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by Katriani Mantja

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Growth and production of determinate tomato (*Lycopersicum esculentum* Mill) with application package of bio-slurry

K Mantja¹, A Mollah¹, N Fitriani¹ and J Y Parlindungan²

¹Department of Agronomy, Universitas Hasanuddin, Makassar, Indonesia

²Department of Chemistry Education, Faculty of Teacher Training and Education, Universitas Musamus, Merauke, Indonesia

Email: katriani@yahoo.co.id

Abstract. This study aimed to analyze the growth and production of tomato (*Lycopersicum esculentum* Mill) with the application of liquid bio-slurry fertilizer at different concentration and interval of application. The design of this study was a Randomized Block Design (RBD) consisting of eight packages of liquid bio-slurry treatment and fertilization intervals with three replications. Eight packages of treatments are: 60 ml L⁻¹ & 3-day interval; 60 ml L⁻¹ & 6-day interval; 120 ml L⁻¹ & 3-day interval; 120 ml L⁻¹ & 6-day interval; 180 ml L⁻¹ & 3-day interval; 180 ml L⁻¹ & 6-day interval; 240 ml L⁻¹ & 3-day interval; and 240 ml L⁻¹ & 6-day interval. The results showed that the treatment package significantly affected all parameters. The package of 240 ml L⁻¹ & 3-day interval gave the best results on the parameters of average plant height of 7 weeks after planting (wap) (107.53 cm), age of harvest (73 dap), and fruit production parameter (316.83 g).

1. Introduction

The consumption of tomatoes increases every year despite the fluctuating yield in Indonesia in the last five years. National tomato production in 2015 decreased by 4.17% from 2014. Tomato production in South Sulawesi in 2014 was 52,431 tons while in 2015 was 47,597 tons [1].

Development of tomato in lowland still faces obstacles causing a decrease in the yield. These constraints include inappropriate farming techniques, limited land resources and pathogen disturbance such as Wilt bacteria as a major disease that has been responsible for production decreased of tomato, this is a reason tomatoes in the lowlands is lower than in highlands [2].

This study aims to determine the package of liquid bio-slurry fertilizer concentration and the best fertilization interval on the growth and production of tomato (*Lycopersicum esculentum* Mill) planted in the lowland of South Sulawesi. There is not much information on the utilization of biogas waste derived from cow manure on tomatoes in this context. Therefore, it is necessary to conduct a study to examine the utilization further and analyze the concentration of the best liquid bio-slurry fertilizer in tomato cultivation.

2. Determinate tomatoes

Determinate tomatoes are varieties with a shorter lifespan, they grow to a certain size of maturity and ripen all fruits within a short period. Once the first wave of fruit has ripened, the senescence period will come not long after, fruiting continues with diminishing plant's vigor make the plant set little to no more new fruit [3].



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Permata F1 is a determinate variety of Tomato that can grow on lowland of 0-400 m asl. The fruit of this variety is resistant to several common diseases such as blossom, rot, and fruit tip disease. Similar to other determinate tomatoes, this variety has fast stem growth and short harvesting age [4].

3. Bio-slurry

Oxygen-free biogas processing made of a mixture of cow manure and water inside a closed compartment produces biogas waste in the form of solid and liquid bio-slurry. Bio-slurry can be a product of organic fertilizer, liquid biofertilizers, bio-pesticides, and a mixture of growing media. Bio-slurry fertilizer has more nitrogen and phosphorus than compost [5]. Bio-slurry has been tested and proven effective to be used in other plants such as soybean [6]

Analysis of liquid bio-slurry by Hartanto [7] it contains macro elemental nutrients, namely nitrogen (N) 0.03% - 1.47%, P_2O_5 0.02% - 0.035%, K_2O 0.07% - 0.58% and microelements namely elements iron (Fe), manganese (Mn), copper (Cu), zinc (Zn). The average content of nitrogen in liquid bio-slurry is higher than the solid form. The content of nitrogen and potassium in bio-slurry is following Organic Fertilizer Quality Standards, which are below 6% on average.

