Difference 2.0155

Means with the same letter are not significantly different.

t Grouping	Mean	N	Maize_ hybrid
A	2.8333	6	3
A	2.6667	6	6
A	2.6667	6	8
A	2.5000	6	5
A	1.8333	6	7
A	1.8333	6	4
A	1.6667	6	2
A	1.5000	6	9
A	0.8333	6	1

Table 34: LSD tests for Disease severity, incidences and response of maize hybrids to *Stenocarpella spp.* in Maseno University Research farm during long rains seasons of 2009 continous

LSD tests for Failed ears continous

Alpha 0.05
Error Degrees of Freedom 36
Error Mean Square 2.962963
Critical Value of t 2.02809
Least Significant Difference 0.9501

Means with the same letter are not significantly different.

t Grouping	Mean	N	Treatment
A	2.5185	27	1
B	1.5556	27	2

LSD tests for Plant stand

Alpha 0.05
Error Degrees of Freedom 36
Error Mean Square 0.555556
Critical Value of t 2.02809
Least Significant Difference 0.8728

Means with the same letter are not significantly different.

t Grouping	Mean	N	Maize_ hybrid
A	85.8333	6	2

A	85.5000	6	5
B	81.5000	6	4
B	81.1667	6	3
B	81.1667	6	8
C	78.8333	6	7
D	75.5000	6	1
D	75.1667	6	6
E	73.8333	6	9

Alpha 0.05
Error Degrees of Freedom 36
Error Mean Square 0.555556
Critical Value of t 2.02809
Least Significant Difference 0.4114

Means with the same letter are not significantly different.

t Grouping	Mean	N	Treatment
A	80.3333	27	2
B	79.3333	27	1

LSD tests for Days to silking

Alpha 0.05
Error Degrees of Freedom 36
Error Mean Square 0.777778
Critical Value of t 2.02809
Least Significant Difference 1.0327

Means with the same letter are not significantly different.

t Grouping		Mean	N	Maize_ hybrid
	A	75.0000	6	1
B	A	74.0000	6	2
B	A	74.0000	6	3
B	A	74.0000	6	4
B	A	74.0000	6	5
B	A	74.0000	6	6
B	A	74.0000	6	7
B		73.0000	6	8

Alpha 0.05
Error Degrees of Freedom 36
Error Mean Square 0.777778
Critical Value of t 2.02809
Least Significant Difference 0.4868

Means with the same letter are not significantly different.

t Grouping	Mean	N	Treatment
A	73.8889	27	1
A	73.8889	27	2

Table 35: Correlation analysis for parameters under *Stenocarpella spp.* in Maseno University Research farm during long rains of 2009

5 Variables: Treatment Maize_hybrid Severity__ incidences Yield__Tonnes_ha_

Simple Statistics

Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
Treatment	54	1.50000	0.50469	81.00000	1.00000	2.00000
Maize_hybrid	54	5.00000	2.60623	270.00000	1.00000	9.00000
Severity__	54	1.33333	0.51396	72.00000	1.00000	3.00000
incidences	54	5.08580	2.50905	274.63300	0.57900	12.00000

Yield__Tonnes_ha_	54	1.02548	0.38938	55.37600	0.28800	1.90000

Pearson Correlation Coefficients, N = 54
Prob > |r| under H0: Rho=0

	Treatment	Maize_ hybrid	Severity__	incidences	Yield__ Tonnes_ ha_
Treatment	1.00000	0.00000	-0.65465	-0.08468	-0.40440
Treatment		1.0000	<.0001	0.5426	0.0024
Maize_hybrid	0.00000	1.00000	0.00000	0.01731	-0.46110
Maize hybrid	1.0000		1.0000	0.9011	0.0004
Severity__	-0.65465	0.00000	1.00000	0.10909	0.35274
Severity %	<.0001	1.0000		0.4323	0.0089
incidences	-0.08468	0.01731	0.10909	1.00000	0.27945
incidences	0.5426	0.9011	0.4323		0.0407
Yield__Tonnes_ha_	-0.40440	-0.46110	0.35274	0.27945	1.00000
Yield (Tonnes/ha)	0.0024	0.0004	0.0089	0.0407	

Table 36: Means breakdown for parameters under *Stenocarpella spp.* in Maseno University Research farm during long rains of 2009

------------------------------------ Effect=MAIZE_HYBRID -------------------------------------

Treatment	Maize hybrid	Rains	Rep	Std. Error of season	Mean of SEVERITY__	Std. Error of SEVERITY__	Mean of INCIDENCES
.	1	.	.	0.16667	1.16667	1.38563	6.45617
.	2	.	.	0.22361	1.50000	0.37709	3.78950
.	3	.	.	0.22361	1.50000	0.56566	5.12283
.	4	.	.	0.21082	1.33333	0.37709	4.78950
.	5	.	.	0.16667	1.16667	0.73634	3.78950
.	6	.	.	0.22361	1.50000	0.97067	6.78950
.	7	.	.	0.00000	1.00000	0.37709	5.78950
.	8	.	.	0.21082	1.33333	0.56566	2.12283
.	9	.	.	0.34157	1.50000	1.52315	7.12283

Treatment	Maize hybrid	Rains	Rep	Std. Error of season	Mean of YIELD__TONNES_ HA_	Std. Error of YIELD__ TONNES_HA_	FAILED_ EARS
.	1	.	.	0.13157	1.41067	0.30732	0.83333
.	2	.	.	0.09417	1.14400	0.33333	1.66667
.	3	.	.	0.16323	1.11067	0.79232	2.83333
.	4	.	.	0.07288	1.17733	1.04616	1.83333
.	5	.	.	0.18613	0.91067	0.67082	2.50000
.	6	.	.	0.19316	1.07733	0.71492	2.66667
.	7	.	.	0.08152	0.91067	0.60093	1.83333
.	8	.	.	0.07288	0.51067	0.55777	2.66667
.	9	.	.	0.16727	0.97733	0.67082	1.50000

