EFFECT OF LIQUID POULTRY MANURE VERSUS AMMONIUM NITRATE AS TOP DRESSING FERTILIZERS ON GROWTH PERFORMANCE, DISEASE INCIDENCES AND YIELD OF MAIZE VARIETY SC403

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(B202395B

BSc Thesis Submitted in Partial Fulfillment of the Requirements for the Bachelor of Agricultural Science Honors Degree Majoring in Crop Science.

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DECLARATION

I, Criswell Mudandara, do hereby declare that this research project is the result of my original work that had been researched and got submitted on fulfilment of the Bachelor of Agricultural Honours Degree Majoring in Crop Science at Bindura University of Science Education. The other information had been derived from other people's work based on trusted sources and had been duly cited, accredited and acknowledged through references.

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ABSTRACT

Maize (*Zea mays*) is of high important paramount and it has been grown worldwide, it is more vital to both human and animal consumption. It is mostly considered as a staple food in Zimbabwe and also an industrial material for confectionery purposes like the production of *maputi*. It is reach in many nutrients that are vital for health issues like carbohydrates, fats, proteins, etc. The research was done in Zimbabwe Mashonaland Central in Mt Darwin a district that is found in ecological region four in Dotito. It took place under a complete random block design on four blocks. The task was based on the aspect of comparing the effect of ammonium nitrate versus liquid poultry manure as top dressing fertilizer on maize SC403 regarding to growth rate, disease incidences, quality and final yield to the maize small holder farmers. Just after planting, the agronomic practices took place which involved weed control, fertilization, scouting, etc. Some of the parameters were put into consideration and get recorded which comprised of plant height, pest and disease incidences, grain quality and final yield. The data had been analyzed using the Gen Stat Statistical Analytical tool for the analysis of the variance**.**

ACKNOWLEDGEMENTS

My heart felt gratitude directly goes to our Lord God Jehovah for the gift of strength, ability and healthy during the course of my study on this research. My uttermost thanks to Ms A. Kamota, my supervisor as well as my lecturer in the department of Crop Science under the Faculty of Agriculture for her consistency support, guidance and care as she used to sacrifice her time to attend me though she used to be occupied most of the time. My thanks giving also goes to Mr Mutsengi and Prof. R. Mandumbu for their consistency guidance and support on the issues that we used to consult them.

My high appreciation to my family members is beyond human measures, they supported me both spiritually and financially. They used to pray for my research and also assisted me with funds to acquire materials I had used to conduct my research.

Not forgetting my friends who anchored me with much courage to endure the long suffering that required more dedication who included Terence. T. Mwavera, Tariroyashe Mahachi, Quinton Chauke and the last one not least among the many, Neka Chekure.

DEDICATION

This research had been dedicated to all those small holder farmers who used to take Agriculture as a business. It also dedicated to the Ministry of Primary and Secondary Education since Agriculture is undertaken from primary up to tertiary level. All my family members and friends had been also dedicated on this research because they really loves agriculture. This research had been also dedicated to the government of Zimbabwe since agriculture is the backbone of our economy of Zimbabwe, it is also emphasized through some programmes like *pfumvudza* and maize is also our staple food.

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CHAPTER ONE

INTRODUCTION

1.1. Background of the study

Maize (Zea mays L.) among the mostly cultivated cereal crops in different parts of the world, providing an important source of for both humans and animals as well as industrial raw materials. Maintaining of the high yields and crop quality is very important for addressing the ever increasing global demand for maize. One of the significant key factors that influencing good maize production involves the efficient as well as the sustainable use of the fertilizers (Amanullah et al., 2016).

Synthetic fertilizers, like ammonium nitrate, had been widely used to supply some necessary nutrients required maize growth and development. These fertilizers supply an efficient and concentrated source of nutrients that involves nitrogen, which promotes plant growth and increase yields (Kumawat et al., 2019). However, overuse or the imbalanced application those synthetic fertilizers can usually leads to the various environmental concerns, which involves the soil degradation, water pollution as well as greenhouse gas emissions (Ju et al., 2016).

In the recent years, there has been increasing interest in using organic fertilizers like liquid poultry manure, as well suitable and sustainable alternative to synthetic fertilizers (Eghball et al., 2004). Liquid poultry manure comprises a wide variety of essential plant nutrients which involves nitrogen, phosphorus, potassium, various micronutrients and also other organic matter (Sistani et al., 2019). The release of some nutrients gradually from organic fertilizers mostly provides a more balanced and also a sustained provision of nutrients to the crop, which potentially accelerates growth performance, minimizing disease incidences, and boosts higher yields (Bulluck et al., 2002).

The way of applying liquid poultry manure as a top dressing fertilizer mostly can be particularly beneficial for the maize cultivation. The top dressing usually takes place soon after the crop emergency and it can help to optimize the nutrient availability and also its distribution throughout the entire growing season (Amanullah et al., 2016). Moreover, the use of liquid poultry manure as the top dressing fertilizer can reduce the chances of nutrient leaching and volatilization, which used to happen on the synthetic fertilizers (Durenkamp et al., 2016).

Many studies have compared some effects of the liquid poultry manure and synthetic fertilizers like ammonium nitrate, on the crop growth and also yield. Those studies had shown that the good application of liquid poultry manure usually leads to improved soil properties, enhanced nutrient use efficiency, and increased crop yields (Eghball and Power, 1999; Adeli et al., 2016).

The maize variety SC403 is a well-recognized, popular and widely cultivated maize hybrid in various regions because of its high yield potential, high disease resistance, and adaptability different environmental conditions. Understanding the comparative aspect on effects of the liquid poultry manure and also ammonium nitrate as the top dressing fertilizers on the growth performance, disease incidences, and yield of this maize variety can gives valuable insights for farmers and agronomists (Sistani et al., 2019).

This research study mainly aims to investigate an effect of liquid poultry manure compared with ammonium nitrate as top dressing fertilizers regarding the growth performance, disease incidences, and yield of the maize variety SC403. The results of this research could contribute to the development of more reliable, sustainable and efficient fertilizer management practices for maize production that could benefiting both farmers and the environment.

Furthermore, the findings of this can have broader implications for the adoption of organic fertilizers, such as liquid poultry manure that is good in maize cultivation and may inform the decision-making process for farmers and policymakers regarding the use of sustainable agricultural practices.

