

# Growth Response of Several Varieties of Tomato Plants (*Solanum lycopersicum* L.) Fed Goat Manure in Polybag

Midranisiah<sup>1</sup>, Krisna Delita<sup>1</sup>, Esa Handayani<sup>1</sup>, Harapin Hafid<sup>2\*</sup>

<sup>1</sup>Departement of Agrotechnology, STIPER Sriwigama Palembang South Sumatera, Indonesia

<sup>2</sup>Animal Science Department, Faculty of Animal Science, Halu Oleo University, Kendari, Indonesia

\*Corresponding author. Email: [harapin.hafid@uho.ac.id](mailto:harapin.hafid@uho.ac.id)

## ABSTRACT

A study aimed to determine the response of several varieties of tomato plants that were given goat manure and to determine the interaction of these two factors. The study used a 3x5 factorial randomized block design (RAK) with 3 replications. There were 2 factors studied, namely varieties (Tymoti, Servo and Permata) and goat manure (0; 250; 500; 750; 1000 g) for each plant. The results showed that the variety had a significant effect on plant height and number of branches, but had no significant effect on the number of petioles, fruit weight and root length. The best growth and yields were obtained on the Servo variety. The dose of goat manure had a significant effect on plant height and fruit weight. The best growth and yields were obtained from the use of goat manure 750 g per plant. Likewise, the interaction, significantly affected plant height and fruit weight. The best growth and yield in the interaction treatment was the interaction between the Servo variety with a dose of 750 g goat manure per cropping.

**Keywords:** Tomato, Goat Manure, Variety, Dosage.

## 1. INTRODUCTION

The tomato plant (*Solanum lycopersicum* L.) is a type of horticultural plant that grows in tropical and sub-tropical regions, and its breeding begins when this toxic plant from the Solanum species family is used as an ornamental plant and eventually becomes an edible plant [1].

Indonesia's tomato production in 2017 was 962.9849 tons with a harvested area of 55.623 ha [2]. Agronomic efforts that can be made to increase the increase in plant production are with correct and appropriate cultivation systems such as fertilization methods and cropping patterns [3].

One of the efforts to increase the production of tomato plants is by providing macro and micronutrients with a balanced composition through fertilization, in the form of organic and inorganic fertilizers to obtain good growth and yields. Goat manure is one type of organic fertilizer that can be used to increase soil fertility. Fertile soil with sufficient nutrient content will affect plant

production and growth, because nutrients are more available and ready to be absorbed by plants [4].

Organic fertilizers have advantages which include increasing soil fertility and keeping organisms in the soil. The application of organic fertilizer to tomato plants also has health benefits for consumers. One of the better soil enhancers than artificial materials is the use of organic fertilizers that have low N, P, and K content but contain sufficient amounts of micronutrients and are indispensable for plants [5]. Hardjowigeno [6] stated that goat manure generally contains 5 kg N, 3 kg P<sub>2</sub>O<sub>5</sub> and 5 kg K<sub>2</sub>O per 1 tonne as well as other small amounts of other nutrients. Goat dung contains N and K twice as large as cow dung.

Tomatoes need more N for the vegetative phase. Nitrogen is needed because it plays a role in plant metabolism as a constituent of proteins, nucleic acids, and chlorophyll. Tomatoes need potassium during the generative phase. Potassium functions for the process of photosynthesis, transport of assimilated products, enzymes, and minerals including water. The

requirement given per planting hole of goat manure is around 750 g/plant or the equivalent of 30 tons/ha [7].

Efforts to increase tomato production in addition to the provision of organic matter can also be done by using superior varieties. Superior varieties are resistant to pests and diseases respond to fertilization, and can adapt to their environment.

The superior varieties that are often cultivated by farmers are the Servo, Intan, Ratna, Permata, Sakura Vicario F1 and Tymoti varieties. Based on research conducted by Kusumastuti and Ardiyanta [8] Servo and Tymoti varieties gave the best response to plant growth, namely plant height. Meanwhile, the results of Saleh and Raihan's research [9], Permata variety tomato plants showed the best results in plant height and fruit weight.

**2. MATERIALS AND METHODS**

The research was conducted from August to November 2019 at Jl. Bukit Indah Ex. District Hall Base. Banyuasin III Kab. Banyuasin - South Sumatra. The altitude of the place ranges from 49-60 m above sea level.