Treatment	Maize hybrid	Rains	Rep	Std. Error of season	Mean of __PLANT_ STAND_	Std. Error of __PLANT_ STAND_	Mean of DAYS_TO_ SILKING
.	1	.	.	0.42817	75.5000	0.00000	75
.	2	.	.	0.30732	85.8333	0.36515	74
.	3	.	.	0.30732	81.1667	0.36515	74
.	4	.	.	0.42817	81.5000	0.36515	74
.	5	.	.	0.42817	85.5000	0.00000	74
.	6	.	.	0.30732	75.1667	0.36515	74

.	7	.	.	0.30732	78.8333	0.36515	74
.	8	.	.	0.30732	81.1667	0.36515	73
.	9	.	.	0.30732	73.8333	0.36515	73

Table 36: Means breakdown for parameters under *Stenocarpella spp.* in Maseno University Research farm during long rains of 2009 continues

--------------------------------------- Effect=Overall ---------------------------------------

Treatment	Maize hybrid	Rep	Rains season	Std. Error of SEVERITY__	Mean of SEVERITY__	Std. Error of INCIDENCES	Mean of INCIDENCES
.	.	.	.	0.069941	1.33333	0.34144	5.08580

Treatment	Maize hybrid	Rep	Rains season	Std. Error of YIELD__TONNES_HA_	Mean of YIELD__TONNES_HA_	Std. Error of FAILED_EARS	Mean of FAILED_EARS
.	.	.	.	0.052988	1.02548	0.22269	2.03704

Treatment	Maize hybrid	Rep	Rains season	Std. Error of __PLANT_STAND_	Mean of __PLANT_STAND_	Std. Error of DAYS_TO_SILKING	Mean of DAYS_TO_SILKING
.	.	.	.	0.57477	79.8333	0.12586	73.8889

------------------------------------ Effect=RAINS_SEASON ------------------------------------

Treatment	Maize hybrid	Rep	Rains season	Std. Error of SEVERITY__	Mean of SEVERITY__	Std. Error of INCIDENCES	Mean of INCIDENCES
.	.	.	1	0.069941	1.33333	0.34144	5.08580

Treatment	Maize hybrid	Rep	Rains season	Std. Error of YIELD__TONNES_HA_	Mean of YIELD__TONNES_HA_	Std. Error of FAILED_EARS	Mean of FAILED_EARS
.	.	.	1	0.052988	1.02548	0.22269	2.03704

Treatment	Maize hybrid	Rep	Rains season	Std. Error of __PLANT_STAND_	Mean of __PLANT_STAND_	Std. Error of DAYS_TO_SILKING	Mean of DAYS_TO_SILKING
.	.	.	1	0.57477	79.8333	0.12586	73.8889

--- Effect=REP ---

Treatment	Maize hybrid	Rep	Rains season	Std. Error of SEVERITY__	Mean of SEVERITY__	Std. Error of INCIDENCES	Mean of INCIDENCES
.	.	1	.	0.11824	1.38889	0.20450	3.78950
.	.	2	.	0.14003	1.33333	0.68789	5.45617
.	.	3	.	0.10863	1.27778	0.64653	6.01172

Treatment	Maize hybrid	Rep	Rains season	Std. Error of YIELD__TONNES_HA_	Mean of YIELD__TONNES_HA_	Std. Error of FAILED_EARS	
.	.	1	.	0.10565	1.03289	0.44383	2.38889
.	.	2	.	0.09031	1.15511	0.32812	1.94444
.	.	3	.	0.06960	0.88844	0.38396	1.77778

Treatment	Maize hybrid	Rep	Rains season	Std. Error of __PLANT_STAND_	Mean of __PLANT_STAND_	Std. Error of DAYS_TO_SILKING	
.	.	1	.	1.01701	80.5	0.16612	74.4444
.	.	2	.	1.01701	79.5	0.22222	73.7778
.	.	3	.	0.99097	79.5	0.20166	73.4444

-------------------------------------- Effect=TREATMENT --------------------------------------

Treatment	Maize hybrid	Rep	Rains season	Std. Error of SEVERITY__	Mean of SEVERITY__	Std. Error of INCIDENCES	Mean of INCIDENCES
1	.	.	.	0.10675	1.66667	0.48574	5.29630
2	.	.	.	0.00000	1.00000	0.48574	4.87530

Treatment	Maize hybrid	Rep	Rains season	Std. Error of YIELD__TONNES_HA_	Mean of YIELD__TONNES_HA_	Std. Error of FAILED_EARS	Mean of FAILED_EARS
1	.	.	.	0.069191	1.18148	0.32629	2.51852
2	.	.	.	0.069191	0.86948	0.27906	1.55556

Treatment	Maize hybrid	Rep	Rains season	Std. Error of __PLANT_STAND_	Mean of __PLANT_STAND_	Std. Error of DAYS_TO_SILKING	Mean of DAYS_TO_SILKING
1	.	.	.	0.81475	79.3333	0.17969	73.8889
2	.	.	.	0.81475	80.3333	0.17969	73.8889

------------------------------ Effect=MAIZE_HYBRID*RAINS_SEASON ------------------------------

Treatment	Maize hybrid	Rep	Rains season	Std. Error of SEVERITY__	Mean of SEVERITY__	Std. Error of INCIDENCES	Mean of INCIDENCES
.	1	.	1	0.16667	1.16667	1.38563	6.45617
.	2	.	1	0.22361	1.50000	0.37709	3.78950
.	3	.	1	0.22361	1.50000	0.56566	5.12283
.	4	.	1	0.21082	1.33333	0.37709	4.78950
.	5	.	1	0.16667	1.16667	0.73634	3.78950
.	6	.	1	0.22361	1.50000	0.97067	6.78950
.	7	.	1	0.00000	1.00000	0.37709	5.78950
.	8	.	1	0.21082	1.33333	0.56566	2.12283
.	9	.	1	0.34157	1.50000	1.52315	7.12283

Table 36: Means breakdown for parameters under *Stenocarpella spp.* in Maseno University Research farm during long rains of 2009 continues