1.2. Problem Statement

The significant decrease in maize production by small holder farmers due to the expensiveness of AN as top dressing fertilizer had led the researcher to come up with concept of liquid poultry manure as a top dressing fertilizer. Liquid poultry manure is believed to contain nitrogen and other nutrients but the challenge is the quantities are unknown, hence the researcher needs to find out if it is suitable to be used as a single top dressing as an alternative fertilizer for AN.

1.3 Justification

Since maize has irreplaceable value in our country of Zimbabwe, efforts to boost its production should remain our top priority. Therefore, this research aims to address the challenges of reduction in maize production especially on small holder farmers due to input shortages that are under the influence of some instability factors which might lead to the fluctuation of input prizes. Despite the input limitations, there is also a number of factors that reduces the maize production. These factors involves pests, diseases, dry drought and poor management.

Results of this study will be well cost effective to the farmers since they will be using less or no money to gather poultry manure. It will also create a guideline and knowledge to the farmers about the use of poultry manure as a straight fertilizer. This will benefit especially low income people to do and boost their farming at lower costs since poultry manure are cheaper and locally found. It will create a chance for decision making especially to those that are financially disadvantaged whether to use the results outcome to do their normal farming practices.

The outcome of this result will be benefit almost everyone within the given community where the maize production is undertaken using the poultry manure. It is because poultry manure is environmentally friendly.

1.4. Overall objective

To investigate the effect of poultry manure versus Ammonium nitrate on growth rate, disease incidences and final yield to the maize small holder farmers.

1.4.1. Specific objectives

1.4.1.1. To evaluate growth performance of maize crop SC403 top dressed with liquid poultry manure versus maize crop SC403 top dressed with Ammonium nitrate.

1.4.1.2.To determine the rate of disease incidences of maize crop SC403 top dressed with liquid poultry manure versus maize crop SC403 top dressed with Ammonium nitrate.

1.4.1.3. To assess grain yield of maize crop SC403 top dressed with liquid poultry manure versus maize crop SC403 top dressed with Ammonium nitrate.

1.5. Hypothesis

H0: There is no difference in growth performance between maize crops SC403 top dressed with liquid poultry manure versus maize SC403 top dressed with Ammonium nitrate.

H0: There is no difference in disease between maize crops SC403 top dressed with liquid poultry manure versus maize SC403 top dressed with Ammonium nitrate.

H0: There is no difference on final yield between maize crops SC403 top dressed with liquid poultry manure versus maize SC403 top dressed with Ammonium nitrate.

CHAPTER TWO (2)

LITERATURE REVIEW

2.1. The overview of Fertilizers

Maize (Zea mays L.) is one of the most important cereal crops worldwide, regarded as a major source of food for both humans and animals as well as industrial raw material (Mosavi et al., 2018). Achieving optimal maize yields is crucial for global food security, and the use of appropriate fertilizers is a key factor in this regard (Adnan et al., 2020).The organic manures like poultry manure have been recognized as one of the effective alternatives to synthetic fertilizers based on their ability to increase soil fertility and plant growth (Lekasi et al., 2020). Poultry manure is rich in nutrients, especially nitrogen, phosphorus, and potassium, which are vital for the plant growth and development (Sánchez-Monedero et al., 2019). Some of the studies have shown that the liquid poultry manure application as a top dressing can results in maize growth, yield, and nutrient uptake compared to inorganic fertilizers (Ojo et al., 2016; Asiedu et al., 2021).

In contrast, the ammonium nitrate is a mostly used synthetic nitrogen based fertilizer that has been proven to have a positive effect on the maize production (Amanullah & Khalid, 2016). It provides the readily available nitrogen to the plants, which can lead to improved growth and yield (Fageria & Baligar, 2005). However, the excessive or imbalanced use of ammonium nitrate had adverse effects which involves plant diseases, threats of the environmental concerns due to the ability of the nitrate for leaching and also results in greenhouse gas emissions (Fageria et al., 2019; Lal, 2019).

The hybrid maize variety SC403 is widely cultivated in various regions globally because of its high yield potential and ability to thrive in different agro-ecological conditions, as noted by Aminu et al. (2020). Researchers have been particularly interested in studying how this variety responds to different fertilizer sources, such as liquid poultry manure and ammonium nitrate, in terms of its growth performance, disease incidences, and overall yield.

Numerous research studies have explored the contrasting impacts of organic and inorganic fertilizers on the growth and yield of maize. For example, Alori and Adekiya (2020) conducted a study indicating that the utilization of poultry manure led to notably greater plant height, stem

girth, leaf area, and grain yield of maize in comparison to the application of ammonium nitrate. Likewise, Owolabi et al. (2019) discovered that the application of liquid poultry manure as a top dressing fertilizer enhanced maize growth, decreased disease occurrence, and boosted grain yield when contrasted with the use of ammonium nitrate.

On the other hand, there are studies indicating that utilizing ammonium nitrate may have positive effects on maize growth. Amanullah and Khalid (2016) discovered that applying top dressing fertilizer containing ammonium nitrate resulted in increased maize grain yield.

In general, available literature indicates that both liquid poultry manure and ammonium nitrate can greatly impact the growth, disease occurrences, and yield of maize variety SC403. However, the efficacy of these fertilizers may be influenced by factors like soil fertility, climate, and management methods.

2.2. IMPORTANCE OF FERTILIZERS

2.2.1. Economic importance of Fertilizers

Increased crop yields remains the top priority, the use of fertilizers especially both synthetic ad well as organic fertilizers stimulates high crop growth rate, increasing the quality and also the final yield, hence this remarks the profitability to the farmer, (Fageria, Baligar and Jones, 2011).

Cost savings is another economic significance of using fertilizers especially poultry manure for maize production. Alam et al., (2021) stated that organic fertilizers like poultry manure can minimize the reliance on most synthetic fertilizers hence reduce the cost to maize farmers.

2.2.2. Social importance of fertilizers

Food Security is one of the most social significance of fertilizers. Fageria et al. (2011) mentioned that increased crop yields from the use of some fertilizers including poultry manure usually contributes to the high yields that could determine the availability and accessibility of food to the local group communities.

