

Effects of Pig Manure and Cow Biourine Dosage on Growth and Yield of Tomato Plants (*Solanum Lycopersicum L.*)

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Abstract

This study aims to determine the effect of pig manure and cow biourine manure fertilizer on growth on the growth and yield of tomato plants and their interactions. The study was carried out in the Serampingan Village, Selemadeg Sub-district, Tabanan. The study was conducted from May 28 to August 28, 2016. The study made use of Randomized-group Design with 2 factors, consisting of 4 level of treatment, each of which was repeated 3 times so that there were 16 treatment combinations obtained. In this experiment 48 polybags were needed. The results show that the treatment of a dose of pig manure 10 tons/ha (P1) gives the highest yield on the fresh weight of fruit harvested per plant that is 895.83 grams with an increase of 7.39% compared to that of pig manure {30 tons/ha (P3)}, which is only 834.17 grams. At the fresh weight of fruit harvested per plant, the highest interaction of pig manure and biourine was obtained in the treatment (P3B1) of 930 grams which increased by 27.39% compared to the lowest in the treatment (K3B3), which was only 730 grams.

Keywords: Pig Manure, Biourine Cow Fertilizer, Tomato

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1. Introduction

Tomato is one of the plants in the *Solanaceae* family, which is a flowering plant like a trumpet. The shape, color, taste, and texture of tomatoes are diverse. There are round, flat, curly, or light bulb-shaped. The color of the ripe fruit varies from yellow, orange to red depending on the type of dominant pigment. The taste also varies, from sour to sweet. The fruit is arranged in bunches. Overall tomatoes are fleshy and contain lots of water (1).

Tomatoes are the easiest plants to find, and their bright colors are very attractive. Besides being rich in vitamins C and A, tomatoes are said to treat various diseases. Tomatoes can treat diarrhea, bile attacks, and digestive disorders and restore liver function. The Institute in Aberdeen, Scotland, has also found other benefits of tomatoes (2). Yellow cells that surround tomato seeds can prevent blood clots and clots that can cause heart disease and stroke (3). Besides tomatoes contain potassium which is very beneficial for reducing symptoms of high blood pressure (1).

Awareness of the importance of sustainable agriculture and the difficulty of obtaining inorganic fertilizers, apart from being expensive, leads farmers to utilize cheap, available and environmentally friendly organic waste, which can be used as organic fertilizer such as manure, such as pigs. Stool is biodegradable organic waste, which is a compound that is easily broken down by microorganisms. (4) states that feces still contain compounds needed by plants, namely 5-7% nitrogen, 3-6% phosphor and 1-6% potassium. In determining the application or placement of fertilizers in the soil, factors must be taken into account, which include the plants to be fertilized, the type of fertilizer used, the dose of fertilizer,

the method of application of fertilizer and the time of fertilization.

The use of pig manure in agriculture is an environmental conservation effort. With pig manure the soil will become loose and agricultural commodities will increase. In contrast to the use of inorganic fertilizers, inorganic fertilizers can indeed supply nutrients to plants but on the other hand have caused damage to agricultural land in the form of reduced organic matter, hardened soil, lack of soil porosity, low ion exchange rate, low water holding capacity, low population and microbial activity, and overall result in low levels of soil fertility (5).

One of the organic fertilizers that can improve soil properties such as chemical and biological properties is cow urine which is the residual excretion from metabolism carried out by cattle. Unfortunately, cow urine is only left wasted by farmers. Farmers only collect cow dung to be used as manure. According to (6) that cow urine can be used as liquid organic fertilizer because of the nutrient content in it, especially nitrogen, phosphorus, potassium, and more water. Cow urine can be used as liquid organic fertilizer because of the nutrient content in cow urine, especially nitrogen (1.00%), phosphorus (0.50%), potassium (1.50%) and water (92%) more. Based on this fact, cow urine should be used as liquid fertilizer for farmers' crops

2. Materials and methods

Time and Location of the Research

This study was carried out in Seramping Village, Selemadeg Sub-district, Tabanan. This place is located at an altitude of 600 m above sea level with an average temperature of 28° - 30° C. The study was conducted from 28 May to 28 August 2016.