Treatment	Maize hybrid	Rep	Rains season	Std. Error of YIELD__TONNES_HA_	Mean of YIELD__TONNES_HA_	Std. Error of FAILED_EARS	Mean of FAILED_EARS
.	1	.	1	0.13157	1.41067	0.30732	0.83333
.	2	.	1	0.09417	1.14400	0.33333	1.66667
.	3	.	1	0.16323	1.11067	0.79232	2.83333
.	4	.	1	0.07288	1.17733	1.04616	1.83333
.	5	.	1	0.18613	0.91067	0.67082	2.50000
.	6	.	1	0.19316	1.07733	0.71492	2.66667
.	7	.	1	0.08152	0.91067	0.60093	1.83333
.	8	.	1	0.07288	0.51067	0.55777	2.66667
.	9	.	1	0.16727	0.97733	0.67082	1.50000

Treatment	Maize hybrid	Rep	Rains season	Std. Error of __PLANT_STAND_	Mean of __PLANT_STAND_	Std. Error of DAYS_TO_SILKING	Mean of DAYS_TO_SILKING
.	1	.	1	0.42817	75.5000	0.00000	75
.	2	.	1	0.30732	85.8333	0.36515	74
.	3	.	1	0.30732	81.1667	0.36515	74
.	4	.	1	0.42817	81.5000	0.36515	74
.	5	.	1	0.42817	85.5000	0.00000	74
.	6	.	1	0.30732	75.1667	0.36515	74
.	7	.	1	0.30732	78.8333	0.36515	74
.	8	.	1	0.30732	81.1667	0.36515	73

.	9	.	1	0.30732	73.8333	0.36515	73

---------------------------------- Effect=MAIZE_HYBRID*REP -----------------------------------

Treatment	Maize hybrid	Rep	Std. Error of Rains season	Mean of SEVERITY__	Std. Error of SEVERITY__	Mean of INCIDENCES
.	1	1	.	0.5	1.5	0.2105	3.7895
.	1	2	.	0.0	1.0	0.2105	4.7895
.	1	3	.	0.0	1.0	0.2105	10.7895
.	2	1	.	0.5	1.5	0.2105	3.7895
.	2	2	.	0.5	1.5	0.2105	2.7895
.	2	3	.	0.5	1.5	0.2105	4.7895
.	3	1	.	0.5	1.5	0.2105	3.7895
.	3	2	.	0.5	1.5	0.2105	4.7895
.	3	3	.	0.5	1.5	0.2105	6.7895
.	4	1	.	0.5	1.5	0.2105	3.7895
.	4	2	.	0.0	1.0	0.2105	5.7895
.	4	3	.	0.5	1.5	0.2105	4.7895

Treatment	Maize hybrid	Rep	Rains season	Std. Error of YIELD__TONNES_HA_	Mean of YIELD__TONNES_HA_	Std. Error of FAILED_EARS	Mean of FAILED_EARS
.	1	1	.	0.156	1.744	0.5	0.5
.	1	2	.	0.156	1.344	0.5	0.5
.	1	3	.	0.156	1.144	0.5	1.5
.	2	1	.	0.156	1.044	0.0	1.0
.	2	2	.	0.156	1.344	0.5	1.5
.	2	3	.	0.156	1.044	0.5	2.5
.	3	1	.	0.156	0.744	0.5	4.5
.	3	2	.	0.156	1.544	0.5	3.5
.	3	3	.	0.156	1.044	0.5	0.5
.	4	1	.	0.156	1.144	1.0	5.0
.	4	2	.	0.156	1.144	0.5	0.5
.	4	3	.	0.156	1.244	0.0	0.0

Treatment	Maize hybrid	Rep	Std. Error of Rains season	Mean of __PLANT_STAND_	Std. Error of __PLANT_STAND_	Mean of DAYS_TO_SILKING
.	1	1	.	0.5	76.5	0	75
.	1	2	.	0.5	75.5	0	75
.	1	3	.	0.5	74.5	0	75
.	2	1	.	0.5	86.5	0	74
.	2	2	.	0.5	85.5	0	75
.	2	3	.	0.5	85.5	0	73
.	3	1	.	0.5	81.5	0	75
.	3	2	.	0.5	80.5	0	74
.	3	3	.	0.5	81.5	0	73
.	4	1	.	0.5	82.5	0	75
.	4	2	.	0.5	81.5	0	73
.	4	3	.	0.5	80.5	0	74

Table 36: Means breakdown for parameters under *Stenocarpella spp.* in Maseno University Research farm during long rains of 2009 continues

---------------------------------- Effect=MAIZE_HYBRID*REP -----------------------------------
(continued)

Treatment	Maize hybrid	Rep	Std. Error of Rains season	Mean of SEVERITY__	Std. Error of SEVERITY__	Mean of INCIDENCES
.	5	1	.	0.5	1.5	0.2105	3.7895
.	5	2	.	0.0	1.0	0.2105	5.7895

.	5	3	.	0.0	1.0	0.2105	1.7895
.	6	1	.	0.5	1.5	0.2105	4.7895
.	6	2	.	0.5	1.5	0.2105	5.7895
.	6	3	.	0.5	1.5	0.2105	9.7895
.	7	1	.	0.0	1.0	0.2105	4.7895
.	7	2	.	0.0	1.0	0.2105	6.7895
.	7	3	.	0.0	1.0	0.2105	5.7895
.	8	1	.	0.0	1.0	0.2105	1.7895
.	8	2	.	0.5	1.5	0.2105	0.7895
.	8	3	.	0.5	1.5	0.2105	3.7895

Treatment	Maize hybrid	Rep	Rains season	Std. Error of YIELD__TONNES_HA_	Mean of YIELD__TONNES_HA_	Std. Error of FAILED_EARS	Mean of FAILED_EARS
.	5	1	.	0.156	0.544	0.5	3.5
.	5	2	.	0.156	1.444	0.5	3.5
.	5	3	.	0.156	0.744	0.5	0.5
.	6	1	.	0.156	1.644	1.0	1.0
.	6	2	.	0.156	0.744	0.5	2.5
.	6	3	.	0.156	0.844	0.5	4.5
.	7	1	.	0.156	1.044	0.5	3.5
.	7	2	.	0.156	0.844	0.5	0.5
.	7	3	.	0.156	0.844	0.5	1.5
.	8	1	.	0.156	0.544	0.5	2.5
.	8	2	.	0.156	0.544	0.5	1.5
.	8	3	.	0.156	0.444	1.0	4.0