Livelihood opportunities could be generated. According to Alam et al., (2021), due to the production, distribution and application of fertilizers including poultry manure creates and employment and leading to the shifting up of general living standards.

Nutrient availability remains another significant, the well balanced nutrients that used to be provided by fertilizers including poultry manure can significantly help to address the nutrient deficiencies and accelerate overall human health nutrition, (Marschner, 2012).

2.2.3. Environmental importance of fertilizers

Blanco-Canqui et Al, (2022) stated that organic fertilizers like poultry manure improves the soil structure, microbial activity as well as promoting long term soil health qualities. This enables the maize to respond to physiological process in a good way.

Reduced emissions is another significant figure in the environment scenario, the use of organic fertilizers like poultry manure helps to reduce the carbon footprints that are usually driven by the production and transportation of the synthetic fertilizers hence by doing so we are mitigating the occurrence of climate change, (Alam et al., 2021).

2.3.0. NUTRITIONAL VALUE

2.3.1. Carbohydrates

Maize comprises of carbohydrates that enables it to be a good source of energy for both human beings and animals. The major carbohydrates component that usually found in maize involves starch, fiber and sugars. According to Bello, Agama and Sayago, (2016), starch is the predominant carbohydrate accounting for approximately 70- 80% of the total carbohydrate content of the maize. Corn comprises a big proportion of starch that is a bit complex system of carbohydrates that h ad been made up of glucose units, this starch provides essential amount of the energy especially when get consumed and is also the crucial key to the source of those dietary carbohydrates.

2.3.2. Dietary Fiber

Maize usually comprises of the dietary fiber which is a very essential for digestive health and the content of this fiber material becomes different due the variety and processing methods. According to Camire, Doughterty and Briggs, (2016), on the average maize contains approximately 2 - 3% dietary fiber. Human beings are being recommended to take about 12% of fiber per day in order to promote a healthy digestion and lowering constipation, (Pamela and Pauline, 2007).

2.3.3. Protein

Zea mays usually not considered as a source of protein as compared to legumes and other animal products, but it also still contributes to a certain percentage to the overall protein content in the diet. According to Bressani and Ellias, (2016), on average maize contains around 9-10% protein. The maize protein content is also mostly considered as it comprises of crucial amino acids which involves some notable amounts of the arginine which is one of the most vital amino acids for the protein synthesis.

2.3.4. Vitamins

Maize also involves different levels of vitamins and they tend to vary due types of varieties, Niacin (Vitamin B3) is vital for the energy metabolism, DNA regeneration and cell communication. The other vitamin is Thiamin (Vitamin B1) which is essential in the energy production, functionality of nerves as well as the metabolism of carbohydrates, (Mertz, 2016). Folate (Vitamin B9) is also one of the vitamins produced by the maize, it plays a very crucial role in cell division for growth especially during the stages of rapid development and like pregnancy and infancy.

2.3.5. Minerals

Maize also contains some essential minerals that are most vital for good health development and contributes to overall nutrition. Minerals like phosphorous are crucial for bone development as well as energy metabolism. Magnesium plays a plenty of roles especially on enzymic reactions and also take part on the nervous system functions. The mineral element potassium plays a vital role as an electrolyte that also helps to maintain the fluid balance, nervous system function as well as proper muscle contraction. These minerals contributes to the 70-78% of the whole germ of the maize kernel, (Bressani et al, 2016)

2.3.6. Antioxidents

These are compounds contained by maize which involves phenolics and carotenoids, their main role is to protect the cells of the body from being damaged by the free radicals, the percentage of antioxidants in maize usually ranges from 0.1% - 0.6%, (Butron and Malvar, 2016). The attack by radicals usually leads to some of the chronic conditions and quick aging, therefore these oxidant compounds contribute to the good body healthy system.

Table: 2.1. Showing nutrition value of Maize expressed as a percentage

Nutrition Element	Percentage value
Carbohydrates	70 – 80 %
Dietary Fiber	2 - 3 %
Protein	9 – 10 %
Vitamins	13 -15%
Minerals	70 – 78 %
Antioxidents	0.1 – 0.6 %

2.5.0. MANAGEMENT PRACTICES THAT INFLUENCE NUTRIENT UPTAKE

2.5.1. Types of soil and its Preparation

In order to minimize soil disturbance and preserve soil structure, optimal soil preparation calls for the use of appropriate tillage techniques, such as conservation or reduced tillage, (Ngongondo, Okullo and Njoroge, 2014). This promotes better water infiltration, less erosion, and increased nutrient availability for the growth of maize. Furthermore, adding organic matter to the soil such as manure or compost can increase soil fertility and encourage healthy microbial activity.

Although it may be grown in a range of soil types, maize likes soils that are rich in nutrients, have good drainage, and can hold a lot of water (Brennan and Smith, 2016). Typically, sandy loam and loam soils are preferred for producing maize because of their ability to retain rainfall without getting too wet. It's important to remember that different varieties of maize may need differing depths of soil. Advice on the ideal soil depth for certain cultivars in your area can be obtained from local breeders of maize or agricultural extension agencies. Other factors including drainage, erosion management methods, and soil fertility must also be considered for successful maize farming.

2.5.2. Nutrient Management

There are various commonly used fertilizers in all agricultural sectors in Zimbabwe and across the world. For top dressing issues Ammonium Nitrate it's mostly used by a wide range of farmers, it is mainly known for its best performance. Nitrogen is mostly best for its versatility, that it can be used for top dressing fertilizer for a variety of crops including vegetables, cereals, etc., (Fageria et al, 2021). The other advantage of using AN as a top dressing fertilizer involves that it has got high nitrogen content around 34% making it a reliable and efficient source of nitrogen, (Havlin, Tisdale, Nelson and Beaton, 2016).

However, though AN is known for its best performing top dressing fertilizer, it has got some limitations as well that involves its potential for leaching, the nitrate form of nitrogen that found in AN has got high leaching potential, which could leads to the environment contamination through water pollution (Havlin et al, 2016). Volatilization is another limiting factor for AN fertilizers, it mostly accelerated by extreme high temperatures that drives the Ammonium in AN fertilizer to turn into gas and vapor into the atmosphere, (Fageria et Al, 2021).

