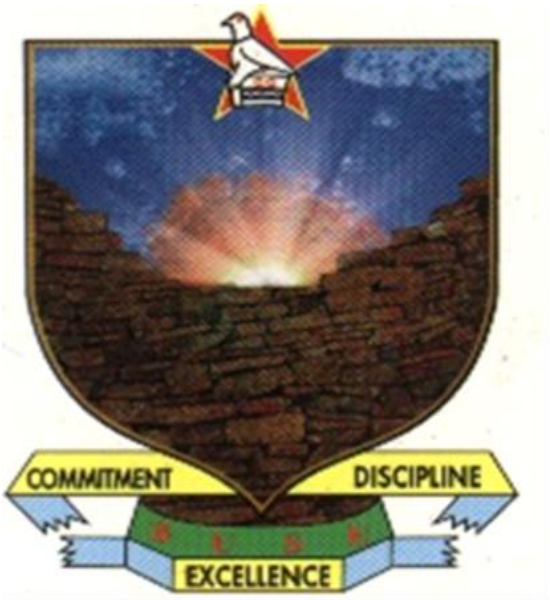
EVALUTION ON EFFECTS OF DIFFERENT LEVELS OF EXTRABOOST AND AMNIOUM NITRATE ON GROWTH, YIELD AND QUALITY OF FINE BEANS (LOMANI)

BINDURA UNIVERSITY OF SCIENCE EDUCATION

DEPARTMENT OF CROP SCIENCE



A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS OF THE BACHELOR OF AGRICULTURAL SCIENCE HONOURS DEGREE

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DECLARATION

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The undersigned certify that they have read and recommended to the Department of Crop Science, this thesis entitled:

Evaluation on the effects of different levels of extra boost and ammonium nitrate on growth, yield and quality of fine beans (Lomani).

Supervisor…….

Date……

Course coordinator……

Date…….

Mr Mutsengi (Chairperson)…….

Date……

DEDICATION

This project is dedicated to my parents, who have worked tirelessly to support my academic endeavours and help me achieve my goals. I would also like to dedicate this work to my supervisor, who has inspired me and installed in me a spirit of perseverance and hard working in my studies.

ACKNOWLEDGEMENTS

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Additionally, I would like to extend my heartfelt appreciation to my colleagues, Terrance Mwavera, Hazel Nhambura and Mavis Mubaiwa who are final year students at BUSE, for assisting me with data collection and project management.

The last but not least, I would like to thank my family for their financial support and words of encouragement throughout the duration of this project.

ABSTRACT

The study evaluated the effects different levels of Extra boost and ammonium nitrate on growth, yield and quality of fine beans (Lomani) which is a variety from SeedCo in Bindura. The objectives of the study were to determine the effects of different levels of extra boost and ammonium nitrate on the vegetative growth of fine beans pre-harvest parameters, reproductive growth and yield. Primary data used for the study was obtained using experimental plots. Randomised complete block design was used with different levels of extra boost and ammonium nitrate in each plot where each experiment (treatment) had three replicates making them eighteen beds. The application rate of extra boost and ammonium nitrate zero units means no application, 100 units was recommended, 150units was above recommended and 50 was below the recommended. Results shows that on combination ratio of 150:150 had a positive impact on growth and development of fine beans. Therefore the application ratio of 50:150 performed lower which resulted in the diminishing of plant growth. Yield from bed T2 and T6 produced high yield and high number of pods demonstrated that the combination with more extra boost is more effective. However leaf rust and leafhopper were major problems during the experiment. The study recommends that the combination of extra boost and ammonium nitrate should balance to produce higher yields and quality fine beans.

Key words: Extra boost, Ammonium Nitrate

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LIST OF ABBREVIATION

AN – Ammonium Nitrate

EB – Extra boost

NPK – Nitrogen, Phosphorus, Potassium

CHAPTER 1

1.1 BACKGROUND/ INTRODUCTION

A fine bean is a type of green bean that is narrower than 7.5 to 9 mm in diameter. It is also known as a French bean, string bean, or bobby bean. Fine beans are popular in European and Asian cuisines, and can be cooked in various ways, such as boiling, steaming, frying, roasting, or pickling. According to Spooner *et al*.2014, fine beans are rich in vitamins, minerals, and fibre, and have a crunchy texture and fresh flavour.

Fine beans, scientifically known as *Phaseolus vulgaris L*., are an essential leguminous crop widely cultivated for their high nutritional value, economic significance, and ecological benefits. They are rich in essential nutrients such as protein, fibre, vitamins, and minerals, making them an important component of a healthy diet. In addition to their nutritional value, fine beans play a crucial role in sustainable agriculture due to their ability to fix atmospheric nitrogen, thus enhancing soil fertility and reducing the need for synthetic fertilizers (Mushekwa Sakumona et al, 2023).

Lomani fine beans variety is a product of Seed Co Zimbabwe, a company that produces certified crop seeds. It is not clear where exactly the variety originated, but it is likely that it was developed from the common bean (*Phaseolus vulgaris*), which is native to Central and South America. The common bean has a long history of cultivation and has many different types and varieties around the world. Lomani is characterised with circular and straight dark green pods that matures in 54 days and is suitable for both fresh market , processing and has disease tolerance to rust and bean mosaic (Bagonza *et al*, 2014). It is a bean with vigorous growth that is well suited for heavy soils.

Lomani is also comparable to Star 2054, another fine bean variety from Starke Ayres, a seed company based in South Africa3. Star 2054 has a slightly longer maturity period of 55 days, and a slightly shorter pod size of 12-14 cm. It also has dark green pods, but they are straighter and have a superior pod quality. Star 2054 also has resistance to rust and bean mosaic, as well as a very slow seed development and excellent gel retention. (Murungweni *et al*, 2020).

In Africa, fine beans, also known as green beans, have gained significant importance in various regions for their nutritional value and culinary versatility. Beans are the most important, widely grown, and consumed grain legume in Eastern, Central, and Southern Africa, with approximately 6.3 million hectares of land used for bean cultivation annual. Fine bean consumption in Eastern Africa is the highest in the world, particularly in western Kenya, Rwanda, and Burundi, where people consume around 50-60 kg of beans per year (Taba-Morales, Hyman, 2020).