Additionally, bio-slurry contains other ingredients such as amino acids, fatty acids, organic acids, humic acid, vitamin B-12, auxin, and cytokines. The nutrient content of bio-slurry, especially nitrogen, is more easily absorbed by plants compared to raw manure or compost. Consequently, application of the substance will make the soil more fertile so that the productivity of plants could be higher.

Bio-slurry improves soil porosity by making the soil more crumbly and more capable of storing water. Bio-slurry has the same benefits as manure, which is to improve soil structure. Application of bio-slurry helps the integration of soil and nutrients as well as increased population and activity of microorganisms in the soil [8].

4. Methodology

An experiment was conducted inside a greenhouse in an area with an altitude of about 20 meters asl. Materials used in this study were Permata F1 tomato seeds, topsoil, biochar, water, NPK fertilizer (16:16:16), cow manure, and liquid bio-slurry.

Treatment of this experiment was arranged with a Randomized Block Design (RBD). The treatments were packages of application involving two main factors related to the bio-slurry application: concentration and interval of application. There were 8 packages which are: b1= 60 ml L⁻¹ & 3-day interval; b2= 60 ml L⁻¹ & 6-day interval; b3= 120 ml L⁻¹ & 3-day interval; b4= 120 ml L⁻¹ & 6-day interval; b5= 180 ml L⁻¹ & 3-day interval; b6= 180 ml L⁻¹ & 6-day interval, b7= 240 ml L⁻¹ & 3-day interval, b8= 240 ml L⁻¹ & 6-day interval. Each treatment package was repeated three times so that there were 27 treatment units. Each unit of treatment package consisted of 3 units making a total of 81 units.

5. Results and discussion

5.1. Vegetative variable

Observable parameters reported in this paper consists of ones represent vegetative and production variables. The vegetative variables are represented by the plant height, and the result is presented in table 1.

Table 1. Average of plant height (cm) at five weeks after planting (wap)

Treatment package	Average of plant height (cm)		Treatment package	Average of plant height (cm)	Significance
b1b3b5b7	84.20	vs	b2b4b6b8	83.45	ns
b1b3	79.00	vs	b5b7	89.40	**
b1	88.33	vs	b3	69.67	**
b5	84.47	vs	b7	94.33	*
b2b4	80.62	vs	b6b8	86.29	ns
b2	83.57	vs	b4	77.67	ns
b6	86.80	vs	b8	85.77	ns

Notes: ** = Very significant, * = Significant, ns = not significant

Orthogonal contrast test results showed that the average plant height of 5 wap in the treatment of 240 ml L⁻¹ & 3-day interval was higher than 94.33 cm and was significantly different from the treatment of 180 ml L⁻¹ & 3-day interval, i.e., 84.47 cm. Vegetative growth is highly influenced by the availability of Nitrogen (N). N content of treatment 240 ml L⁻¹ & 3-day interval was higher than the treatment of 180 ml L⁻¹ & 3-day interval because of presumably more fertilizer results in more N which functions to stimulate growth and formation of the main stem of plants. It is in line with [9] and [10] that nitrogen is an essential macronutrient for vegetative growth of plants such as leaves, stems, branches, and roots.

According to Chalimah [11], the provision of organic materials such as bio-slurry fertilizers can cause the availability of nutrients to support plant vegetative growth. Bio-slurry fertilizer has enough macronutrient content which can be absorbed by plants for translocation to other parts.

5.2. Production variable

This study took three main parameters to observe the significance of the treatment to generative phase that affects yields and production, i.e., yielding age (dap), fruit weight per plant unit (g) and the number of fruits per plant unit (fruit).

5.2.1. *Yielding age.* Determinate tomato has a shorter lifespan, thus yielding age become significant for production, table 2 show the average of yielding age.