There are other organic manure that can be used for top dressing which involves the use of poultry manure. Poultry manure is rich in some nutrients including nitrogen, it also add organic matter to the soil, hence making the soil fertile as well as maintaining its structure, (Eghball, Wienhold, Gilley and Eigenberg, 2002). The major challenge based on the use of poultry manure as a top dressing fertilizer includes the potential for pathogens. Poultry manure contains pathogens that can even pose some risks to crops if not treated and handled in a good way, (Eghball et at , 2002).

2.5.3. Irrigation

Irrigation provides moisture to the soil which is more crucial factor that determines the availability and also an uptake of soil nutrients by plants. There is a direct relationship between soil moisture and Nutrient uptake in so many ways that involves nutrient solubility. Adequate soil moisture improves the solubility of Nutrients making then available for uptake by plants, (Mengel and Kirkby, 2001).Nutrient mobility facilitated by soil moisture through the soil solution system enabling their translocation to the root surfaces, (Havlin et al., 2016). This enables proper utilization of nutrients by plants since they would have access to the nutrients through their roots.

2.5.4. Pest and disease management

Disruption of Nutrient Absorption by Pests and diseases due to physically damaging or disrupting the plant root system. This hinders the ability of a plant to absorb water and other essential valuable nutrients from the soil (Dordas, 2008). The example involves the root biting and feeding insects or other pathogens that can cause the root to get rot which would retards the plant's capacity to uptake water and other nutrients (Havlin et al., 2016).

Reduced Photosynthesis by pests and diseases could affect the leaves of a plant like foliar diseases or other chewing pathogens that can avoid the plant's photosynthetic high capacity. This limits the production of the carbohydrates as well as energy that is mostly necessary for nutrient uptake and utilization (Havlin et al., 2016).

To reduce the pressure of pests and diseases, integrated pest management (IPM) solutions combine chemical, biological, and cultural control measures, (Lopez, Montesinos and Garcia, 2018). Using resistant maize varieties, rotating crops to break the cycles of pests and diseases, introducing beneficial insects or microbial agents as biological control agents, and using targeted pesticide applications all in accordance with integrated pest management guidelines.

2.5.5. Crop Rotation and Intercropping Strategies

Crop rotation involves alternating maize with other crops to improve soil fertility, suppress pests and diseases, and enhance overall productivity. Intercropping maize with legumes, such as beans or cowpeas, can improve nitrogen fixation, increase soil fertility, and provide additional income through the sale of legume crops, (Singh, et al, 2018). Intercropping with other complementary crops, such as sorghum or millet, can also improve resource utilization and reduce pest pressure.

CHAPTER THREE (3)

3.0. METHODOLOGY

3.1. Site Description

The research had been conducted in Zimbabwe in Mashonaland Central province in the district of Mount Darwin, ward 19 in Mazwimaviri Village. This district is found in ecological region 4 which is mostly known for uneven rainfall distribution and also dry spells to some part of it. The district usually used to receive the annual rainfall of 600mm which believed that it's not being fixed due to the variability in climate changes aspects. The area is characterized by lightly red loamy-sandy soils, these soils are mostly known for their quick dry up if not getting water for a short space of time. Mount Darwin temperature ranges involves the annual high temperatures of about 29.26ºC, annual low temperatures are about 15.78ºC and the warmest temperatures ranges 34.73ºC.

3.2. Experimental design

The research was done in the field using RCBD with four replications based on the four treatments (liquid poultry manure, Ammonium Nitrate, a mixture of both liquid poultry manure, AN and a control with no fertilizer) replicated three times resulting in 12 plots. The area was divided into 3 blocks with 4 plots in each block giving a total of 12 plots. Each plot had a total of 8m² (4m x 2m). The whole area occupied a total space of (15m x 11m). The usual recommended application rate for AN fertilizer its 250kg/ha. The area covered its 154m² hence 3.85kg had used.