Treatment	Maize hybrid	Rep	Rains season	Std. Error of __PLANT_STAND_	Mean of __PLANT_STAND_	Std. Error of DAYS_TO_SILKING	Mean of DAYS_TO_SILKING
.	5	1	.	0.5	86.5	0	74
.	5	2	.	0.5	85.5	0	74
.	5	3	.	0.5	84.5	0	74
.	6	1	.	0.5	75.5	0	75
.	6	2	.	0.5	74.5	0	74
.	6	3	.	0.5	75.5	0	73
.	7	1	.	0.5	79.5	0	75
.	7	2	.	0.5	78.5	0	74
.	7	3	.	0.5	78.5	0	73
.	8	1	.	0.5	81.5	0	74
.	8	2	.	0.5	80.5	0	73
.	8	3	.	0.5	81.5	0	72

------------------------------------ Effect=MAIZE_HYBRID*REP ------------------------------------
(continued)

Treatment	Maize hybrid	Rep	Rains season	Std. Error of SEVERITY__	Mean of SEVERITY__	Std. Error of INCIDENCES	Mean of INCIDENCES
.	9	1	.	0.5	1.5	0.2105	3.7895
.	9	2	.	1.0	2.0	0.2105	11.7895
.	9	3	.	0.0	1.0	0.2105	5.7895

Treatment	Maize hybrid	Rep	Rains season	Std. Error of YIELD__TONNES_HA_	Mean of YIELD__TONNES_HA_	Std. Error of FAILED_EARS	Mean of FAILED_EARS
.	9	1	.	0.156	0.844	0.0	0.0
.	9	2	.	0.156	1.444	0.5	3.5
.	9	3	.	0.156	0.644	0.0	1.0

Std. Error of | Mean of | Std. Error of | Mean of

Treatment	Maize hybrid	Rep	Rains season	__PLANT_ STAND_	__PLANT_ STAND_	DAYS_TO_ SILKING	DAYS_TO_ SILKING
.	9	1	.	0.5	74.5	0	73
.	9	2	.	0.5	73.5	0	72
.	9	3	.	0.5	73.5	0	74

---------------------------------- Effect=REP*RAINS_SEASON ------------------------------------

Treatment	Maize hybrid	Rep	Rains season	Std. Error of SEVERITY__	Mean of SEVERITY__	Std. Error of INCIDENCES	Mean of INCIDENCES
.	.	1	1	0.11824	1.38889	0.20450	3.78950
.	.	2	1	0.14003	1.33333	0.68789	5.45617

Table 36: Means breakdown for parameters under *Stenocarpella spp.* in Maseno University Research farm during long rains of 2009 continues

Treatment	Maize hybrid	Rep	Rains season	Std. Error of YIELD__TONNES_ HA_	Mean of YIELD__ TONNES_HA_	Std. Error of FAILED_ EARS	Mean of FAILED_ EARS
.	.	1	1	0.10565	1.03289	0.44383	2.38889
.	.	2	1	0.09031	1.15511	0.32812	1.94444

Treatment	Maize hybrid	Rep	Rains season	Std. Error of __PLANT_ STAND_	Mean of __PLANT_ STAND_	Std. Error of DAYS_TO_ SILKING	Mean of DAYS_TO_ SILKING
.	.	1	1	1.01701	80.5	0.16612	74.4444
.	.	2	1	1.01701	79.5	0.22222	73.7778

---------------------------------- Effect=REP*RAINS_SEASON ------------------------------------

(continued)

Treatment	Maize hybrid	Rep	Rains season	Std. Error of SEVERITY__	Mean of SEVERITY__	Std. Error of INCIDENCES	Mean of INCIDENCES
.	.	3	1	0.10863	1.27778	0.64653	6.01172

Treatment	Maize hybrid	Rep	Rains season	Std. Error of YIELD__TONNES_ HA_	Mean of YIELD__ TONNES_HA_	Std. Error of FAILED_ EARS	Mean of FAILED_ EARS
.	.	3	1	0.069604	0.88844	0.38396	1.77778

Treatment	Maize hybrid	Rep	Rains season	Std. Error of __PLANT_ STAND_	Mean of __PLANT_ STAND_	Std. Error of DAYS_TO_ SILKING	Mean of DAYS_TO_ SILKING
.	.	3	1	0.99097	79.5	0.20166	73.4444

-------------------------------- Effect=TREATMENT*MAIZE_HYBRID ---------------------------------

Treatment	Maize hybrid	Rep	Rains season	Std. Error of SEVERITY__	Mean of SEVERITY__	Std. Error of INCIDENCES	Mean of INCIDENCES
1	1	.	.	0.33333	1.33333	2.18581	6.66667
1	2	.	.	0.00000	2.00000	0.57735	4.00000
1	3	.	.	0.00000	2.00000	0.88192	5.33333
1	4	.	.	0.33333	1.66667	0.57735	5.00000

Treatment	Maize hybrid	Rep	Rains season	Std. Error of YIELD__TONNES_ HA_	Mean of YIELD__ TONNES_HA_	Std. Error of FAILED_ EARS	Mean of FAILED_ EARS
1	1	.	.	0.17638	1.56667	0.33333	1.33333
1	2	.	.	0.10000	1.30000	0.57735	2.00000
1	3	.	.	0.23333	1.26667	1.20185	3.33333

1	4	.	.	0.03333	1.33333	1.85592	2.33333

Treatment	Maize hybrid	Rep	Rains season	Std. Error of __PLANT_STAND_	Mean of __PLANT_STAND_	Std. Error of DAYS_TO_SILKING	Mean of DAYS_TO_SILKING
1	1	.	.	0.57735	75.0000	0.00000	75
1	2	.	.	0.33333	85.3333	0.57735	74
1	3	.	.	0.33333	80.6667	0.57735	74
1	4	.	.	0.57735	81.0000	0.57735	74

-------------------------------- Effect=TREATMENT*MAIZE_HYBRID --------------------------------
(continued)