According to (PABRA, 2014) research and development efforts such as collaborative plant breeding efforts, such as those by the Pan Africa Bean Research Alliance (PABRA), have led to the development and scaling up of dozens of varieties of iron-biofortified beans to address nutritional deficiencies. PABRA, established in 1996, aims to enhance food and nutrition security, incomes, resilience to climate change, and gender equality for improved rural and urban livelihoods in 32 African countries.

Nutritional and culinary importance of beans, are recognized for their nutritional value and potential to effectively balance the diets of millions of Africans by providing essential nutrients and protein. Fine beans are a major source of dietary protein in various African countries, including Kenya, Malawi, Tanzania, Uganda, and Zambia. Understanding the impact of Extra boost and ammonium nitrate on the vegetative growth of fine beans is crucial for optimizing crop management practices and maximizing the overall productivity of the Lomani variety. Fine beans are a popular choice for cultivation due to their numerous advantages. These advantages encompass nutritional benefits, versatility in culinary applications, and their potential for sustainable agriculture. Fine beans play a significant role in sustainable agriculture. As leguminous crops, green beans have the ability to fix atmospheric nitrogen through symbiotic relationships with nitrogen-fixing bacteria in their root nodules. This nitrogen fixation enhances soil fertility, reduces the need for synthetic nitrogen fertilizers, and promotes sustainable farming practices. By cultivating fine beans, farmers can contribute to the maintenance of healthy soil ecosystems and reduce the environmental impact of agricultural activities (Unilever, 2023)

According to (U.S. Department of Agriculture, 2021)Vitamins and Minerals are in green beans too. Green beans contain essential vitamins and minerals, including iron, calcium, magnesium, phosphorus, potassium, and folate. For example, 1 cup of cooked chickpeas provides 71% of

the Daily Value (DV) for folate, along with significant amounts of copper and manganese. They also contain vitamins B1, B6, E, and K, as well as zinc and selenium.

Health Benefits, consumption of beans, including green beans, has been associated with various health benefits, such as reducing cholesterol levels, managing blood sugar, and promoting healthy gut bacteria. Beans are also recognized for their potential to impact weight management and support overall health, including cardiovascular and metabolic health.

Economic and agricultural impact of fine beans are well suited to smallholder agriculture and low-input production systems, making them an important source of income for many farmers in Africa. The African Bean Consortium (ABC) plays a significant role in promoting the cultivation and trade of common beans (Phaseolus vulgaris) in Africa, benefiting over 100 million people (Travis, 2022).The introduction and cultivation of fine beans in Africa have not only contributed to addressing nutritional challenges but have also had a significant impact on agricultural economies and food security across the continent.

According to (Sprent, 2009) the introduction and effects of fertilizers in growing fine beans has several effects which are beneficial and non-beneficial. The use of fertilizers in growing fine beans plays a crucial role in ensuring optimal growth, yield, and nutritional value. Legumes, such as beans, have the ability to fix their own nitrogen through a process involving soil-borne bacteria and the extraction of nitrogen from the soil as ammonia. Excessive nitrogen from chemical fertilizers can lead to lush foliage growth but fewer beans, showing the importance of balancing nitrogen levels for optimal bean production. It's important to consider the process of nitrogen fixation when using chemical fertilizers to avoid overstimulating foliage growth at the expense of bean production (Marschner, 2012) .

(Jalali, Mohammadian et al, 2023) stated the effects of organic fertilizers while other researches has shown that the use of organic fertilizers, such as vermicompost and traditional compost, can significantly impact the productivity of fine beans. In an experiment evaluating the effects of vermicompost and compost on the growth and yield of various leguminous vegetables, including beans, it was found that these organic fertilizers had notable effects on the fresh biomass and pod characteristics of the beans (Mahmoud et al, 2020). Organic fertilizers, when used in locations with poor soil, can create optimal conditions for beans to grow, positively impacting the beans and the surrounding soil. (Atiyeh , et al, 2000) agreed that proper soil enrichment with mature compost or long-term organic fertilizers is recommended when planting beans in locations with poor soil. This preparation ensures that the soil provides

sufficient nutrients for the beans to thrive.The use of well-balanced nutrients and proper soil preparation is essential for good yields and a large proportion of high-quality pods when growing fine beans.

Balancing fertilization is essential in the growth rate of fine beans and quality. Over-fertilizing bean plants early in the growing season can prevent them from producing blooms and pods, emphasizing the importance of balanced fertilization practices. Proper fertilization, including the application of potassium-rich fertilizers when the plant starts developing bean pods, is crucial for supporting the growth and health of the beans .The introduction and effects of fertilizers in growing fine beans encompass considerations of nitrogen fixation, the impact of organic fertilizers on productivity, nutrient requirements, and the importance of balanced fertilization practices for optimal growth and yield (Moridani et al, 2023).

The productivity and quality of fine beans are influenced by various factors, including soil fertility, climate conditions, and agronomic practices. Among these factors, the application of fertilizers has been recognized as a key determinant of yield, growth, and quality of fine beans. In this context, the use of Extraboost, a bio-organic fertilizer, and ammonium nitrate, a commonly used inorganic fertilizer, has gained considerable attention due to their potential to enhance the performance of fine bean.

Fine beans thrive in well-drained soils, particularly those with a silty loam to heavy clay texture and high organic matter content. The ideal pH range for growing Lomani beans is between 5.5 and 6.5, ensuring optimal soil conditions for their growth and development. The optimum temperature range for growing Lomani beans is 20-25°C, with the ability to tolerate temperatures ranging between 14 and 32°C. Adequate moisture is essential, especially during the dry season, with up to 50 mm of water per week required. Rainfed cultivation is possible in areas with well-distributed, medium to high annual rainfall, but irrigation is essential to maintain continuous production, particularly during the dry season (Soil Science of America, 2021).

