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Utilizing GA3 Plant Growth Using Goat Manure To Improving The Growth And Yield Of Mustroll (*Brassica juncea* L.)

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ABSTRACT

The vegetable *Brassica juncea* L., commonly known as mustard greens, is widely popular. This study examines the impact of ZPT GA3 and goat manure fertilizer on the growth and yield of mustard greens (*Brassica juncea* L.). The research was carried out in Aek Nabara, specifically in Pondok Sentosa. It was organized based on a two-factor Randomized Block Design (RAK), with factor A being goat manure fertilizer at 0.150 and 300 grams/polybag and factor B being ZPT GA3 at 0.2 and 4 ml/L of water. The findings of the research revealed that the treatment of 150 mg/polybag of goat manure and GA3 4 ml/L of water resulted in the highest growth of mustard greens at the age of 2 MST, measuring 6.5 cm, while the lowest growth was observed in the treatment of 150 mg/polybag of goat manure and GA3 0 ml/L of water, measuring 4.9 cm. At the age of 4 MST, the highest growth was achieved in the treatment without the provision of goat manure and GA3. measuring 14.83 cm, while the lowest was in the treatment of 150 mg/polybag of goat manure and GA3 2 ml/L, measuring 10 cm. The highest number of mustard greens leaves at the age of 2 MST was obtained in the treatment of 150 mg/polybag goat manure and GA3 0 ml/L, with 7 leaves, while the lowest was in the treatment of 150 mg/polybag goat manure and GA3 2 ml/L, with 5 leaves. At the age of 4 MST, the highest number of leaves was observed in the treatment of 300 mg/polybag goat manure and GA3 2 ml/L, with 10.67 leaves, while the lowest was in the treatment of 150 mg/polybag goat manure and GA3 2 ml/L, with 8 leaves. The highest wet weight of mustard greens was recorded in the treatment of 300 mg/polybag goat manure and GA3 2 ml/L, with 83 g, while the lowest was in the treatment without goat manure and GA3. with 62.67 g.

Keywords: *Goat Manure Fertilizer, Mustard Greens, Production, ZPT GA3. Growth*

1. INTRODUCTION

Mustard greens (*Brassica juncea* L.) are a variety of horticultural plants known by various names, such as caisim, caisin, and Bakso mustard greens. The cultivation of this plant involves harvesting the entire biomass, including leaves and stems. Due to its nutritional value and commercial potential, mustard greens are particularly suitable for cultivation in tropical regions (Budi et al., 2021).

Mustard greens (*Brassica juncea L.)* are a popular horticultural plant among consumers due to their rich vitamin content, commonly grown in lowland and highland areas (ADI & PUJA, 2019).

Yuli Ataribaba and colleagues (2021) have also highlighted the popularity of mustard greens among the general public due to their palatable taste, accessibility, affordability, and ease of cultivation. Despite their potential for easy cultivation, various challenges arise during the growth of mustard greens, particularly concerning the choice of planting media. Ideally, mustard greens thrive in nutrient-rich soil with a high organic matter content. In cases where the organic matter content is insufficient, the growth of the plants may be suboptimal.

Low levels of organic matter in the soil can lead to water stress as the soil cannot retain water in its pores. From a physiological perspective, efforts should be made to enhance land use and manage water loss through percolation and evaporation processes in mustard plant cultivation. Increasing the organic matter content can be achieved by applying agricultural waste and returning leftover harvests. Furthermore, organic matter can be supplemented by incorporating livestock manure from ruminant animals and goats, which can provide nutrients through the mineralization process. The decomposition of organic material from manure can also enhance soil aggregation, improving soil structure and water retention capacity. By supporting physical, chemical, and biological conditions, soil fertility can be enhanced as a conducive medium for growing mustard plants (Kholidin et al., 2016).

The application of organic materials through animal manure, especially goat manure, which has undergone decomposition and mineralization, will release inorganic compounds that can be entirely absorbed by plants in the form of nitrogen (N), phosphorus (P), and potassium (K) (Veronika et al., 2023).