Materials and Instruments of the Research

The materials used are tomato seeds with fortuner varieties, pig manure, biourine, compost and polybags. The tools used are spray, stationery, meter/ruler, and bottles of used mineral water.

Research design

This experiment is a simple factorial experiment using a Randomized Block Design with two factors consisting of four levels of treatment, namely: Manure Factor (P), which consists of four levels, namely P0 (without manure 0/ha), P1 (10 tons of fertilizer pens/ha), P2 (20 tons of manure/ha), and P3 (30 tons of manure/ha). Biourine dosage factor (B), consisting of 4 levels, namely B0 (without biourine 0 l/ha), B1 (biourine dose 200 l/ha), B2 (biourine dose 400 l/ha), B3 (biourine dose 600 l/ha). Each treatment was repeated 3 times so that there were 16 combination treatments obtained. In this experiment 48 polybags were used.

Observation

The variables observed in this study were plant height, number of leaves, total leaf area, number of fruits formed per plant, fresh weight of fruit harvested per plant, fruit diameter, weight of fruit harvested per plant, number of fruit harvested per plant, fresh weight of stover per plant, oven dry weight per plant, oven dry weight stover per plant and harvest index.

Analysis Data

Research data were analyzed by analysis of variance using analysis of variance according to the

design used. If the results of the analysis show a significant effect until very real, followed by a BNT test of 5% (Sunarjono, 2012).

3. Results and Discussion

Findings

A list of the significance of the effects of pig manure (P) and cow biourine (B) and their interactions (PxB) on the observed variables is presented in Table 1.

Table 1.
Significance of the effect of the treatment of pig manure and biourine doses and their interactions on the observed variables

	Variable	Treatment		
		Manure (P)	Biourine (B)	Interaction (PxB)
1	Maximum height of plant (cm)	**	**	**
2	Maximum number of leaves (strands)	**	ns	ns
3	Total leaf area (cm ²)	**	**	**
4	Number of fruits formed per plant (piece)	ns	**	**
5	Fresh weight per fruit harvest (g)	ns	*	ns
6	Diametre of fruit (cm)	**	**	**
7	Fresh weight of fruit harvested per plant (g)	**	**	**
8	Amount of fruit harvest (fruit)	**	**	**
9	Fresh stover weight (g)	ns	ns	ns
10	Oven dry weight of fruit per plant (g)	ns	ns	ns
11	Oven dry weight stover per plant	*	ns	ns
12	Harvest index	ns	ns	ns

Notes:

* = having significant effect (P<0,05)

** = having very significant effect (P<0,01)

ns = having no significant effect (P≥0,05)

As shown by Table 1, the interaction between the treatment of pig manure and cow biourine fertilizer (PxB) had no significant effect (P> 0.05) on the number of leaves per plant, fresh weight per fruit harvested per plant, fresh stover weight, stover oven dry weight, oven dry weight per plant and harvest index but had a very significant effect (P <0.01) on maximum plant height, total leaf area, number of fruits formed, fresh weight of fruit harvested per plant, number of fruit harvested per plant and fruit diametre. The treatment of manure (P) had no significant effect (P> 0.05) on the variable number of fruits formed per plant, fresh weight per fruit harvest per plant, fresh weight of stover and oven dry weight per fruit per plant. However, it had a significant effect (P <0.05) on the stover oven dry weight variable and the harvest index. Whereas, on the variable maximum plant height, maximum number of leaves, total leaf area, fresh weight of fruit harvested per plant, fruit diametre, fresh weight of fruit harvested per plant and number of fruit harvested per plant, these variables had a very significant effect (P <0.01). In the biourine treatment (B), these variables had no significant effect (P> 0.05) on the variable of the maximum number of leaves, number of fruits formed per plant, fresh weight of stover,

oven dry weight of stover, oven dry weight of fruit and harvest index. However, these variables had a significant effect ($P < 0.05$) on the variable of fresh weight per fruit harvest per plant. Meanwhile, on the maximum height per plant, total leaf area, fruit diameter, fresh weight of fruit harvested per plant and number of fruit harvested per plant, these variables have a very significant effect ($P < 0.01$).