1.2 PROBLEM STATEMENT

Farmers generally are facing low yields and poor quality in fine beans farming due to the most common method of applying fertilizers they are using. Farmers use granular fertilizers in which they apply direct to the soil and the challenge of doing this is that the distance from plant roots to fertilizer nutrients is not close and sometimes disturbances may be encountered as plant roots

try to extract nutrients. Fertilizers can volatize into the air resulting in shortage of nutrients, lateral movement of water can carry fertilizers, leaching and erosion can make fertilizers applied to crops to become of short.

1.3 JUSTIFICATION

The use of Extra Boost which is a foliar fertilizer and AN at different levels in combinations has an advantage since Ammonium Nitrate will be applied to the soil it may come across disturbances of soil applied fertilizers so, Extra Boost will be a supplement to cater for the disturbances. Foliar feeding addresses the immediate needs of a growing crop, as opposed to long-term soil deficiencies, by spraying water-soluble fertilizers onto the leaf surface of the plants. All plants absorb nutrients through their leaves and stems, using stomata—little openings similar to the pores of our skin. Plants absorb foliar sprays 20 times faster than soil-applied nutrients. Foliar help plants compensate for soil deficiencies (low fertility, low soil temperature) during the growing season.

Foliar fortify plants facing other types of stress as well, such as drought, heat, cold, mechanical or insect damage or the onset of disease-susceptible periods Extra Boost foliar fertilizer complex consists of NPK and trace element as its active ingredients. Liquid kelp fertilizers contain over 70 trace minerals. The gentle N-P-K values make these natural, whole-food, broad-spectrum fertilizers essential to the soil food web. More importantly, they are an excellent source of cytokinins and auxins, two essential plant growth hormones. They also contain vitamins, natural chelating agents, and amino acids. When applied as a fertilizer, kelp supplies the vast nutritional benefits of the ocean and brings more than seventy minerals and vitamins to the plants.

1.4 OBJECTIVE MAIN OBJECTIVE

- To identify the best combination level of Extra boost and Ammonium nitrate which gives the highest yield.

1.4.1 SPECIFIC OBJECTIVES

- To determine effects of different combination levels of Extra boost and AN on the vegetative growth of fine beans pre -harvest parameters (leaf length, plant height and dry matter accumulation).
- To determine the effects of different combination levels of Extra boost and AN on fine beans reproductive growth.
- To determine the effects of different combination levels of Extraboost and Ammonium nitrate on yield and quality of fine beans.

1.5 HYPOTHESIS

- H0: Extra boost and Ammonium levels have no effects pre -harvest parameters (plant height, leaf length, pod length and dry matter accumulation).
- H1: Extra boost and Ammonium nitrate levels have effects on pre -harvest parameters (plant height, leaf length, pods dry matter accumulation and pod length).
- H0: Extra boost and Ammonium nitrate levels have no effects on post-harvest parameters (moisture, weight loss and humidity).
- H1 :Extra boost and Ammonium nitrate levels have effects post-harvest parameters(moisture , weight loss and humidity)

CHAPTER 2

LITERATURE REVIEW

2.1 EXTRA BOOST AND AMMONIUM NITRATE

Extra Boost is a highly effective Nitrogen-based blend, foliar fertilizer. Extra Boost foliar fertilizer offers a balanced NPK (25:15:25) formulation needed for growth and yield for all field crops. Also extra boost contains elements such as boron, manganese and others. Nutrients content in extra boost fertilizer makes it a very good alternative for regular top dressing by clean Ammonium nitrate. This makes the crops survive disease outbreaks as well as summer dry spells. Extra Boost can be applied as a substitute for regular top dressing. It has a triple action meaning to say it is absorbed by the plant through its stems, leaves and roots so the plant has an advantage of gaining more nutrients. Extra Boost, although it is prone to losses such as leaching and volatilization are less compared to Ammonium nitrate.It is highly compatible with other crop sprays therefore enhancing timeless of farm operations. It can be applied using a knapsack sprayer, boom sprayer, pivot irrigation and sprinkler irrigation (Bantilan *et al.*2017).

Ammonium Nitrate is a straight fertilizer which provides nitrogen to the plant during the vegetative stage when it needs it most. AN is widely known as a top dressing fertilizer, which ensures that the crop finishes the race strong. Ammonium nitrate is an important fertilizer with NPK rating 34-0-0 (34% nitrogen), (da Cruz *et al.*2014). In ammonium nitrate nutrients are readily available and the time they are applied the work fast.

Foliar fertilization with nitrogen helps to increase the yield of fine beans by reducing the blind seed content and increasing the absolute weight of seeds in the beans. Foliar top fine beans fertilization with ammonium nitrate slightly increases the content of total nitrogen, protein, starch and the total dry substances content in the seeds. The total bean plants density per unit area of sowing consists of the number of branches per bush. On sparse crops in the middle of the plants flowering phase the total number of branches increases significantly due to improved conditions of plants nitrogen nutrition. In the case of sparse crops, the introduction of nitrogen fertilizers can stimulate branching, although high doses should be used more carefully in this case, since before the formation of a sufficiently large biomass, rare crops achieve the depressing effect of excess nitrogen earlier than on normally thickened crops. This is due to competition between plants, common in density, and even sparse crops, the potential

genetically determined beans productivity is realized only to a small extent. The main factor for which bean plants compete during the emergence phase-the flowering beginning under normal cultivation conditions is the soil available nitrogen. Taking into account all the above, I consider it necessary to recommend foliar top fertilization of beans with nitrogen in the phase of emergence- flowering beginning as a way to increase plant productivity.(El-Aziz, 2013).

Foliar fertilization increases micronutrient uptake and physiological and biochemical indexes. Many studies suggest that foliar fertilization may help to stimulate the uptake of soil applied fertilizers, which could provide a solution to salt accumulation in the soil. (Lopez-Calix et al, 2017).

Foliar application pros and cons. The main advantages of foliar application include: Increased nutrient use efficiency, Reduced nutrient losses through leaching or volatilization, reduced risk of nutrient toxicity in the soil, increased crop yield and quality. However, there are also some disadvantages to foliar application, including the need for specialized equipment and training, increased labor costs, the potential for phytotoxicity if the wrong concentration of nutrients is used. Increased nutrient use efficiency. Foliar application of nutrients can be up to 10 times more efficient than soil application, because the nutrients are applied directly to the leaves, where they are immediately available for uptake by the plant. In contrast, when nutrients are applied to the soil, they may be lost through leaching or volatilization before the plant can take them up. Additionally, foliar application can help to reduce nutrient losses from the soil due to erosion or runoff (M.B. Kishore and K.A. Reddy, 2015.)