The growth of mustard plants cannot be optimally supported by organic materials alone without readily available nutrients and growth hormones. Hence, combining organic materials with growth regulators, which can be administered through leaf tissue via spraying, is recommended. Applying ZPT directly on the leaves can enhance the growth and development of mustard plants, with GA3 being one of the ZPTs that can be utilized for this purpose.

Gibberellin (GA3) plant growth regulator (PGR) is a substance that can enhance the seed germination process and expedite the formation of plant shoots. Additionally, gibberellin can accelerate bud development and vegetative growth, such as stem elongation and leaf expansion, while stimulating generative growth, including flower and fruit formation (Huljannah et al., n.d.).

Based on this information, researchers are prompted to conduct a study investigating the effectiveness of goat manure fertilizer combined with GA3 PGR in promoting the growth and yield of mustard greens (*Brassica juncea* L.).

2. MATERIAL AND METHODS

This research was conducted at the study location on Jln. Pondok Sentosa Aek Nabara, Village: Emplasmen, District: Bilah Hulu, Regency: Labuhanbatu, Province: North Sumatra, approximately 27 meters above

sea level. The study commenced in April and will continue until May 2024. The materials used in this research include GA3 plant growth regulator and goat manure as fertilizer. The equipment utilized comprises polybags, writing instruments, notebooks, a digital scale, a measuring tape, a spraying device, and a 5ml syringe.

The study employs a Factorial Randomized Block Design (FRBD) with two factors: the factor of goat manure with three levels, namely: Control (No treatment), goat manure at 150 g per polybag, and 300 g per polybag, and the factor of GA3 (Gibberellin) with three levels, specifically: Control (No treatment), GA3 at 2 ml per liter of water, and 4 ml per liter of water. The number of repetitions is three, with one plant per polybag, totaling 27 plants.

2.1 Research Implementation

2.1.1 Preparing Land

Research land is prepared by providing a research area to arrange polybags. Furthermore, polybags are arranged on a clean land area from bushes and grass.

2.1.2 Germination

Mustard seeds are utilized for this purpose. Before planting, the seeds undergo a 15-minute soaking in hot water to separate the undesirable seeds. The float seeds are removed, while those that sink are retained for further study before being dried. The planting process takes place on a seedling tray.

2.1.3 Preparing Planting Media

The planting medium used is soil from burned land, which is then placed into polybags and arranged in the experimental plots. Fertilization with goat manure is also applied one week before planting. This application is made by mixing the manure according to the specified dosage and thoroughly mixing it until well combined.

2.1.4 Planting

Seeds that have been sown for 14 days or have developed 4-5 leaves are ready to be planted in polybags. Planting should be carried out in the afternoon. Each polybag should contain one mustard seedling, which is to be buried along with the growing medium in a hole in the soil just up to the collar of the roots. After planting, the seedlings should be watered adequately.

2.1.5 Plant Maintenance

Irrigation is conducted twice daily, in the morning and evening. The purpose of irrigation is to maintain water availability for the plants. Weeding is performed by manually pulling out weeds growing within the polybags using hands; this is done to ensure that no weeds interfere with the growth of the plants. Pest control is carried out manually by removing the pests that attack the plants to prevent any disruption to their growth.

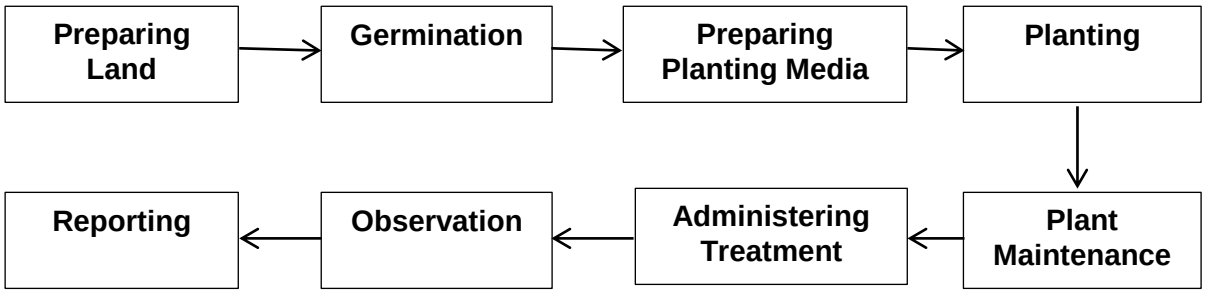

Figure 1. Research flow diagram

2.2 Observation Parameter

2.2.1 Plant Height (cm)

Plant height was measured using a meter, and it was measured when the mustard greens were 14 days old after transplanting. Observations were made at 2 MST and 4 MST.