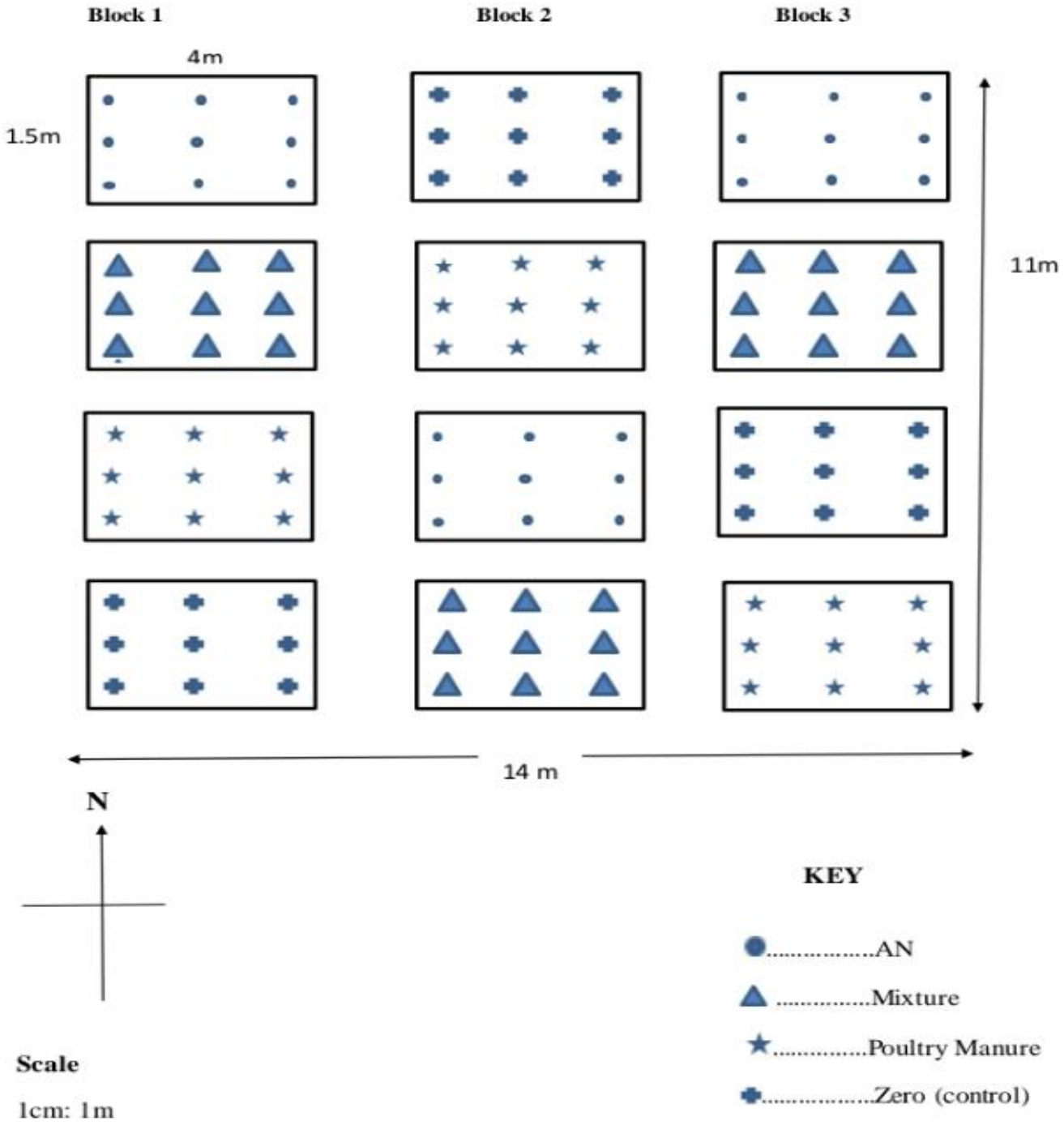


Figure 3.1. The experimental design layout of the research

3.3. AGRONOMIC MANAGEMENT

3.3.1. Land Preparation

The land was cleared of its grasses and bushes using a slasher and a hoe respectively and were set on fire. Stones heaped and taken out of the filed using a wheelbarrow. The land ploughed using an ox-drawn plough and a certain depth of 30cm leaving it in a rough state, back of the whole had used for pulverization in order to achieve a fine texture, (Onweremadu, Onyia and Anikwe, 2017).

3.3.2. Planting

The maize seed SC403 from a well-recognized company Seed Co was planted, 2 seeds were dropped in a hole using bare hands and been covered using a thin layer of soil in such a way of maximizing germination percentage in case if one seed fails the other one will be able to germinate. The planted area involved of 3 blocks having 4 plots each to make a total of 12 plots and each plot consisted of 9 planting stations.

3.3.3. Weed and pest control

Weeds were under strict management in order to maximize better results, it was monitored using the IPM (Integrated Pest Management), (Lamichhane, Dachbrod, Kudsk & Messéan, 2016). Hoes were used to instantly get rid of weeds, some were physically uprooted using bare hands. Some of the herbicides like glyphosate and Atrazine had been used which had been a successful element in the weed eradication.

3.3.4. Harvesting

Harvesting was done using bare hands, it took place within the range of four months soon after the maize reached its physiological maturity and when the moisture was at its recommended stage, 12.5%. The cobs of maize from each plant had been removed manually using bare hands. Shelling was done using bare hands as well and then it taken to the balance for its weight determination

3.3.5 Fertilizer Application

The usual recommended application rate for AN fertilizer on maize its 250kg/ha, the used area was 154m² hence a rate of 3.85kg/ha used. The usual recommended application rate for AN fertilizer on maize its 250kg/ha, the used area was 154m² hence a rate of 3.85kg/ha used. The

amount of AN and poultry manure used its 4.53kg and 308kg respectively. The mixing ratios could be like 4.53kg of AN fertilizer as to 308kg of poultry manure (USDA-NRCS, 2012). The liquid poultry manure had been prepared in very simple steps. The procedure involved gathering the fresh manure from a poultry storage place, some caution measurements had taken which included that the manure is free from the bedding material other obstacles. The poultry manure got mixed with water in a well suitable container and the mixing ratios was 1kg of manure as per 5 liters of water, (Oenema, Witzke, Klimont, Lesschen & Velthof, 2009).

3.4. DATA COLLECTION

3.4.1. Plant height

The height measurement took place from the two weeks after the date of planting (14 days) to capture early stages until the plants reach their physiological maturity when they will be no longer able to increase in their height, (Tollenar and Daynard, 1978). A string was used to measure the height of the plant from its base to the most top point of a tallest leaf, then that string taken and get stretched on a meter ruler for more accurate measurements, (Sandras and Calderin, 2012).

3.4.2. Pest and Disease Incidences

The disease severity was determined through observation in such a way that 5 plants from each plot were randomly selected, the number of plants attacked by diseases were countered and recorded, It been observed that the plants were mostly attacked on their leaves and stems making them to be more visible and easier to identify, (Nyende, Mwongela and Kauriku, 2011). They expressed as a percentage of the total plants per plot then they averaged per each block.

3.4.3. Maize Quality

The quality of maize was determined mainly based on the nutritional value of the maize especially carbohydrates and proteins. Maize collected from each plot was being tested of its nutritional value status and recorded. The maize appearance was also considered when the shape of maize kernels were carefully observed and noted down. Kernel sizes were observed as well across the maize from all plots and get recorded.

3.4.4. Final Yield

Shelled maize from each plot had been weighed and recorded of its mass and it been placed into well labelled envelope pockets. Each pocket had labeled abbreviations of each nutrient sources that had applied as top dressing to each plot in such a way that Ammonium Nitrate (AN), Liquid Poultry Manure (LP), Mixture (Mx) and a control with Zero (Z). The envelopes had been kept a well dry, cool and ventilated place, (Ogunwole, Adeyemi and Adeyemo, 2012).

3.5. DATA ANALYSIS

The collected data had been subjected to the ANNOVA system (analysis of variance) using the Gen stat Statistical analytical tool package (18^{th} Edition). The Least Significant Difference (L.S.D.) had been used to separate the means at ($P<0.05$).