Reduced risk of nutrient toxicity in the soil. When nutrients are applied to the soil, there is a risk that the soil may become saturated with excess nutrients, which can lead to nutrient toxicity. This can be a particular problem in areas with high rainfall, as the nutrients can leach into groundwater or surface water. By contrast, foliar application does not pose the same risk of soil toxicity, as the nutrients are applied directly to the plant and do not accumulate in the soil. The increased labor costs associated with foliar application. This method requires specialized equipment to spray the nutrients on the leaves, as well as trained personnel to operate the equipment. Additionally, foliar application is typically done multiple times during the growing season, which can increase labor costs even further. Another disadvantage is the potential for phytotoxicity, or damage to the plant, if the wrong concentration of nutrients is used. Too much or too little of a nutrient can cause damage to the leaves and reduce plant growth, (S.C. Taneja, 2012.)

Excess AN can cause plants to grow excessively and develop overly succulent leaves and shoots, which promotes outbreaks of certain sucking insects and mites. Excessive nitrogen cause fine beans to produce relatively more foliage, reducing their pod production and delaying pods maturity, (Chaves *et al*, 2018).

The production of fine beans in Zimbabwe, according to recent statistics, Zimbabwe is one of the leading producers of fine beans in Africa, with an average annual production of about 20,000 metric tons. Most of this production comes from small-scale farmers who grow the beans on small plots of land, (R.M. Mapfumo, 2019). The fine beans are mainly exported to Europe, where they're sold in supermarkets and restaurants. 'N. Saini' 2017, stated globally the major fine bean-producing countries are India, China, and Mexico.

More about how fine beans are produced. The first step is to prepare the land for planting. This involves clearing the land, removing any weeds or debris, and breaking up the soil to make it more fertile. Next, the beans are sown by hand. After the beans have germinated and started to grow, the soil needs to be kept moist and well-drained. Weeding and pest control are also important during this time. Finally, the beans are harvested by hand when they've reached the desired size. (T. Mahungu, .2020).

Topdressing is an important part of fine bean production. The first step is to determine the appropriate amount of topdressing based on the crop's nutritional needs and soil type. The next step is to apply the fertilizer in a way that ensures even distribution. The challenges associated with topdressing include ensuring the right rate is applied, proper timing of application, and avoiding nutrient leaching. Diseases such as root rot, leaf spot, and rust can also pose challenges during topdressing (Zimbabwe Ministry of Agriculture).

There are two main types of fertilizers that can be used for topdressing fine beans which are inorganic and organic. Inorganic fertilizers are typically made from minerals and synthetic chemicals, while organic fertilizers are derived from natural sources such as animal manure, compost, or crop residues. Inorganic fertilizers are fast-acting and can be applied at any time during the growing season, while organic fertilizers are slower to break down and should be applied in advance of planting so they breakdown slowly until the bean are sown. (P. Mohammadi et al, 2020).

The main advantage of inorganic fertilizers is that they provide a quick release of nutrients, making them ideal for short-term crop production. However, they can be expensive and can

have negative environmental impacts if not used properly. Organic fertilizers, on the other hand, have the benefit of providing long-term nutrient release and promoting soil health, but they can be less efficient and can take longer to see results. Ultimately, the best fertilizer for topdressing fine beans depends on the specific needs of the crop and the grower's goals that is fast returns and soil conversation, (M.M. Wood, 2019)

The investigation of the effects of different levels of Extra boost and ammonium nitrate on the growth, yield and quality of fine beans (Lomani) holds significant implications for sustainable agriculture, food production, and economic development. The findings of this study are expected to contribute to the optimization of fertilizer management practices, the enhancement of fine bean production, and the promotion of nutritious, high-quality food products. Ultimately, this research endeavors to support the advancement of sustainable agricultural systems and the improvement of livelihoods for farmers, while meeting the growing demand for nutritious and sustainably produced fine beans in the global market.

Extra boosts can be considered as growth enhanser and in Fine beans they are useful to provide nutrients.The advantages of growth enhancers and their specific effects on fine beans, Growth enhancers can improve plant growth by increasing the rate of photosynthesis, improving root growth, and improving nutrient uptake. This can result in increased yields and improved overall plant health. On the downside, growth enhancers can have negative effects on the environment, including water pollution and soil acidification. Additionally, some growth enhancers may be harmful to humans if ingested, and can cause allergic reactions in some individuals, (M.A. Jain *et al.* 2019.)

The environmental effects of growth enhancers can be quite serious. For example, the overuse of nitrogen-based growth enhancers can lead to water pollution, as excess nitrogen can leach into groundwater and cause eutrophication (nutrient enrichment) of waterways therefore leading to death of aquatic life. Other growth enhancers can cause soil acidification, which can damage the ecosystem and reduce crop yields over time. Some growth enhancers may also be harmful to beneficial insects and wildlife, (M.F.T. Samiullah 2020).

Growth enhancers and their effect on fine beans are that the main benefit of using growth enhancers on fine beans is that they can increase yield and improve overall crop quality. Specifically, growth enhancers can increase bean size, improve bean color and texture, and increase total bean biomass. On the negative side, some growth enhancers can have adverse

effects on bean quality, causing them to be smaller or more susceptible to diseases, (S. Gur *et al., 2017).*

The nutrients supply of fine beans it's important to note that fine beans are a type of legume, and as such, they are able to fix nitrogen from the atmosphere. This means that fine beans do not require as much nitrogen fertilizer as some other crops. However, they do require adequate amounts of phosphorus and potassium for optimal growth. Additionally, a study conducted in Siaya, Kenya stated that micronutrients like calcium, magnesium, and boron are important for good plant health that is for nitrogen, fine beans typically require between 60 and 120 kg/ha of nitrogen per season, depending on soil conditions and other factors, phosphorus, a rate of 30-60 kg/ha is usually recommended, and for potassium, a rate of 40-80 kg/ha is typically used. As for micronutrients, calcium and magnesium are typically applied at a rate of 1-2 kg/ha each, while boron is typically applied at a rate of 0.5-1 kg/ha, (P.O. Chepkwony *et al* 2021).