2.2.2 Number of leaves (blades)

The number of leaves was counted and observed at 2 MST and 4 MST.

2.2.3 Wet weight (g)

Wet weight weighing was carried out at the end of the study. The wet weight of the plant was calculated by weighing all parts of the plant. Weighing was done after the plants were cleaned of dirt and air-dried, then weighed using a digital scale.

3. RESULT AND DISCUSSION

3.1 Plant Height (cm)

The ANOVA test was employed in this investigation. Table 1 shows notable variances in the main factors of goat manure and ZPT GA3 at planting age 2 MST. This indicates the need for additional DMRT tests at a significance level of 5%. Conversely, at 4 MST, it was determined that there was no significant distinction between the goat manure and ZPT GA3 combination.

Table 1. Plant height

Treatment	MST 2	MST 4
	cm	
Without Goat manure and GA3	6.1 ± 0.4 ab	14.83 ± 2.1 a
Goat manure 0 g/polybag and GA3 2 ml/L water	5.6 ± 0.5 ab	12.47 ± 1.4 a
Goat manure 0 g/polybag and GA3 4 ml/L water	5.4 ± 0.4 ab	13.13 ± 1.8 a
Goat manure 150 g/polybag and GA3 0 ml/L water	4.9 ± 0.1 b	14.33 ± 0.1 a
Goat manure 150 g/polybag and GA3 2 ml/L water	4.97 ± 0.5 b	10 ± 0.2 a
Goat manure 150 g/polybag and GA3 4 ml/L water	5.8 ± 0.0 ab	13.67 ± 1.8 a
Goat manure 300 g/polybag and GA3 0 ml/L water	5 ± 0 b	11.97 ± 1.8 a
Goat manure 300 g/polybag and GA3 2 ml/L water	5.87 ± 0.3 ab	14.8 ± 1.1 a
Goat manure 300 g/polybag and GA3 4 ml/L water	6.5 ± 0.3 a	12.2 ± 2.0 a

Notes: Numbers followed by different letters in the same column indicate significant differences based on the 5% DMRT test.

Table 1 presents the findings of the DMRT follow-up test conducted at 2 MST, indicating that the K2G2 combination exhibited the highest growth rate at 6.5 cm, while the K1G0 combination displayed the lowest growth rate at 4.9 cm. Conversely, at 4 MST, it was observed that the most effective treatment was K0G0. yielding a growth rate of 14.83 cm, whereas the least effective treatment was K1G1. resulting in a growth rate of 10 cm. These results are consistent with the research conducted by Habib (2020), which highlights the significant impact of goat manure observations on plant height measurements.

3.2 Number of leaves (blades)

Table 2 shows that the influence of goat manure and ZPT GA3 has a significant effect on increasing the number of leaves, especially at 4 MST. After further testing, there has been no significant difference between each treatment combination.

Table 2 illustrates that at the age of 2 MST, the K1G0 treatment had the highest number of leaves at 7. while at 4 MST, the most effective treatment was K2G1 with 10.67 leaves. The findings of this study are consistent with the research conducted by Styaningrum et al. (2013), which emphasizes the significant impact of goat manure fertilizer application. Goat manure is rich in essential macronutrients, particularly phosphorus, which are crucial for plant growth. Phosphorus aids in plants' root development, ATP synthesis, and cell growth by being absorbed from the soil solution. Additionally, plants require phosphorus and potassium during the generative phase. Phosphorus is essential for seed and fruit formation, while potassium is involved in assimilation, translocation, and stomatal opening processes (Styaningrum et al., 2013). This study's observation of leaf blade development was linked to nitrogen, which enhances leaf growth by boosting photosynthesis and chlorophyll

production (Gede et al., 2020). Hikmah (2015) highlighted that nitrogen stimulates vegetative growth, particularly leaf development, leading to increased photosynthesis rates. The energy produced through photosynthesis supports plant growth.