Treatment	Maize hybrid	Rep	Rains season	Std. Error of SEVERITY__	Mean of SEVERITY__	Std. Error of INCIDENCES	Mean of INCIDENCES
1	5	.	.	0.33333	1.33333	1.15470	4.00000
1	6	.	.	0.00000	2.00000	1.52753	7.00000
1	7	.	.	0.00000	1.00000	0.57735	6.00000
1	8	.	.	0.33333	1.66667	0.88192	2.33333
1	9	.	.	0.57735	2.00000	2.40370	7.33333
2	1	.	.	0.00000	1.00000	2.18581	6.24567
2	2	.	.	0.00000	1.00000	0.57735	3.57900
2	3	.	.	0.00000	1.00000	0.88192	4.91233
2	4	.	.	0.00000	1.00000	0.57735	4.57900
2	5	.	.	0.00000	1.00000	1.15470	3.57900
2	6	.	.	0.00000	1.00000	1.52753	6.57900
2	7	.	.	0.00000	1.00000	0.57735	5.57900

Table 36: Means breakdown for parameters under *Stenocarpella spp.* in Maseno University Research farm during long rains of 2009 continues

Treatment	Maize hybrid	Rep	Rains season	Std. Error of YIELD__TONNES_HA_	Mean of YIELD__TONNES_HA_	Std. Error of FAILED_EARS	Mean of FAILED_EARS
1	5	.	.	0.27285	1.06667	1.00000	3.00000
1	6	.	.	0.28480	1.23333	0.88192	3.33333
1	7	.	.	0.06667	1.06667	0.88192	2.33333
1	8	.	.	0.03333	0.66667	0.88192	3.33333
1	9	.	.	0.24037	1.13333	1.20185	1.66667
2	1	.	.	0.17638	1.25467	0.33333	0.33333
2	2	.	.	0.10000	0.98800	0.33333	1.33333
2	3	.	.	0.23333	0.95467	1.20185	2.33333
2	4	.	.	0.03333	1.02133	1.33333	1.33333
2	5	.	.	0.27285	0.75467	1.00000	2.00000
2	6	.	.	0.28480	0.92133	1.15470	2.00000
2	7	.	.	0.06667	0.75467	0.88192	1.33333

Treatment	Maize hybrid	Rep	Rains season	Std. Error of __PLANT_STAND_	Mean of __PLANT_STAND_	Std. Error of DAYS_TO_SILKING	Mean of DAYS_TO_SILKING
1	5	.	.	0.57735	85.0000	0.00000	74
1	6	.	.	0.33333	74.6667	0.57735	74
1	7	.	.	0.33333	78.3333	0.57735	74
1	8	.	.	0.33333	80.6667	0.57735	73
1	9	.	.	0.33333	73.3333	0.57735	73
2	1	.	.	0.57735	76.0000	0.00000	75
2	2	.	.	0.33333	86.3333	0.57735	74
2	3	.	.	0.33333	81.6667	0.57735	74
2	4	.	.	0.57735	82.0000	0.57735	74
2	5	.	.	0.57735	86.0000	0.00000	74

Treatment	Maize hybrid	Rep	Rains season	Std. Error of __PLANT_ STAND_	Mean of __PLANT_ STAND_	Std. Error of DAYS_TO_ SILKING	Mean of DAYS_TO_ SILKING
2	6	.	.	0.33333	75.6667	0.57735	74
2	7	.	.	0.33333	79.3333	0.57735	74

-------------------------------- Effect=TREATMENT*MAIZE_HYBRID --------------------------------
(continued)

Treatment	Maize hybrid	Rep	Rains season	Std. Error of SEVERITY__	Mean of SEVERITY__	Std. Error of INCIDENCES	Mean of INCIDENCES
2	8	.	.	0.00000	1.00000	0.88192	1.91233
2	9	.	.	0.00000	1.00000	2.40370	6.91233

Treatment	Maize hybrid	Rep	Rains season	Std. Error of YIELD__TONNES_ HA_	Mean of YIELD__ TONNES_HA_	Std. Error of FAILED_ EARS	Mean of FAILED_ EARS
2	8	.	.	0.03333	0.35467	0.57735	2.00000
2	9	.	.	0.24037	0.82133	0.88192	1.33333

Treatment	Maize hybrid	Rep	Rains season	Std. Error of __PLANT_ STAND_	Mean of __PLANT_ STAND_	Std. Error of DAYS_TO_ SILKING	Mean of DAYS_TO_ SILKING
2	8	.	.	0.33333	81.6667	0.57735	73
2	9	.	.	0.33333	74.3333	0.57735	73

-------------------------------- Effect=TREATMENT*RAINS_SEASON --------------------------------

Treatment	Maize hybrid	Rep	Rains season	Std. Error of SEVERITY__	Mean of SEVERITY__	Std. Error of INCIDENCES	Mean of INCIDENCES
1	.	.	1	0.10675	1.66667	0.48574	5.29630
2	.	.	1	0.00000	1.00000	0.48574	4.87530

Treatment	Maize hybrid	Rep	Rains season	Std. Error of YIELD__TONNES_ HA_	Mean of YIELD__ TONNES_HA_	Std. Error of FAILED_ EARS	Mean of FAILED_ EARS
1	.	.	1	0.069191	1.18148	0.32629	2.51852
2	.	.	1	0.069191	0.86948	0.27906	1.55556

Treatment	Maize hybrid	Rep	Rains season	Std. Error of __PLANT_ STAND_	Mean of __PLANT_ STAND_	Std. Error of DAYS_TO_ SILKING	Mean of DAYS_TO_ SILKING
1	.	.	1	0.81475	79.3333	0.17969	73.8889
2	.	.	1	0.81475	80.3333	0.17969	73.8889

------------------------------------ Effect=TREATMENT*REP ------------------------------------

Treatment	Maize hybrid	Rep	Rains season	Std. Error of SEVERITY__	Mean of SEVERITY__	Std. Error of INCIDENCES	Mean of INCIDENCES
1	.	1	.	0.14699	1.77778	0.28868	4.00000
1	.	2	.	0.23570	1.66667	1.00000	5.66667
1	.	3	.	0.17568	1.55556	0.93953	6.22222
2	.	1	.	0.00000	1.00000	0.28868	3.57900
2	.	2	.	0.00000	1.00000	1.00000	5.24567
2	.	3	.	0.00000	1.00000	0.93953	5.80122

Table 36: Means breakdown for parameters under *Stenocarpella spp.* in Maseno University Research farm during long rains of 2009 continues