The utilization of Extra boost, a bio-organic fertilizer, in combination with ammonium nitrate, an inorganic fertilizer, presents an opportunity to explore the synergistic effects of organic and inorganic sources of nutrients on the performance of fine beans. The potential benefits of this approach include improved soil health, increased nutrient availability, and enhanced crop resilience to environmental stress, ultimately leading to higher yields and superior quality of fine beans.

CHAPTER 3

METHODOLOGY

3.1 Study site description

The experiment was carried out at Bindura University farm in Shamva district which is located in the Mashonaland Central province. The area has fertile soils that vary from sand loamy soil to very deep red soils. The trial was established in sandy loamy soil which are suitable for intensive and extensive agricultural activities. The experimental site falls in Agro ecological zone 2A with altitude that is 1 400 above sea-level. The average temperature of 20 degrees Celsius and it is characterised with two major season winter and summer. The area receives 700 to 1 050 of rainfall per year. The landscape is mostly hilly, with flat areas.

3.2 Experimental design

A randomised complete block design was used, with different combinations levels of extra boost and ammonium nitrate in each plot. The current experiment was performed to evaluate the effects of different combination levels of Extra Boost and Ammonium on yield, growth and quality of fine beans. The experimental layout was a randomized complete block design (RCBD). Each treatment had three replicates making eighteen beds. Zero units means no application, 100 units was the recommended rate of application, 150 units was above the recommended and 50 was the half of the recommended as shown in table below.

Table 1: List of treatments and ratios

TREATMENTS	EXTRA BOOST UNITS	AN UNITS
1	0	0
2	150	150
3	100	100
4	150	50
5	50	150
6	150	100

Table 2: Showing rate of Extra boost and AN application

EXTRA BOOST/ha		Per plot	AN/ha		Per plot
0	0 L	0	0	0kg	0
50	5 L	1.875ml	50	175kg	62.625g
100	10 L	3.755ml	100	350kg	131.25g
150	15	5.625ml	150	525kg	196.785g

3.3 Trial management

3.3.1 Land preparation

Land preparation was done by digging a depth of 30cm, followed by harrowing a fine tilt using a rake so as to promote best germination as well as levelling. Fishing line was used to straighten beds, meter rule was used to measure the length and width of beds in order to have uniform beds. A hoe was used to open rows and after planting was used cover the seeds. Compound D was applied as basal dressing in each bed.

3.3.2 Water management

A 20 litre bucket was used to apply water in treatment plots basing on crop growth stage water requirements. Two buckets per plot was used from 0-20 days after sowing and thereafter four buckets per plot from reproduction to harvesting crop stage.

3.3.3 Fertilization application

Fertiliser was applied to green beans according to the treatments. The treatment received in Extra boost and AN was applied after two weeks and every two weeks early in the morning at different rates. A hand knapsack was used to apply Extra boost.

3.3.4 Weed control and pest control.

The field was kept weed free throughout the entire growing season. This was due to use of pre-emergency herbicides before planting and used atrazine after germination and the late stages of the plant growth stages hand and hoe weeding was used. Insects, pest and fungal diseases were scouted on weekly basis from emergence until maturity stage of fine beans. Leafhoppers, moth, bird bettle, white flies, powdery mildew and thrips were controlled using Lambda, Diathane and Malathion. Molasses was used as a sticking agent each time the fungicide and insecticide was applied.

3.3.5 Harvesting

Harvesting was done after sixty day of planting and the first harvesting was for consumption and later on when the pods were fully grown and dry for weighing.

3.4 Data collection

3.4.1 Plant height

The height in cm of 3 selected plants in each block were measured weekly from 14 days after germination and first application of EB and AN until the plant reach its physiological maturity stage. The height from the plant's base to the tip of the longest leaf was measured and recorded using a millimeter ruler.

3.4.2 Fine beans leaf area

The leaf area of the Lomani variety was measured manually by selecting a 3 leaves randomly from each plot and measure its length and width and record the findings.

3.4.3 Fine beans chlorophyll content

Fine beans chlorophyll content was measured from all the plots using a chlorophyll meter. Chlorophyll content was measured from the first 3 top leaves on selected 3 plants per plot.

3.4.4 Fine beans yield

The yield of fine beans was measured by weighing the harvested pods of the plants. This was done by collecting a representative sample of the harvested fine beans and weighing it. The yield was expressed in terms of weight per unit area (kilograms per hectare).

3.4.5 Data analysis

Analysis of data was done using qualitative analysis. Through qualitative analysis, the research uncovered the holistic impact of the fertilizer treatments on the overall performance of the Lomani variety, offering valuable insights into the intricacies of sustainable fine bean production.

CHAPTER FOUR

4.1 RESULTS

Effects of different extra boost levels and AN on fine beans yield, chlorophyll content, plant height and leaf area are presented in tables below.

Table 3: Data for leaf area, plant height and chlorophyll content for week 1

WEEK	EXPERIMENT	RATIO	LEAF AREA	HEIGHT	CHLOROPHYL CONTENT
1	T1	0:0	12	8	7.6
1	T2	150:150	29	20	16.4
1	T3	100:100	26	15	11.4
1	T4	150:50	23	12	6.4
1	T5	50:150	21	10	8.2
1	T6	150:100	29	15	12.7

Table 4: Data for leaf area, plant height and chlorophyll content for week 2

WEEK	EXPERIMENT	RATIO	LEAF AREEA	HEIGHT	CHLOROPHYL CONTENT
2	T1	0:0	11	8	6.4
2	T2	150:150	35	20	15.5
2	T3	100:100	17	18	10.2
2	T4	150:50	18	10	6.4
2	T5	50:150	19	11	8.4
2	T6	150:100	35	16	11.2