Discussion

In the treatment of pig manure dosage (10 tons/ha), (P1) gave the highest yield of fresh fruit harvest per plant that is 895.83 grams, which increased by 7.39% compared to the dose of pig manure 30 tons/ha (P3), which is 834.17 grams. The treatment of pig manure dosage has a significant effect on the growth and yield of tomato plants, supported by a positive correlation between increasing the maximum plant height ($r = 0.99^{**}$), number of leaves per plant ($r = 1.00^{**}$), total leaf area ($r = 0.98^{**}$), number of fruits formed per plant ($r = 0.99^{**}$), fresh weight per fruit ($r = 1.00^{**}$) and fruit diameter ($r = 1, 00^{**}$). This happens because pig manure has many advantages compared to synthetic fertilizer. In addition to the high levels of nitrogen (N), phosphorus (P) and Potassium (K), pig manure contains quite complete nutrients (7).

The highest oven dry weight per plant was obtained in the treatment of pig manure dosage (30 tons/ha) of P3, which is 67.82 grams, or experienced an increase of 4.34% compared to the lowest weight without pig manure (P0), namely 64.77 grams. The height of the oven dry weight of the fruit is supported by the positive correlation relationship, namely the maximum increase in plant height ($r = 1.00^{**}$), number of leaves per plant ($r = 1.00^{**}$), total leaf area ($r = 0.99^{**}$), number of fruits formed per plant ($r = 0.99^{**}$), fresh weight per fruit ($r = 1.00^{**}$), fruit diameter ($r = 1.00^{**}$), fresh weight of fruit harvested per plants ($r = 1.00^{**}$), number of fruits per plant ($r = 0.96^{**}$) and fresh stover weight ($r = 1.00^{**}$), which cause increased interception of sunlight by leaves (source) for produce photosynthates and in subsequent developments these photosynthates will be transferred to plant organs, which actively carry out the process of metabolism, so that the growth of roots, stems, leaves and fruit of the plant is good, which in turn affects plant growth and yield. Good plant growth in the vegetative phase will have a good impact on the generative phase (8). This is also because the pig manure contains complete nutrients, both macro and micro nutrients (9)].

The highest fresh weight of fruit harvested per plant was 882.50 grams in the treatment of biourine fertilizer (B1) (200 l/ha), an increase of 8.72% compared to the lowest in the treatment dose of biourine (B3) (600 l/ha) which is only 811.67 grams. Increased fresh weight of fruit harvested per plant on biourine fertilizer treatment of 200 l/ha (B1) supported by maximum plant height ($r = 0.99^{**}$), number of leaves per plant ($r = 1.00^{**}$), total leaf area ($r = 0.98^{**}$), number of fruits formed per plant ($r = 0.96^{**}$), fresh weight per fruit ($r = 1.00^{**}$) and fruit diameter ($r = 1.00^{**}$). This is because biourine fertilizer can provide the nutrients needed, so that soil and plant fertility can be improved. Biourine fertilizer has advantages, which among others are having the amount of nitrogen, phosphorus, potassium and water that can provide a positive influence on plant growth and development (10). The results of the study (11) stated that cow biourine fertilizer with a dose of 200 ml l⁻¹ water showed the best results of mustard greens.

The highest oven dry weight per plant was 69.48 grams in the treatment of biourine fertilizer (B2) (400 l/ha) which increased by 0.14% compared to those without biourine fertilizer (B0) which was 5.89 grams. There is a positive correlation that is maximum plant height ($r = 0.99^{**}$), number of leaves per plant ($r = 1.00^{**}$), total leaf area ($r = 0.98^{**}$), number of fruits formed per plant ($r = 0.96^{**}$), fresh

weight per fruit ($r = 1.00^{**}$), fruit diameter ($r = 1.00^{**}$), fresh weight of fruit harvested per plant ($r = 1.00^{**}$), number of planted fruits ($r = 0.97^{**}$) and fresh stover weight ($r = 0.98^{**}$). The application of cow biourine fertilizer, in addition to increasing the availability of nutrients, can also improve the physical properties of the soil. Some soil physical properties that can be influenced by biourine fertilizer include aggregate stability, volume weight, total pore space, plasticity and water holding capacity (12)].