Treatment	Maize hybrid	Rep	Rains season	Std. Error of YIELD__TONNES_ HA_	Mean of YIELD__ TONNES_HA_	Std. Error of FAILED_ EARS	Mean of FAILED_ EARS
1	.	1	.	0.14380	1.18889	0.67586	2.88889
1	.	2	.	0.11954	1.31111	0.44444	2.44444
1	.	3	.	0.08517	1.04444	0.59577	2.22222

2	.	1	.	0.14380	0.87689	0.56383	1.88889
2	.	2	.	0.11954	0.99911	0.44444	1.44444
2	.	3	.	0.08517	0.73244	0.47140	1.33333

Treatment	Maize hybrid	Rep	Rains season	Std. Error of __PLANT_ STAND_	Mean of __PLANT_ STAND_	Std. Error of DAYS_TO_ SILKING	Mean of DAYS_TO_ SILKING
1	.	1	.	1.47196	80	0.24216	74.4444
1	.	2	.	1.47196	79	0.32394	73.7778
1	.	3	.	1.43372	79	0.29397	73.4444
2	.	1	.	1.47196	81	0.24216	74.4444
2	.	2	.	1.47196	80	0.32394	73.7778
2	.	3	.	1.43372	80	0.29397	73.4444

----------------------------- Effect=MAIZE_HYBRID*REP*RAINS_SEASON -----------------------------

Treatment	Maize hybrid	Rep	Rains season	Std. Error of SEVERITY__	Mean of SEVERITY__	Std. Error of INCIDENCES	Mean of INCIDENCES
.	1	1	1	0.5	1.5	0.2105	3.7895
.	1	2	1	0.0	1.0	0.2105	4.7895
.	1	3	1	0.0	1.0	0.2105	10.7895
.	2	1	1	0.5	1.5	0.2105	3.7895
.	2	2	1	0.5	1.5	0.2105	2.7895
.	2	3	1	0.5	1.5	0.2105	4.7895
.	3	1	1	0.5	1.5	0.2105	3.7895
.	3	2	1	0.5	1.5	0.2105	4.7895
.	3	3	1	0.5	1.5	0.2105	6.7895
.	4	1	1	0.5	1.5	0.2105	3.7895
.	4	2	1	0.0	1.0	0.2105	5.7895
.	4	3	1	0.5	1.5	0.2105	4.7895

Treatment	Maize hybrid	Rep	Rains season	Std. Error of YIELD__TONNES_ HA_	Mean of YIELD__ TONNES_HA_	Std. Error of FAILED_ EARS	Mean of FAILED_ EARS
.	1	1	1	0.156	1.744	0.5	0.5
.	1	2	1	0.156	1.344	0.5	0.5
.	1	3	1	0.156	1.144	0.5	1.5
.	2	1	1	0.156	1.044	0.0	1.0
.	2	2	1	0.156	1.344	0.5	1.5
.	2	3	1	0.156	1.044	0.5	2.5
.	3	1	1	0.156	0.744	0.5	4.5
.	3	2	1	0.156	1.544	0.5	3.5
.	3	3	1	0.156	1.044	0.5	0.5
.	4	1	1	0.156	1.144	1.0	5.0
.	4	2	1	0.156	1.144	0.5	0.5
.	4	3	1	0.156	1.244	0.0	0.0

Treatment	Maize hybrid	Rep	Rains season	Std. Error of __PLANT_ STAND_	Mean of __PLANT_ STAND_	Std. Error of DAYS_TO_ SILKING	Mean of DAYS_TO_ SILKING
.	1	1	1	0.5	76.5	0	75
.	1	2	1	0.5	75.5	0	75
.	1	3	1	0.5	74.5	0	75
.	2	1	1	0.5	86.5	0	74
.	2	2	1	0.5	85.5	0	75
.	2	3	1	0.5	85.5	0	73
.	3	1	1	0.5	81.5	0	75
.	3	2	1	0.5	80.5	0	74
.	3	3	1	0.5	81.5	0	73
.	4	1	1	0.5	82.5	0	75

Treatment	Maize hybrid	Rep	Rains season	Std. Error of __PLANT_STAND_	Mean of __PLANT_STAND_	Std. Error of DAYS_TO_SILKING	Mean of DAYS_TO_SILKING
.	4	2	1	0.5	81.5	0	73
.	4	3	1	0.5	80.5	0	74

------------------------------ Effect=MAIZE_HYBRID*REP*RAINS_SEASON ------------------------------
(continued)

Treatment	Maize hybrid	Rep	Rains season	std. Error of SEVERITY__	Mean of SEVERITY__	Std. Error of INCIDENCES	Mean of INCIDENCES
.	5	1	1	0.5	1.5	0.2105	3.7895
.	5	2	1	0.0	1.0	0.2105	5.7895
.	5	3	1	0.0	1.0	0.2105	1.7895
.	6	1	1	0.5	1.5	0.2105	4.7895
.	6	2	1	0.5	1.5	0.2105	5.7895
.	6	3	1	0.5	1.5	0.2105	9.7895
.	7	1	1	0.0	1.0	0.2105	4.7895
.	7	2	1	0.0	1.0	0.2105	6.7895
.	7	3	1	0.0	1.0	0.2105	5.7895
.	8	1	1	0.0	1.0	0.2105	1.7895
.	8	2	1	0.5	1.5	0.2105	0.7895
.	8	3	1	0.5	1.5	0.2105	3.7895

Table 36: Means breakdown for parameters under *Stenocarpella spp.* in Maseno University Research farm during long rains of 2009 continues

Treatment	Maize hybrid	Rep	Rains season	Std. Error of YIELD__TONNES_HA_	Mean of YIELD__TONNES_HA_	Std. Error of FAILED_EARS	Mean of FAILED_EARS
.	5	1	1	0.156	0.544	0.5	3.5
.	5	2	1	0.156	1.444	0.5	3.5
.	5	3	1	0.156	0.744	0.5	0.5
.	6	1	1	0.156	1.644	1.0	1.0
.	6	2	1	0.156	0.744	0.5	2.5
.	6	3	1	0.156	0.844	0.5	4.5
.	7	1	1	0.156	1.044	0.5	3.5
.	7	2	1	0.156	0.844	0.5	0.5
.	7	3	1	0.156	0.844	0.5	1.5
.	8	1	1	0.156	0.544	0.5	2.5
.	8	2	1	0.156	0.544	0.5	1.5
.	8	3	1	0.156	0.444	1.0	4.0