CHAPTER FOUR (4)

RESULTS

4.1 Effects of liquid poultry manure and ammonium nitrate on disease incidences on maize crops (SC404)

Table 1: Effects of liquid poultry manure versus ammonium nitrate on disease incidences on maize crops (SC403)

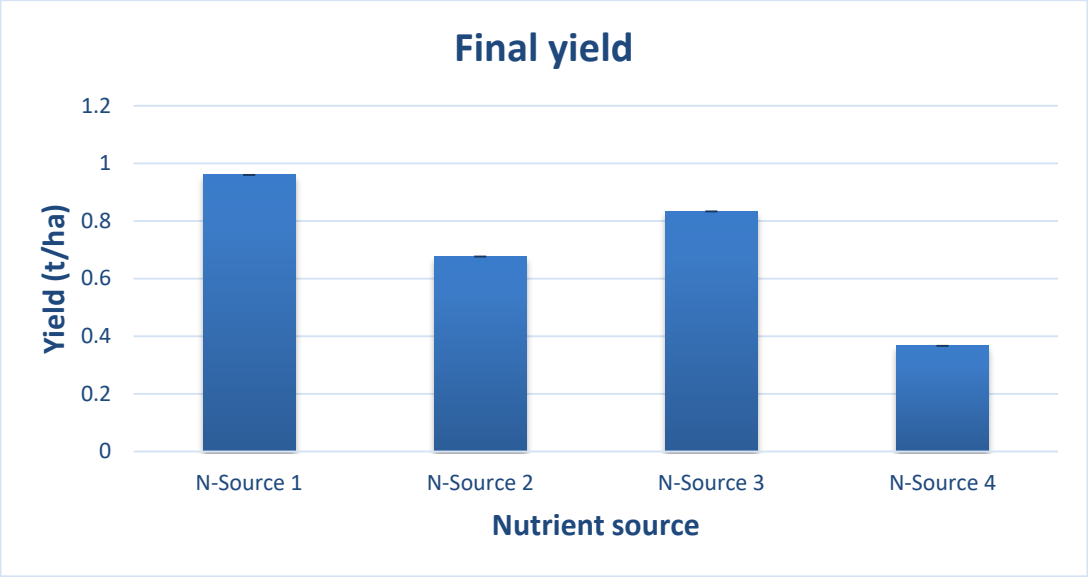
Nutrient source	Disease incidences (%) 6WAP	Disease incidences (%) 7WAP	Disease incidences (%) 8WAP
1	0.0750 *d*	0.257 *b*	0.293 *b*
2	0.04767 *b*	0.770 *a*	0.953 *a*
3	0.2567 *c*	0.733 *a*	0.697 *a*
4	0.6967 *a*	0.660 *a*	0.770 *a*
P-value	<.001	0.018	0.005
S.E.D	0.02536	0.1207	0.1090
L.S.D	0.06205	0.2953	0.2667
cv%	8.3	24.4	19.7

Means followed by the same letter are not significantly different

Liquid poultry manure and ammonium nitrate had an effect (P<0.05) on disease incidences on maize crops (SC403) at all the weeks (6, 7 and 8WAP). At 6WAP, (control), have the highest mean 0.6967 % of disease incidences. At 7WAP, (liquid poultry manure) also gave the highest mean 0.770% of disease incidences and at 8WAP the highest mean 0.953% of disease incidence was obtained from (liquid poultry manure).

4.2 Effects of liquid poultry manure and ammonium nitrate on final yield of maize crops (SC403)

Figure 4.1: Effects of liquid poultry manure and ammonium nitrate on final yield of maize crops (SC403)

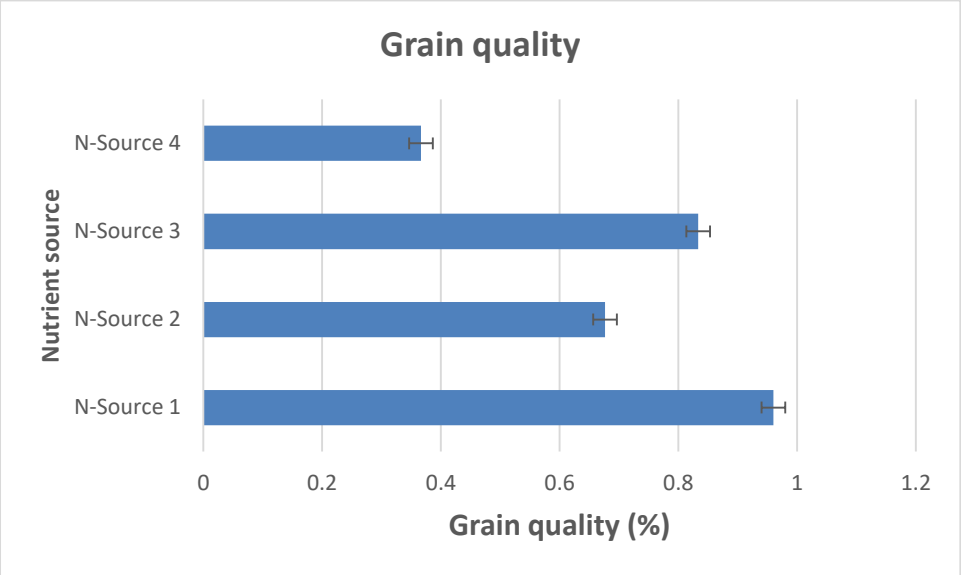


Liquid poultry manure and ammonium nitrate had an effect ($P<0.05$) on the final yield of maize crops (SC403) after harvesting. (Ammonium nitrate have the highest mean yield of 0.00550t/ha after harvesting, followed by (mixture of liquid poultry manure and ammonium nitrate) with 0.00400t/ha.

There was a notable statistical difference ($P<0.05$) on the means of final yield of maize crops (SC403) of liquid poultry manure and ammonium nitrate on all the nutrient sources

4.3 Effects of liquid poultry manure and ammonium nitrate on grain quality of maize crops (SC403).

Figure 4.2: Effects of liquid poultry manure versus ammonium nitrate on grain quality of maize crops (SC403).



Liquid poultry manure and ammonium nitrate had an effect (P<0.05) on the grain quality of maize crops (SC403). (Ammonium nitrate) gave the highest mean of grain quality of 0.9600%, followed by nutrient source 3 (mixture of liquid poultry manure and ammonium nitrate) with the mean grain quality of 0.8333%.

There was a significant difference (P<0.05) on the means of maize crops (SC403) grain quality of liquid poultry manure and ammonium nitrate on all the nutrient sources (nutrient sourrce1, nutrient source 2, nutrient source 3 and nutrient source 4) at 9WAP.