Table 2. Numbers of leaves

Treatment	MST 2	MST 4
	cm	
Without Goat manure and GA3	6.33 ± 0.8 a	9.33 ± 0.8 ab
Goat manure 0 g/polybag and GA3 2 ml/L water	5.67 ± 1.2 a	8.67 ± 1.2 ab
Goat manure 0 g/polybag and GA3 4 ml/L water	6.67 ± 0.6 a	9.33 0.8 ab
Goat manure 150 g/polybag and GA3 0 ml/L water	7 ± 0.0 a	9.33 ± 0.3 ab
Goat manure 150 g/polybag and GA3 2 ml/L water	5 ± 0.5 a	8 ± 1.0 b
Goat manure 150 g/polybag and GA3 4 ml/L water	6 ± 0.0 a	10.33 ± 0.3 ab
Goat manure 300 g/polybag and GA3 0 ml/L water	6 ± 0.0a	10 ± 0.0ab
Goat manure 300 g/polybag and GA3 2 ml/L water	6.67 0.3 a	10.67 ± 0.3 a
Goat manure 300 g/polybag and GA3 4 ml/L water	6.33 0.8 a	10.33 ± 0.6ab

Notes: Numbers followed by different letters in the same column indicate significant differences based on the 5% DMRT test.

3.3 Wet weight (g)

Table 3 reports significant differences between goat manure and GA3 ZPT combinations based on the ANOVA test.

Based on the analysis of variance with a treatment value > 0.05, the number of leaves was not significantly different, and no further testing was needed.

Table 3 demonstrates that the most effective treatment can be found in K2G1. boasting a weight of 83 g in contrast to the K0G0 control, which only weighs 62.67 g. The wet weight is predominantly influenced by the quantity of plant leaves, which correlates directly with the photosynthesis rate and the optimal nutrient outcomes derived from the roots. This phenomenon occurs due to the rise in wet weight, which is attributed to an escalation in protoplasm that is capable of retaining carbon dioxide and water (Salamah, 2017).

Table 3. Wet weight

Treatment	Plant Wet Weight (g/plant)
Without Goat manure and GA3	62.67 ± 4.3 b
Goat manure 0 g/polybag and GA3 2 ml/L water	66.33 ± 4.0 b
Goat manure 0 g/polybag and GA3 4 ml/L water	65.33 ± 2.0 b
Goat manure 150 g/polybag and GA3 0 ml/L water	71.67 ± 2.7 ab
Goat manure 150 g/polybag and GA3 2 ml/L water	63.67 ± 6.0 b
Goat manure 150 g/polybag and GA3 4 ml/L water	70.00 ± 3.2 ab
Goat manure 300 g/polybag and GA3 0 ml/L water	82.67 ± 2.4 a
Goat manure 300 g/polybag and GA3 2 ml/L water	83.00 ±1.1 a
Goat manure 300 g/polybag and GA3 4 ml/L water	72.33 ± 6.8 ab

Notes: Numbers followed by different letters in the same column indicate significant differences based on the 5% DMRT test.

4. CONCLUSION

The application of goat manure fertilizer and ZPT GA3 significantly impacted the height of mustard greens 2 MST in the K2G2 treatment, achieving optimal results with a dosage of 300g per polybag and 4 ml per liter of water.

The utilization of goat manure fertilizer and ZPT GA3 significantly influenced the quantity of mustard green leaves 4 MST in the K2G1 treatment,

showing the most favorable outcomes with a dosage of 300g per polybag and 2 ml per liter of water.

The incorporation of goat manure fertilizer and ZPT GA3 substantially affected the moisture content of mustard greens in the K2G1 treatment, yielding the best results with a dosage of 300g per polybag and 2ml per liter of water.

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