Table 5: Data for leaf area, plant height and chlorophyll content for week 3

WEEK	EXPERIMENT	RATIO	LEAF AREA	HEIGHT	CHLOROPYL CONTENT
3	T1	0:0	13	7	7.3
3	T2	150:150	23	23	14.7
3	T3	100:100	19	19	10.6
3	T4	150:50	20	12	7.4
3	T5	50:150	19	12	8.1
3	T6	150:100	22	18	12.3

4.2 DATA ANALYSIS

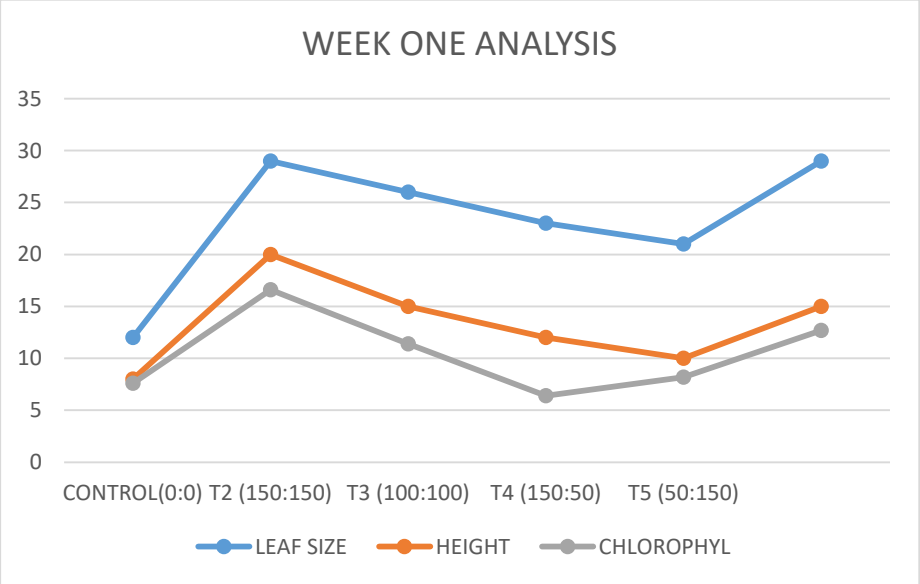

Figure 1: Analysis for leaf size, height and chlorophyll for week 1

As illustrated on the diagram above, the control (0:0 combination).