The method used in this study was a factorial randomized block design (RAKF) with 15 treatment combinations and 3 replications, where each treatment consisted of 3 plants, the total number of plants studied was 135 plants, the factors treated were:

1. The first factor is 3 kinds of varieties, namely:
  - V1 : Tymoti . variety
  - V2 : Servo variety
  - V3 : Permata variety
2. The second factor is the use of manure doses:
  - D0 : 0 g per plant
  - D1 : 250 g per plant
  - D2 : 500 g per plant
  - D3 : 750 g per plant
  - D4 : 1000 g per plant

The data obtained from the results of the study were statistically analyzed using analysis of variance in a factorial randomized block design (RBDF). To see the difference between treatments, further tests were carried out using the Turkey Test (HSD). The test formula for

Honest Significant Difference (HSD) is:

$$HSD\alpha = Q\alpha.(p:dbg) \sqrt{\frac{KTG}{k}}$$

Seedlings are carried out on nursery media and after the seedlings are 20 days old and have 3-4 leaves, the seedlings are transferred to the polybag media that has been provided. Goat manure was given 10 days before the seedlings were transferred to polybags with doses according to treatment, namely: 0 g, 250 g, 500 g, 750 g and 1000 g/polybag.

The stems of tomato plants are tied to a pole so that they grow upright and do not collapse easily. Furthermore, maintenance is carried out including watering so that the media remains at field capacity conditions. Weeding weeds when the media is overgrown with weeds is mechanical, removing the existing weeds.

Observations were made when the plants were 4 to 8 weeks old with an interval of once a week on the variables of plant height, number of leaf stalks, number of branches, plant weight and root length.

**3. RESULTS AND DISCUSSION**

The results of the analysis of diversity showed that the varietal treatment had a significant effect on plant height and the number of branches. The dose of manure treatment and the interaction had a significant effect on plant height and fruit weight. but had no significant effect on the number of petioles, number of branches and root length (Table 1).

The results of further tests on the effect of varieties and goat manure and their interactions on all observed variables can be seen in Tables 2, 3 and 4.

The treatment of goat manure had a significant effect on the parameters of plant height and fruit weight. This is because organic goat manure can improve soil fertility conditions so that it can support the growth and development of tomato plants. Goat manure contains organic matter that can provide nutrients for plants through the decomposition process.

**Table 1.** Analysis of the diversity of several varieties of tomato plants and application of manure to the observed variables

Variable	F Count			
	Varieties	Manure Dosage	Interaction	CV (%)
Plant Height (cm)	5.49 <sup>s</sup>	3.54 <sup>s</sup>	2.29 <sup>s</sup>	17.69
Number of Petioles (strands)	3.08 <sup>ns</sup>	1.85 <sup>ns</sup>	1.59 <sup>ns</sup>	11.89
Number of Branches (branches)	4.72 <sup>n</sup>	1.16 <sup>ns</sup>	1.5 <sup>ns</sup>	20.67
Planting Fruit Weight (g)	0.90 <sup>ns</sup>	9.27 <sup>s</sup>	4.36 <sup>s</sup>	16.97
Root Length(cm)	3.11 <sup>ns</sup>	2.64 <sup>ns</sup>	1.24 <sup>ns</sup>	16.88
F Table (5%)	3.34	2.71	2.29	

Note: ns (no significance); s (signification); CV (Coefficient of Variation)

**Table 2.** The effect of several varieties on the observed variables

Multiple Varieties	Plant Height (cm)	Number of Petioles (strands)	Number of Branches (branches)	Planting Fruit Weight (g)	Root Length (cm)
V <sub>1</sub>	24.68 a	10.33 a	1.60 ab	91.58 a	13.11 a
V <sub>2</sub>	29.77 b	10.73 a	1.67 b	95.62 a	15.24 a
V <sub>3</sub>	25.06 a	9.76 a	1.33 a	88.00 a	13.88 a
HSD 0.05=	4.24	1.09	0.28	14.03	2.15

Note: The notation in each column is the same, indicating that the difference is not significant

**Table 3.** Honestly Significant Difference Test the effect of manure application on the observed variables

The dose of manure	Plant Height (cm)	Number of Petioles (strands)	Number of Branches (branches)	Planting Fruit Weight (g)	Root Length (cm)
D0	25.19 ab	10.67 a	2.33 a	87.63 a	13.35 a
D1	23.35 a	10.37 a	2.33 a	78.04 a	12.48 a
D2	29.13 ab	10.07 a	2.59 a	99.33 ab	15.04 a
D3	30.09 b	10.74 a	2.63 a	115.33 b	15.68 a
D4	24.74 ab	9.52 a	2.22 a	78.33 a	13.83 a
HSD 0.05=	6.44	3.67	0.43	21.38	3.26