Treatment	Maize hybrid	Rep	Rains season	Std. Error of __PLANT_STAND_	Mean of __PLANT_STAND_	Std. Error of DAYS_TO_SILKING	Mean of DAYS_TO_SILKING
.	5	1	1	0.5	86.5	0	74
.	5	2	1	0.5	85.5	0	74
.	5	3	1	0.5	84.5	0	74
.	6	1	1	0.5	75.5	0	75
.	6	2	1	0.5	74.5	0	74
.	6	3	1	0.5	75.5	0	73
.	7	1	1	0.5	79.5	0	75
.	7	2	1	0.5	78.5	0	74
.	7	3	1	0.5	78.5	0	73
.	8	1	1	0.5	81.5	0	74
.	8	2	1	0.5	80.5	0	73
.	8	3	1	0.5	81.5	0	72

------------------------------ Effect=MAIZE_HYBRID*REP*RAINS_SEASON ------------------------------
(continued)

Treatment	Maize hybrid	Rep	Rains season	Std. Error of SEVERITY__	Mean of SEVERITY__	Std. Error of INCIDENCES	Mean of INCIDENCES

.	9	1	1	0.5	1.5	0.2105	3.7895
.	9	2	1	1.0	2.0	0.2105	11.7895
.	9	3	1	0.0	1.0	0.2105	5.7895

Treatment	Maize hybrid	Rep	Rains season	Std. Error of YIELD__TONNES_HA_	Mean of YIELD__TONNES_HA_	Std. Error of FAILED_EARS	Mean of FAILED_EARS
.	9	1	1	0.156	0.844	0.0	0.0
.	9	2	1	0.156	1.444	0.5	3.5
.	9	3	1	0.156	0.644	0.0	1.0

Treatment	Maize hybrid	Rep	Rains season	Std. Error of __PLANT_STAND_	Mean of __PLANT_STAND_	Std. Error of DAYS_TO_SILKING	Mean of DAYS_TO_SILKING
.	9	1	1	0.5	74.5	0	73
.	9	2	1	0.5	73.5	0	72
.	9	3	1	0.5	73.5	0	74

------------------------- Effect=TREATMENT*MAIZE_HYBRID*RAINS_SEASON -------------------------

Treatment	Maize hybrid	Rep	Rains season	Std. Error of SEVERITY__	Mean of SEVERITY__	Std. Error of INCIDENCES	Mean of INCIDENCES
1	1	.	1	0.33333	1.33333	2.18581	6.66667
1	2	.	1	0.00000	2.00000	0.57735	4.00000

Treatment	Maize hybrid	Rep	Rains season	Std. Error of YIELD__TONNES_HA_	Mean of YIELD__TONNES_HA_	Std. Error of FAILED_EARS	Mean of FAILED_EARS
1	1	.	1	0.17638	1.56667	0.33333	1.33333
1	2	.	1	0.10000	1.30000	0.57735	2.00000

Treatment	Maize hybrid	Rep	Rains season	Std. Error of __PLANT_STAND_	Mean of __PLANT_STAND_	Std. Error of DAYS_TO_SILKING	Mean of DAYS_TO_SILKING
1	1	.	1	0.57735	75.0000	0.00000	75
1	2	.	1	0.33333	85.3333	0.57735	74

Table 37: Means breakdown for parameters under *Stenocarpella spp.* in Maseno University Research farm during long rains of 2009 continues

------------------------- Effect=TREATMENT*MAIZE_HYBRID*RAINS_SEASON -------------------------
(continued)

Treatment	Maize hybrid	Rep	Rains season	Std. Error of SEVERITY__	Mean of SEVERITY__	Std. Error of INCIDENCES	Mean of INCIDENCES
1	3	.	1	0.00000	2.00000	0.88192	5.33333
1	4	.	1	0.33333	1.66667	0.57735	5.00000
1	5	.	1	0.33333	1.33333	1.15470	4.00000
1	6	.	1	0.00000	2.00000	1.52753	7.00000
1	7	.	1	0.00000	1.00000	0.57735	6.00000
1	8	.	1	0.33333	1.66667	0.88192	2.33333
1	9	.	1	0.57735	2.00000	2.40370	7.33333
2	1	.	1	0.00000	1.00000	2.18581	6.24567
2	2	.	1	0.00000	1.00000	0.57735	3.57900
2	3	.	1	0.00000	1.00000	0.88192	4.91233
2	4	.	1	0.00000	1.00000	0.57735	4.57900
2	5	.	1	0.00000	1.00000	1.15470	3.57900

Treatment	Maize hybrid	Rep	Rains season	Std. Error of YIELD__TONNES_HA_	Mean of YIELD__TONNES_HA_	Std. Error of FAILED_EARS	Mean of FAILED_EARS
1	3	.	1	0.23333	1.26667	1.20185	3.33333
1	4	.	1	0.03333	1.33333	1.85592	2.33333
1	5	.	1	0.27285	1.06667	1.00000	3.00000
1	6	.	1	0.28480	1.23333	0.88192	3.33333
1	7	.	1	0.06667	1.06667	0.88192	2.33333
1	8	.	1	0.03333	0.66667	0.88192	3.33333
1	9	.	1	0.24037	1.13333	1.20185	1.66667
2	1	.	1	0.17638	1.25467	0.33333	0.33333
2	2	.	1	0.10000	0.98800	0.33333	1.33333
2	3	.	1	0.23333	0.95467	1.20185	2.33333
2	4	.	1	0.03333	1.02133	1.33333	1.33333
2	5	.	1	0.27285	0.75467	1.00000	2.00000