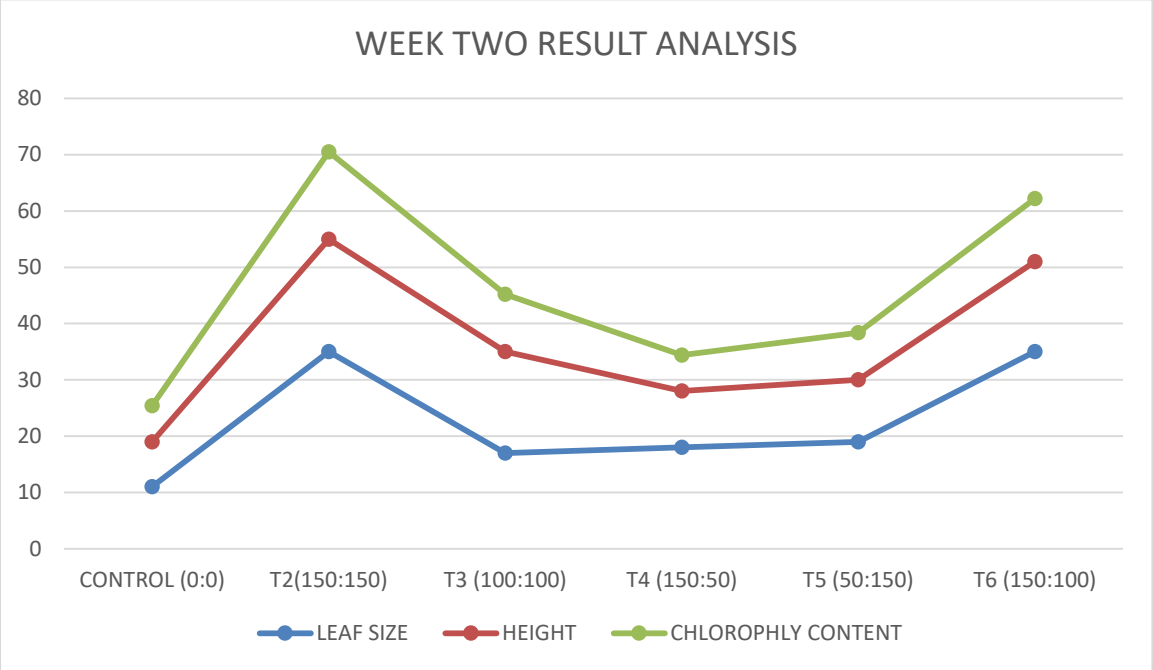

Figure 2: Analysis of leaf area, height and chlorophyll content for week 2

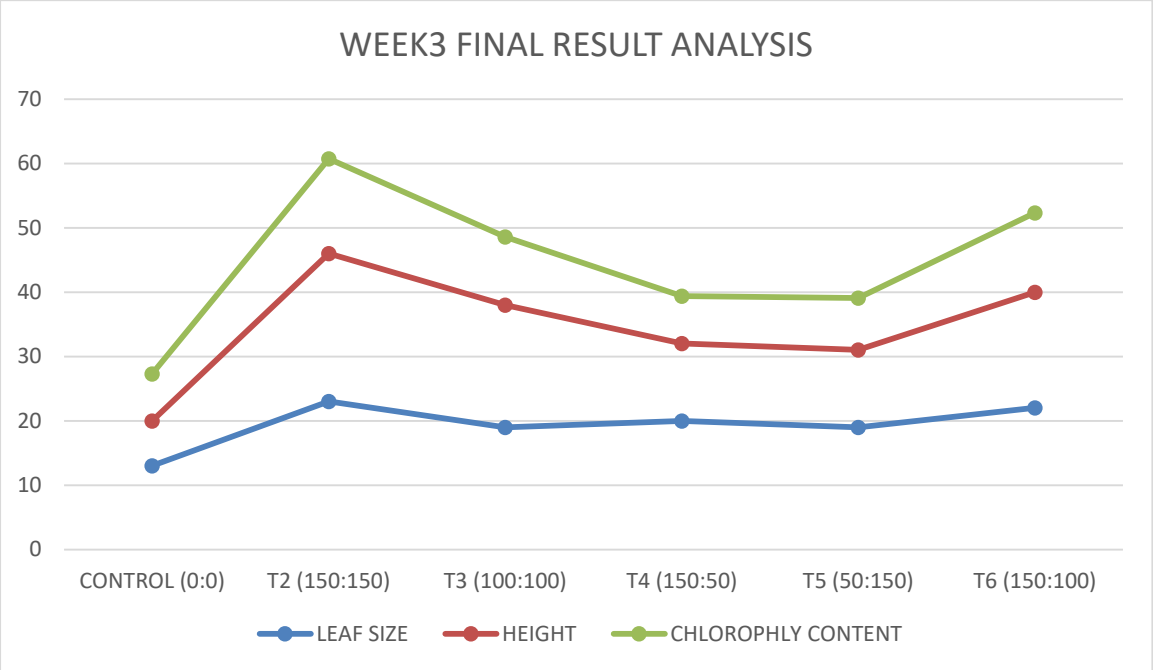

Figure 3: Analysis of leaf area, height and chlorophyll content for week 3

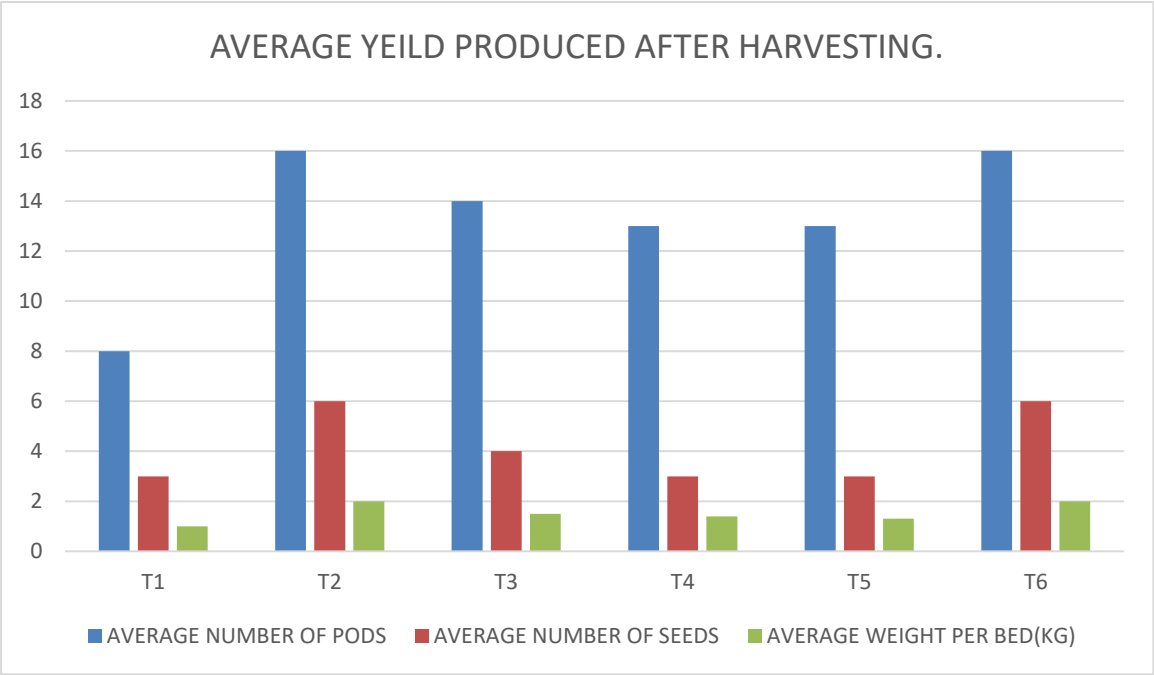

Figure 4: Average yield produced after harvesting

The above graph illustrate number of yield produced per each bed, treated with different combinations of extra boost and ammonium nitrate. Bed T2, T3 and T6 produced high yields, this clearly demonstrate that the combination with more concentration of extra boosters is much effective.

Analysis of Combination Ratios for Extra boost and Ammonium Nitrate on fine bean plant growth. Based on the analysis above and the effects of different combination ratios of extra boost and ammonium nitrate on bean plant growth were observed.

4.2.1 Combination Ratios and Plant Growth

The 150:150 combination ratio of extra boost and ammonium nitrate resulted in significant improvements in both plant height and leaf size. This indicates that the balanced application of these substances had a positive impact on the overall growth and development of the bean pplants On the other hand, the 100:150 combination ratio led to lower plant height and smaller leaf size compared to the 150:150 ratio. This suggests that a higher proportion of extra boost relative to ammonium

nitrate may not have provided the necessary nutrients for optimal plant growth in this specific scenario.

4.2.2 Effect of Different Combination Ratios

The 100:100 ratio performed lower than the 100:150 ratio, indicating that an increased proportion of ammonium nitrate relative to extra boost had a positive impact on plant growth in terms of height and leaf size Furthermore, the 50:150 ratio performed lower than the 100:100 ratio, suggesting that a reduced proportion of extra boost relative to ammonium nitrate resulted in diminished plant growth.

4.2.3 Control Group Observations

The control group, which consisted of 0 units of ammonium nitrate and 0 units of extra boost, produced low yields in terms of plant height, leaf size, and chlorophyll content. This indicates that the absence of extra boost and ammonium nitrate did not support optimal plant growth.

4.2.4 Implications for Bean Plant Cultivation

The results demonstrate the importance of carefully determining the combination ratios of fertilizers and plant boosters based on the specific nutritional requirements of bean plants. It's crucial to strike a balance between the nutrients provided by extra boost and ammonium nitrate to support healthy growth.

The 150:150 combination ratio appears to have provided the optimal balance of nutrients, resulting in improved plant height and leaf size. This ratio could serve as a valuable guideline for future bean plant cultivation projects, highlighting the effectiveness of a balanced approach to nutrient application.