Table 2. Average of yielding age (dap) under different treatment of bio-slurry application packages

Treatment package	Average of yielding age (dap)		Treatment package	Average of yielding age (dap)	Significance
b1b3b5b7	78.83	vs	b2b4b6b8	75.92	ns
b1b3	84.50	vs	b5b7	73.17	**
b1	83.00	vs	b3	86.00	ns
b5	73.33	vs	b7	73.00	ns
b2b4	76.50	vs	b6b8	75.33	ns
b2	79.00	vs	b4	74.00	ns
b6	75.00	vs	b8	75.67	ns

Notes: ** = Very significant, * = Significant, ns = not significant

Orthogonal contrast test showed treatment of 180 ml L⁻¹ & 3-day interval and 240 ml L⁻¹ & 3-day interval gave earlier yielding age at 73.17 days after planting (dap) and was very significantly different from the treatment of 60 ml L⁻¹ & 3-day interval and 120 ml L⁻¹ & 3-day interval, both at 84.50 dap.

Application of 3-day interval of all concentration did not significantly affect whether they are applied at 6-day interval. It indicated that concentration was what matter and presumably three days difference will not make any difference, probably further research needs to investigate the more frequent application, e.g., daily application.

Bio-slurry also contains the P element, which is essential for the generative phase of plants. Ritawati et al. [12] emphasized the phosphorus role to accelerate the ripening and harvesting of fruit.

5.2.2. *Fruit weight.* Variance showed that the treatments had significant and very significant effects on fruit weight per plant.

Table 3. Average of fruit weight (g) per plant unit under different treatment of bio-slurry application packages

Treatment package	Average fruit weight (g)		Treatment package	Average fruit weight (g)	Significance
b1b3b5b7	88.41	vs	b2b4b6b8	75.53	*
b1b3	72.50	vs	b5b7	104.33	**
b1	89.63	vs	b3	55.37	**
b5	103.04	vs	b7	105.61	ns
b2b4	82.71	vs	b6b8	68.34	ns
b2	83.00	vs	b4	82.42	ns
b6	63.83	vs	b8	72.85	ns

Notes: ** = Very significant, * = Significant, ns = not significant

The best plant height seven after weeks of tomato planting was achieved by the treatment of 240 ml L⁻¹ & 3-day interval. There is a correlation between plant height and weight of fruit which according to Surtinah [13], tomato production is influenced by vegetative growth such as plant height, i.e., the higher the plant, the more weight of the fruit which is offset by the increasing number of productive branches and the diameter of the plant stems.

5.2.3. *Number of fruits.* Variance showed that the treatments had very real and significant effects on the number of fruits.

Table 4. The average number of fruits (fruit) per plant unit under different treatment of bio-slurry application packages

Treatment package	Average number of fruit (fruit)		Treatment package	Average number of fruit (fruit)	Significance
b1b3b5b7	6.86	vs	b2b4b6b8	6.24	ns
b1b3	6.00	vs	b5b7	7.72	*
b1	7.78	vs	b3	4.22	**
b5	7.22	vs	b7	8.22	ns
b2b4	6.72	vs	b6b8	5.75	ns
b2	7.56	vs	b4	5.89	ns
b6	5.00	vs	b8	6.50	ns

Notes: ** = Very significant, * = Significant, ns = not significant

More fruits produced by the treatment of 240 ml of L⁻¹ & 3-day interval compared to 120 ml of L⁻¹ & 3-day interval. Phosphorus and potassium content are more in higher concentration. Thus, better result in higher concentration is explainable since phosphorus and potassium are essential in fruit

formation. Neliyati [14] stated that phosphorus stimulates flower and fruit formation. Potassium can prevent fruit loss, increase the quantity and quality of fruit. Potassium plays a role in the formation of carbohydrates, increased assimilation of CO₂, and increases the translocation of photosynthetic assimilates out of leaves. Plants will bear heavy fruit if they can produce high carbohydrates and translocation works well. Additionally, potassium plays a role in regulating water within plant tissues by limiting water loss and encouraging water absorption [11].