At the fresh weight of fruit harvested per plant, the highest interaction of pig manure and biourine is obtained in the treatment (P3B1) which is 930 grams which increases by 27.39% compared with the lowest in the treatment (P3B3) which was 730 grams (Table 4.7) supported by a positive correlation on the variable of fresh weight per fruit ($r = 1.00^{**}$). This is because the two types of fertilizers are organic fertilizers that have almost the same function and characteristics, namely improving soil fertility, increasing soil productivity, soil physical properties, and chemical and soil biology so that nutrients in the soil that are beneficial to increase the vegetative growth phase are available (13).

Good tomato plant growth shows the nutrients contained in biourine liquid fertilizer can be utilized by plants. Based on this, cow urine is suitable for liquid fertilizer for farmers' crops (14). It was also further mentioned that cattle biourine is one alternative to increase the availability, adequacy and efficiency of nutrient uptake for plants containing microorganisms so as to reduce the use of inorganic fertilizers (N, P, K) and increase crop yields maximally. The existence of organic material in biourine can improve the physical, chemical and biological properties of the soil. According to (15) organic fertilizer can be added to the soil, besides being able to enrich the nutrients of plant parts, it can also increase humus levels and encourage the life of soil microorganisms.

4. Conclusion

Building on the results of this study, it can be concluded that the highest dry weight of fruit oven per plant was obtained in the treatment of pig manure (P3) (30 tons/ha) that is 67.82 grams which experiences an increase of 4.34% compared to the results the lowest without pig manure tons per hectare (P0) which is only 64.77 grams. The highest oven dry weight per plant is obtained at 69.48 grams in the treatment of biourine fertilizer (B2) (400 l/ha) which increases by 14% compared to those without biourine fertilizer (B0) which is only 58.91 grams. At the fresh weight of fruit harvested per plant, the highest interaction of pig manure and biourine was obtained in the treatment (P3B1) that is 930 grams which increases by 27.39% compared to the lowest in the treatment (P3B3) which is only 730 grams.

References

- [1] Cahyono B. *Budidaya Tomat dan Analisis Usaha Tani*. Yogyakarta; 2005.
- [2] Rowet. *Physiology of Salt Tolerance*. *Ann. Rev. Plant Physiol* [Internet]. 1934 [cited 2011 Mar 10]. Available from: <http://www.journalinternasional.com>
- [3] Mumtazanas. *Tomat Obat Berbagai Penyakit*. 2007.
- [4] Suriawiria. *Mikrobiologi Umum*. Bandung: Departemen biologi FMIPA; 2007.
- [5] Aryantha INP. *Membangun Sistem Pertanian Berkelanjutan KPP Ilmu Hayati LPPM-ITB*. Bandung: Ganesha; 2001.
- [6] Murniati N, Safriani E. *Pemanfaatan Urine Sapi Sebagai Pupuk Organik Cair Untuk Meningkatkan Produktivitas Tanaman Selada (Lactuca sativa L.)*. *J silampari Fak Pertan Unmura*. 2013;1(2):9–17.
- [7] Sutedjo MM. *Pupuk dan Cara Pemupukan*. Jakarta: Rineka Cipta; 2002.
- [8] Mulyani ES. *Dasar-Dasar Fisiologi Tanaman*. Jakarta: SITC; 2006.
- [9] Hendarsin M, Srijono. *Pupuk Organik*. Jakarta: PT. Balai Pustaka; 2002.
- [10] Misa D. *Biourine, pupuk*. Universitas Brawijaya Malang; 2011.
- [11] Sutari. *Kamus Ilmiah Populer*. Surabaya: Karya Utama; 2010.

- [12] Soepardi G. Sifat dan Ciri Tanah. Bogor: Departemen Ilmu Tanah Fakultas Pertanian IPB; 1983.
- [13] Marliah A. Pengaruh Jarak Tanam dan Jenis konsentrasi Pupuk Cair Organik. Universitas Padjadjaran; 2014.
- [14] Rinsema. Peranan Pupuk Organik Terhadap Sifat-Sifat Tanah. Jakarta: Swadaya; 1986.
- [15] Hakim, Al E. Biologi Tanah Dalam Praktek. Bogor: IPB; 1996.