4.2.5 Implications for Nutrient Application

The findings emphasize the significance of the balance between extra boost and ammonium nitrate in promoting bean plant growth. The 100:150 ratio demonstrated superior results, highlighting the importance of a higher proportion of ammonium nitrate in this specific context.

Additionally, the 100:100 ratio outperformed the 100:150 ratio, indicating that an equal balance of extra boost and ammonium nitrate may have been more conducive to bean plant growth in this particular experiment.

4.2.6 Practical Considerations for Cultivation

When applying fertilizers and plant boosters to support bean plant growth, it is crucial to consider the specific nutrient requirements of the plants. The observed performance of different combination ratios underscores the need for tailored nutrient application based on the unique needs of bean plant. These findings can serve as valuable insights for future bean plant cultivation projects, guiding the selection of combination ratios that are most conducive to achieving optimal plant growth and yield.

CHAPTER 5

5.1 DISCUSSION OF RESULTS

In this chapter, the findings obtained from the analysis of different combination ratios of extra boost and ammonium nitrate on bean plant growth.The results provide valuable insights into the impact of nutrient balance on plant development and have significant implications for optimizing bean plant cultivation practices.

The experiment yielded several key findings regarding the effects of different combination ratios on bean plant growth:

5.1.1 Effect of Combination Ratios on leaf area, height and yield

The 100:150 ratio of extra boost to ammonium nitrate resulted in significant improvements in plant height and leaf area, indicating the positive impact of a higher proportion of ammonium nitrate in this specific content. Conversely, the 100:100 ratio outperformed the 100:150 ratio, suggesting that an equal balance of extra boost and ammonium nitrate may be more conducive to bean plant growth in certain scenarios including yield.

The 50:150 ratio performed lower than the 100:100 ratio, indicating that a reduced proportion of extra boost relative to ammonium nitrate resulted in diminished plant growth.

Control group, which received 0 units of ammonium nitrate and 0 units of extra boost, produced low yields in terms of plant height, leaf size, yield and chlorophyll content. This highlights the negative impact of the absence of extra boost and ammonium nitrate on plant growth.

5.1.2 Implications for Nutrient Application

The findings have significant implications for the application of fertilizers and plant extra boosters to support bean plant growth.

Optimizing Combination Ratios

The results emphasize the importance of carefully determining the combination ratios of extra boost and ammonium nitrate based on the specific nutritional requirements of bean plants. The 100:150 ratio demonstrated superior results, indicating the importance of a higher proportion of ammonium nitrate in this specific context.

5.1.3 Balancing Nutrient Application

It is crucial to achieve a balanced application of nutrients to support healthy and vigorous bean plant growth. The observed performance of different combination ratios underscores the need for tailored nutrient application based on the unique needs of bean plants.

5.1.4 Practical Considerations for Cultivation

The findings from this experiment offer practical considerations for optimizing bean plant cultivation practices.

5.1.5 Guiding Future Cultivation Projects

The results can serve as valuable insights for future bean plant cultivation projects, guiding the selection of combination ratios that are most conducive to achieving optimal plant growth and yield. Future experiments can build upon these findings to further refine the understanding of nutrient application for bean plant at different growth stages.

5.1.6 Iterative Approach to Nutrient Application

An iterative approach, involving the monitoring of plant response to different combination ratios over time, can provide valuable insights into the long-term effects on plant health and productivity. This iterative process can inform adjustments to combination ratios for optimal results in future cultivation projects.

CHAPTER 6

CONCLUSION AND RECOMMENDATION

6.1 Conclusion

In conclusion, the analysis of the combination ratios for Extra boost and Ammonium nitrate on bean plant growth provides valuable insights into the impact of nutrient balance on plant development. The findings underscore the importance of tailored nutrient application to meet the specific needs of bean plants, ultimately contributing to successful cultivation outcomes.

The analysis of the combination ratios for Extra boost and Ammonium Nitrate on bean plant growth provides valuable insights into the impact of nutrient balance on plant development. The results underscore the importance of carefully determining the combination ratios to support healthy and vigorous bean plant growth that gives high yield.

Practical Considerations for Cultivation

When applying fertilizers and plant boosters to support bean plant growth, it is crucial to consider the specific nutrient requirements of the plants. The observed performance of different combination ratios underscores the need for tailored nutrient application based on the unique needs of bean plants. These findings can serve as valuable insights for future bean plant cultivation projects, guiding the selection of combination ratios that are most conducive to achieving optimal plant growth and yield.

The research has demonstrated that the application of Extra boost and ammonium nitrate at different levels significantly influences the yield, growth, and quality of fine beans. The combined use of bio-organic and inorganic fertilizers has led to improved soil health, increased nutrient availability, and enhanced crop resilience to environmental stress, resulting in higher yields and superior quality of fine beans. Furthermore, the study has elucidated the influence of different fertilizer treatments on the growth parameters and quality attributes of fine beans, providing valuable insights for optimizing crop management practices and promoting high-quality produce.

In conclusion, the research on the effects of different levels of Extra boost and ammonium nitrate on the yield, growth, and quality of fine beans (Lomani) has provided significant implications for sustainable agriculture, food production, and economic development. The qualitative research approach has offered comprehensive and nuanced insights into the effects

of the selected fertilizers on fine beans, advancing our understanding of sustainable agricultural practices and the production of high-quality, nutritious food.

6.2 RECOMMENDATION

My recomentation to farmers are that at the end the one that was not applied any trreatments has got slowest growth rate compared to the other treated beds. The combinations of extra boost and ammonium nitrate produced better, showing mprovements in leaf area and yields. So I recommend farmers to grow fine beans with combination of extraboost and ammonium nitrate to achieve better yields.

6.2.1 Considerations for Future Projects

When embarking on future bean plant cultivation projects, it is essential to consider the specific nutrient requirements of bean plants at different growth stages. This understanding can help in determining the most effective combination ratios of extra boost and ammonium nitrate to support healthy and vigorous plant growth.

Additionally, monitoring plant response to different combination ratios over time can provide valuable insights into the long-term effects on plant health and productivity. This iterative approach can inform adjustments to combination ratios for optimal results in future cultivation projects.

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