6. Conclusion

Application of liquid bio-slurry with a concentration of 240 ml L⁻¹ every three days gave the best results on all observational parameters reported in this article except on fruit weight. It can be seen that more concentration with more frequent application had a significant result for the growth and production of tomatoes in this experiment. However, a further experiment is necessary to obtain the most optimal concentration and interval of application. A comparison could also be made with highland tomatoes to see the effectiveness of bio-slurry at the two altitudes.

References

- [1] Statistik Indonesia 2014 Statistik Indonesia 2014: Produksi tanaman sayuran dan buah-buahan semusim menurut jenis tanaman (ton), 2010–2013 [Statistical Yearbook of Indonesia 2014: Production of seasonal vegetables and fruits by kind of plant (ton), 2010–2013] *Jakarta Stat. Indones.*
- [2] Sanura C P E 2013 Pengaruh Naungan Terhadap Produksi dan Kualitas Buah Enam Varietas Tomat (*Lycopersicon esculentum* Mill.) *Skripsi. Inst. Pertan. Bogor. Bogor*
- [3] Iannotti M 2018 What Do Determinate and Indeterminate Tomato Varieties Mean? *Spruce-Design your dream yard*
- [4] Wiryanta B T W 2002 *Bertanam tomat* (AgroMedia)
- [5] Widodo T W, Ana N, Asari A, Elita R and Serpong B B P M P 2009 Pemanfaatan limbah industri pertanian untuk energi biogas *Balai Besar Pengemb. Mek. Pertanian, Serpong, Tangerang* **12**
- [6] Rafiuddin, Mollah A and Iswoyo H 2018 Effectiveness of bio-slurry on the growth and production of soybean (*Glycine max* (L.) Merrill) *IOP Conference Series: Earth and Environmental Science* vol 157 (IOP Publishing) p 12019
- [7] Hartanto Y and Putri C H 2013 Pedoman Pengguna & Pengawas Pengelolaan dan Pemanfaatan Bio-slurry *TimBiogas Rumah (Biru), Yayasan Rumah Energi. Jakarta*
- [8] Juarsah I 2017 Keragaman Sifat-Sifat Tanah Dalam Sistem Pertanian Organik Berkelanjutan *Prosiding Seminar Nasional Teknologi Pertanian*
- [9] Sihotang R H, Zulfita D and Surojul A M 2013 Pengaruh Pupuk Organik Cair Terhadap Pertumbuhan dan Hasil Kacang Hijau Pada Tanah Aluvial *J. Sains Mhs. Pertan.* **2**
- [10] Puji A 2011 Pengaruh Pupuk Organik Cair Terhadap Pertumbuhan dan Hasil Tanaman Tomat (*Lycopersicum esculentum* Mill) *Agroqua* **9** 1–7
- [11] Chalimah S and Sulaiman W 2015 Uji Potensi Hasil Produksi Pupuk Organik Granul Limbah Biogas terhadap Pertumbuhan Tanaman Tomat (*Solanum lycopersicum*)
- [12] Ritawati S, Firnia D and Rosyitah I 2017 Pengaruh pemberian beberapa jenis pupuk kotoran hewan dan konsentrasi air kelapa terhadap hasil tanaman tomat (*Lycopersicum esculentum* Mill.) *J. Agroekoteknologi* **9**
- [13] Surtinah S 2007 Kajian hubungan pertumbuhan vegetatif dengan produksi tomat (*Lycopersicum esculentum*, Mill) *J. Ilm. Pertan.* **4** 1–7
- [14] Neliyati 2005 Pertumbuhan dan hasil tanaman tomat pada beberapa dosis kompos sampah kota *Agronomi* **10** 93–7

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