Note: The same notation in each column indicates no significance

**Table 4.** Effect of interaction of several varieties with the application of manure to the observed variable

Interaction	Plant Height (cm)	Number of Petioles (strands)	Number of Branches (branches)	Planting Fruit Weight (g)	Root Length (cm)
V <sub>1</sub> D0	23.44 a	10.89 b	1.55 a	84.78 ab	12.28 a
V <sub>1</sub> D1	22.22 a	10.33 a	1.55 a	72.78 a	11.89 a
V <sub>1</sub> D2	28.94 ab	10.22 a	1.89 a	110.22 b	14.83 a
V <sub>1</sub> D3	21.89 a	9.89 a	1.44 a	90.33 ab	12.10 a
V <sub>1</sub> D4	26.89 ab	10.33 a	1.56 a	99.78 ab	14.44 a
V <sub>2</sub> D0	29.22 ab	10.89 b	1.78 a	108.33 b	15.22 a
V <sub>2</sub> D1	24.22 a	10.44 a	1.44 a	80.89 ab	13.17 a
V <sub>2</sub> D2	31.61 ab	10.44 a	1.56 a	90.33 ab	15.78 a
V <sub>2</sub> D3	40.06 b	12.55 c	2.11 a	138.44 b	18.78 a
V <sub>2</sub> D4	23.72 a	9.33 a	1.44 a	60.11 a	13.28 a
V <sub>3</sub> D0	22.89 a	10.22 a	1.22 a	69.78 a	12.56 a
V <sub>3</sub> D1	23.61 a	10.34 a	1.33 a	80.44 ab	12.39 a
V <sub>3</sub> D2	26.83 ab	9.56 a	1.44 a	97.44 ab	14.50 a
V <sub>3</sub> D3	28.33 ab	9.78 a	1.44 a	117.22 b	16.17 b
V <sub>3</sub> D4	23.61 a	8.89 a	1.22 a	75.11 ab	13.78 a
HSD 0.05	14.18	1.66	0.96	47.10	7.19

In organic fertilizer, goat manure contains N nutrients of 0.67% [10]. Nitrogen is one of the most essential elements needed in large quantities to support plant metabolic processes and to support plant growth processes when plants enter the vegetative phase. This

agrees with [11] who stated that the function of nitrogen is to improve plant vegetative growth and is an important ingredient for preparation. Amino acids, amides, nucleotides, and nucleoproteins, and are essential for cell division and cell enlargement.

The results showed that the effect of giving goat manure 750 g/plant gave the best tomato growth and production when compared to the dose of manure 250, 500, and 1,000 g/plant because at that dose the nutrients can be absorbed optimally. This is in line with [12] which states that the addition of a dose of organic goat manure of 750 g/plant can increase eggplant plant height by 18.58%.

Soil fertility factors are very supportive in increasing plant growth and production, besides that aeration and good soil drainage are also needed [13]. Organic fertilizers are able to create these conditions through their negative charge which can increase the availability of P in the soil thereby increasing P uptake by plants [14] and P is needed for the process of fruit formation in plants so that the highest and optimal fruit weight is obtained at 750 g treatment. /plant that is equal to 138.44 g, while at a dose of 1000 g/plant there have been a decrease in tomato yield.

Furthermore, according to [15] that with sufficient plant nutrient needs, macro and micro elements, plant growth and productivity will run smoothly. In addition, the dose of manure 750 g/plant can improve the physical, chemical, and biological properties of the soil. This is supported by [16], stating that organic matter serves to improve physical properties such as increasing soil absorption of water, improving soil biology by increasing microorganisms, and improving soil chemistry by providing nutrients.

The best growth and production responses were found in the Servo variety when compared to the Timoty and Permata varieties. This is because the Servo variety has the highest plant height, number of leaves and number of branches when compared to the Timoty and Permata varieties. The process of photosynthesis in plants takes place in the leaves of the plant so that as the leaf area increases, the process of photosynthesis will also increase, so that the photosynthetic results will affect the formation of tomato fruit as indicated by the best plant height and fruit weight.

One of the determining factors for the success of tomato cultivation is the use of high-yielding varieties that adapt well to the growing environment [17]. The factors that cause differences in characteristics between varieties are genetic factors, habitat (place to live), and the availability of nutrients. Differences in varieties resulted in differences in regulatory genes that affect the level of plant growth and development [18]. Furthermore, the high productivity of a variety is because the variety can adapt to its growing environment [19].

The interaction treatment between the Servo variety with a dose of 750 g of manure/plant gave the best growth and yield of 138.44 g in tomato plants when compared to interactions with other treatments. This is because the Servo variety is more adaptive and superior than the Tymoti and Permata varieties. In accordance with the opinion of other experiments which stated that

each individual shows diverse growth and yields as a result of genetic and environmental influences, where genetic influence is the influence of heredity possessed by each variety while environmental influence is the influence caused by habitat and environmental conditions [20].

Although genetically other varieties have good production potential, but because they are still in the adaptation stage and the environmental conditions on the research land are not supportive, these varieties cannot show superior characteristics such as lower production than they should [21].

#### 4. CONCLUSION

Treatment with a dose of 750 g of organic fertilizer/plant gave the best results on the growth and production of tomato plants. Servo varieties provide the best response to the growth and production of tomato plants. Treatment of goat manure dose of 750 g/plant and Servo variety is the best treatment.

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