Treatment	Maize hybrid	Rep	Rains season	Std. Error of __PLANT_STAND_	Mean of __PLANT_STAND_	Std. Error of DAYS_TO_SILKING	Mean of DAYS_TO_SILKING
1	3	.	1	0.33333	80.6667	0.57735	74
1	4	.	1	0.57735	81.0000	0.57735	74
1	5	.	1	0.57735	85.0000	0.00000	74
1	6	.	1	0.33333	74.6667	0.57735	74
1	7	.	1	0.33333	78.3333	0.57735	74
1	8	.	1	0.33333	80.6667	0.57735	73
1	9	.	1	0.33333	73.3333	0.57735	73
2	1	.	1	0.57735	76.0000	0.00000	75
2	2	.	1	0.33333	86.3333	0.57735	74
2	3	.	1	0.33333	81.6667	0.57735	74
2	4	.	1	0.57735	82.0000	0.57735	74
2	5	.	1	0.57735	86.0000	0.00000	74

------------------------- Effect=TREATMENT*MAIZE_HYBRID*RAINS_SEASON -------------------------

(continued)

Treatment	Maize hybrid	Rep	Rains season	Std. Error of SEVERITY__	Mean of SEVERITY__	INCIDENCES	INCIDENCES
2	6	.	1	0.00000	1.00000	1.52753	6.57900
2	7	.	1	0.00000	1.00000	0.57735	5.57900
2	8	.	1	0.00000	1.00000	0.88192	1.91233
2	9	.	1	0.00000	1.00000	2.40370	6.91233

Treatment	Maize hybrid	Rep	Rains season	Std. Error of YIELD__TONNES_HA_	Mean of YIELD__TONNES_HA_	Std. Error of FAILED_EARS	Mean of FAILED_EARS
2	6	.	1	0.28480	0.92133	1.15470	2.00000
2	7	.	1	0.06667	0.75467	0.88192	1.33333
2	8	.	1	0.03333	0.35467	0.57735	2.00000
2	9	.	1	0.24037	0.82133	0.88192	1.33333

Treatment	Maize hybrid	Rep	Rains season	Std. Error of __PLANT_STAND_	Mean of __PLANT_STAND_	Std. Error of DAYS_TO_SILKING	Mean of DAYS_TO_SILKING
2	6	.	1	0.33333	75.6667	0.57735	74
2	7	.	1	0.33333	79.3333	0.57735	74
2	8	.	1	0.33333	81.6667	0.57735	73
2	9	.	1	0.33333	74.3333	0.57735	73

----------------------------- Effect=TREATMENT*REP*RAINS_SEASON -------------------------------

Std. Error Std. Error

Treatment	Maize hybrid	Rep	Rains season	Mean of SEVERITY__	of SEVERITY__	Mean of INCIDENCES	INCIDENCES
1	.	1	1	0.14699	1.77778	0.28868	4.00000
1	.	2	1	0.23570	1.66667	1.00000	5.66667
1	.	3	1	0.17568	1.55556	0.93953	6.22222
2	.	1	1	0.00000	1.00000	0.28868	3.57900
2	.	2	1	0.00000	1.00000	1.00000	5.24567
2	.	3	1	0.00000	1.00000	0.93953	5.80122

Table 37: Means breakdown for parameters under *Stenocarpella spp.* in Maseno University Research farm during long rains of 2009 continues

Treatment	Maize hybrid	Rep	Rains season	Std. Error of YIELD__	Mean of TONNES_ HA_	Std. Error of YIELD__ TONNES_HA_	Mean of FAILED_ EARS	FAILED_ EARS
1	.	1	1	0.14380	1.18889	0.67586	2.88889	
1	.	2	1	0.11954	1.31111	0.44444	2.44444	
1	.	3	1	0.08517	1.04444	0.59577	2.22222	
2	.	1	1	0.14380	0.87689	0.56383	1.88889	
2	.	2	1	0.11954	0.99911	0.44444	1.44444	
2	.	3	1	0.08517	0.73244	0.47140	1.33333	

Treatment	Maize hybrid	Rep	Rains season	Std. Error of __PLANT_ STAND_	Mean of __PLANT_ STAND_	Std. Error of DAYS_TO_ SILKING	Mean of DAYS_TO_ SILKING
1	.	1	1	1.47196	80	0.24216	74.4444
1	.	2	1	1.47196	79	0.32394	73.7778
1	.	3	1	1.43372	79	0.29397	73.4444
2	.	1	1	1.47196	81	0.24216	74.4444
2	.	2	1	1.47196	80	0.32394	73.7778
2	.	3	1	1.43372	80	0.29397	73.4444

Plate 1: Plates of identified ear rot

Plate 2: Giberrella zeae infected maize cob and husks

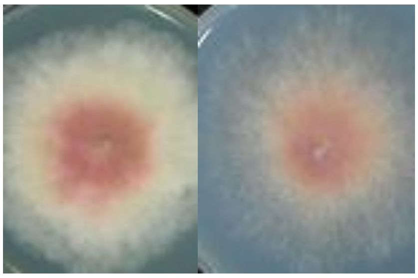


Plate 3: Microscopic identification of Giberrella zeae isolates at Mg X100

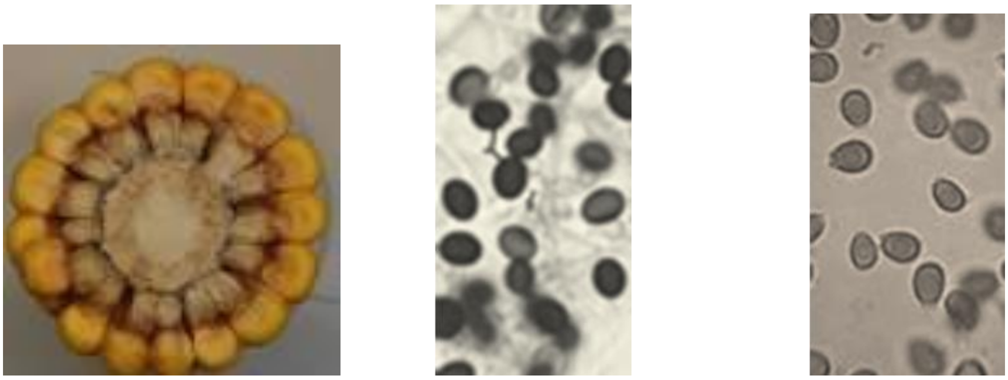


Plate 4: Internal part of the cob (a); Mature conidia dark conidiain at Mg X100 (b); Mature conidia light colored/ yellow conidia at Mg X100