4.4 Effects of liquid poultry manure and ammonium nitrate on maize crop height (SC403)

Table 4.2: Effects of liquid poultry manure and ammonium nitrate on maize crop height (SC403)

Nutrient source	**Height (cm) 5WAP**	**Height (cm) 6WAP**	**Height (cm) 7WAP**	**Height (cm) 8WAP**
1	66.00 *a*	96.50 *a*	122.67 *a*	179a
2	61.00 *b*	80.67 *c*	95.50 *c*	118c
3	64.67 *a*	91.67 *b*	116.00 *b*	501b
4	49.00 *c*	68.00 *d*	75.83 *d*	80d
P-value	<.001	<.001	<.001	0.351

S.E.D	0.816	1.529	1.408	235.9
L.S.D	1.998	3.741	3.444	577.3
cv%	1.7	2.2	1.7	131.6

Liquid poultry manure and ammonium nitrate had an effect ($p<0.05$) on the height of maize crops at 5, 6 and 7 wap. at 8 wap there was no notable statistical difference observed ($p>0.05$) between poultry manure and ammonium nitrate in terms of maize crops height. at 6 and 7wap, there was a notable statistical difference ($p<0.05$) on the means of maize crops height of liquid poultry manure and ammonium nitrate on all the nutrient sources

CHAPTER FIVE (5)

5.0. RESULTS DISCUSSION

5.1. Effects of liquid poultry manure and ammonium nitrate on disease incidences on maize crops (SC403)

One maize variety SC403 has been subjected under different top dressing fertilizers which included Ammonium nitrate, liquid poultry manure, mixture and control to figure out the severity of diseases under such treatments. Top dressing fertilizers had a significant element that enables plants to boost their system and resists the pests and diseases attacks. The Nitrogen element stimulates the production of chlorophyll which is an essential element in the health of plants as it promotes growth and overcome delaying growth stages which might leads to the attack by both pests and diseases, (Marschner, 2012). Liquid poultry manure believed to habber pests and diseases hence any plant top dressed with it might be prone to pests and diseases attacks.

There is notable significant difference on the disease incidences on maize variety SC403 top dressed with Ammonium nitrate, liquid poultry manure and mixture and zero (control). Maize SC403 top dressed with AN exhibited high resistance to diseases attacks as compared to those top dressed using poultry manure, this is due to the balanced nutrient availability. Huber and Thompson, (2007) and also Dordas, (2008) had suggested that Ammonium nitrate (AN) as a top dressing fertilizer provides a more balanced supply of nitrogen to the maize plants compared to liquid poultry manure. The studies by these authors shown that a balanced nutrient supply, particularly nitrogen, can enhance the plant' defense mechanisms and overall resistance to diseases and pests .The combination (mixture) of both AN and liquid poultry manure had shown a better resistance than the liquid poultry manure itself, (Banziger, Edmeades, Beck, and Bellon, 2000). Maize SC403 without any element applied became the one with the highest percentage of disease severity.

5.2 Effects of liquid poultry manure and ammonium nitrate on final yield of maize crops (SC403)

Results from the research have shown that Maize variety SC403 has variably responded to the top dressing fertilizer elements Ammonium Nitrate, Liquid poultry manure, and mixture and

zero (control). Maize SC403 top dressed with AN has got highest yield as compared to other fertilizer. This may be due to some reasons like that nitrogen contains known quantities of nitrogen which are 34.5% and elements like nitrogen in AN promotes the green pigment of the plant that is the chlorophyll, (Sarkodie, Konlan, Kombiok, 2013). It is essential for light absorption that is vital for the plant reproduction of starch that promotes the dry matter accumulation that will determine the crop yield.

Nitrogen element is vital for the production of amino acids that are essential for the production of enzymes that are vital for the physiological processes like the production of proteins that are necessary for the production. Maize SC403 top dressed with a mixture had earned a second yield from the highest, this is because of he presents of nitrogen from both nutrients sources (liquid poultry manure and AN). They both contain nitrogen but it is believed that liquid poultry manure comprises of lower nitrogen content than AN itself. The other reason could be that liquid poultry manure has got high potential to habber pests and diseases and it contains unknown quantities of nitrogen, (Adeli, Bolster, Rowe, & McLaughlin, 2008), hence maize plants became more susceptible to the agency of affection which are pathogens that are responsible for the formation of diseases.

Maize SC403 top dressed with liquid poultry manure had experienced very lower yield as compared to those first two. This had shown that nitrogen content is lower in poultry manure as compared in Ammonium nitrate. The main reason for such a lower yield could be due that fact that liquid poultry manure provides favorable conditions for the pathogens that attacks plants hindering them to attain proper health conditions. When liquid poultry manure applied to the plants, they will be prone to the agents of destruction which actually damages vital plant organs like leaves that are responsible for the physiological processes like photosynthesis.

Poor yield had been recorded on Maize SC403 without top dressing fertilizer, this is actually led by the fact that there was zero element in the maize that could lead to no dry matter accumulation and the maize plant could be more prone to the pathogens that damage the plant important organs. According to Mupangwa, Banziger, Edmeades, & Lafitte, (1999), maize varieties that were not adequately supplied with nitrogen fertilizer exhibited reduced biomass accumulation and were more susceptible to biotic and abiotic stresses, leading to significantly lower yields. The destruction of such organs definitely leads to lower yields because they are also essential for the reproduction process that actually determines the final yield of the maize.

5.3. Effects of liquid poultry manure and ammonium nitrate on grain quality of maize crops (SC403).

From the research results the maize SC403 have shown a significant difference in grain quality due to some nutrient sources that had been used for top dressing. Maize SC403 top dressed with AN have shown the highest grain quality as compared to other three nutrient sources. This might be due to the good health condition of the maize through its growing stages fueled by nitrogen in the Ammonium nitrate that ensures proper growing conditions for the maize, (Amanullah, Asif, Almas, & Shah, 2010). Good physiological processes like photosynthesis definitely leads to the high dry matter accumulation which promotes good grain quality.

Maize grain quality had been recoded second from the highest on Maize SC403 top dressed with a mixture. This could be due to some facts that both poultry manure and AN contains the nitrogen elements which are vital for the reproduction and other physiological processes that will actually leads to the good kernel formation. There is a lower rate of pests and diseases incidences as compared to the one top dressed poultry manure only, hence the chances of better production could be high leading to a better grain quality. Maize SC403 top dressed with poultry manure alone recorded the third position of grain quality, this might be due to some factors which involves the occurrence of pests and diseases, (Adeli, A.et al, 2008). Poultry manure also contains unknown quantities of nitrogen, hence maize got poor grain quality. The maize SC403 without any top dressing element recorded the least significance on grain quality and it might be due to the absence of any elements that are responsible for any production, like the absence of nitrogen.

5.4 Effects of liquid poultry manure and ammonium nitrate on maize crop height (SC403)

Results from the research had reviewed that Maize SC403 top dressed with nutrient source 1 (Ammonium Nitrate) had the highest crop height especially from week 5WAP to week 7 WAP as compared to other nutrient sources that are liquid poultry manure, mixture and the one with zero (control) that gave lower crop heights.

Maize SC403 top dressed with AN gave highest growth rate due to the present of known quantities of nitrogen in the nutrient source, (Ruffo, Bollero, Bullock, and Franzen, 2003). Nitrogen stimulates the plant growth rate, it has got areas of specific targets within the plant

especially in meristems where it stimulates hormones of length increment, hence the plant experienced high growth rate.

There was no much difference between the Maize SC403 plant top dressed with the Ammonium nitrate and other top dressed with mixture of liquid poultry manure in terms of growth rate. This might be due to some specific reasons which involves that they both contains the nitrogen element though the liquid poultry manure contains unknown quantities of nitrogen. Maize SC403 top dressed with poultry manure only have shown big difference from the one top dressed with AN, but not that much significantly differing from the mixture, this is still coming back to the fact that liquid poultry manure contains nitrogen though its quantities are not known, (Eghball, & Power, 2019). Maize SC403 with zero (control) recorded the lowest growth rate due to no top dressing element applied.

CHAPTER SIX (6)

6.0. CONCLUSION AND RECOMMENDATIONS

6.1. CONCLUSION

The results of this study have shown the responses of the four nutrient sources as top dressing fertilizers which are (Ammonium Nitrate), (liquid poultry manure), (mixture) and with zero (control). Maize SC403 top dressed with AN have dominated all the parameters as it had the highest growth rate, highest disease resistance, highest grain quality and also highest final yield. Maize top dressed with the mixture have shown better resistance as compared to those top dressed with liquid poultry manure only. That one top dressed with liquid poultry manure only have shown poor performance in all parameters which have been shown by poor growth rate, high disease incidences, poor grain quality and also poor final yield. The lowest performance had been shown by the maize SC403 without top dressing element as it shown the lowest figures and also the most affected by the diseases.

6.2. RECOMMENDATIONS

Farmers in region four (4) are being recommended to adapt to the clean way of farming which involves the use of approved sources of fertilizers with well-known quantities like nitrogen with 34.5%. This may enables them to boost up their yields as well as to overcome unnecessary expenses like the purchasing of chemicals as well as to bypass loss during the course of production. Farmers are not being encouraged to use some means of top dressing like poultry manure since they may leads a farmer to engage in some expenses through issues like the outbreak of diseases incidences which will makes the farmer to acquire some chemicals. If farmers have persisted to use liquid poultry manure for top dressing, they are being recommended to buy insecticides and other chemicals to prevent diseases.

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APPENDICES

Analysis of variance

Appendix 1

Diease_incidences Week 6

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
BLOCK stratum	2	0.0257625	0.0128813	13.35	
BLOCK.*Units* stratum					
NUTRIENT_SOURCE	3	0.6534063	0.2178021	225.80	<.001
Residual	6	0.0057875	0.0009646		
Total	11	0.6849563			

APPENDIX 2

Diease_incidences Week 7

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
BLOCK stratum	2	0.00605	0.00302	0.14	
BLOCK.*Units* stratum					
NUTRIENT_SOURCE	3	0.50417	0.16806	7.69	0.018
Residual	6	0.13108	0.02185		
Total	11	0.64130			

APPENDIX 3
Diease_incidences Week 8

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
BLOCK stratum	2	0.01412	0.00706	0.40	
BLOCK.*Units* stratum					
NUTRIENT_SOURCE	3	0.69777	0.23259	13.06	0.005
Residual	6	0.10688	0.01781		

Total	11	0.81877			

APPENDIX 4

Final yield week 9

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
BLOCK stratum	2	4.279E-07	2.140E-07	1.18	
BLOCK.*Units* stratum					
NUTRIENT_SOURCE	3	3.489E-05	1.163E-05	64.39	<.001
Residual	6	1.084E-06	1.806E-07		
Total	11	3.640E-05			

APPENDIX 5

Grain quality Week 9

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
BLOCK stratum	2	0.0002167	0.0001083	0.18	
BLOCK.*Units* stratum					
NUTRIENT_SOURCE	3	0.5900917	0.1966972	329.35	<.001
Residual	6	0.0035833	0.0005972		
Total	11	0.5938917			

APPENDIX 6

Height Week 5

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
BLOCK stratum	2	0.667	0.333	0.33	
BLOCK.*Units* stratum					
NUTRIENT_SOURCE	3	539.000	179.667	179.67	<.001
Residual	6	6.000	1.000		
Total	11	545.667			

APPENDIX 7

Height week 6

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
BLOCK stratum	2	2.792	1.396	0.40	
BLOCK.*Units* stratum					
NUTRIENT_SOURCE	3	1445.896	481.965	137.43	<.001
Residual	6	21.042	3.507		
Total	11	1469.729			

APPENDIX 8

Height week 7

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
BLOCK stratum	2	6.500	3.250	1.09	
BLOCK.*Units* stratum					
NUTRIENT_SOURCE	3	4047.167	1349.056	453.89	<.001
Residual	6	17.833	2.972		
Total	11	4071.500			

APPENDIX 9

Height week 8

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
BLOCK stratum	2	166346.	83173.	1.00	
BLOCK.*Units* stratum					
NUTRIENT_SOURCE	3	332058.	110686.	1.33	0.351
Residual	6	501023.	83504.		
Total	11	999427.			