[biodiv] Editor Decision - darwin

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7 of 11

[biodiv] Editor Decision

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Smujo Editors <smujo.id@gmail.com>
to me, Ermawati, Ni, Wahyu

Mon, Nov 15, 2021, 1:24 PM

Darwin H. Pangaribuan, Ermawati Ermawati, Ni Made Widi Suryani, Wahyu Sara Maria:

We have reached a decision regarding your submission to Biodiversitas Journal of Biological Diversity, "The growth and yield responses of two bean cultivars to organic and inorganic nitrogen sources".

Our decision is: Revisions Required

Reviewer A:

Dear Authors,
Despite this research topic and the whole paper are rather interesting, there are considerable problems with the structure of the manuscript. I found some inconsistencies with the quality of English, and in the spelling of some terms. I left my comments and some corrections in the manuscript file, attached to my review. Please, pay special attention to my comment related to

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30°C Berawan 12:52 09/05/2023

Reviewer Evaluation

Title: THE GROWTH AND YIELD RESPONSES OF TWO BEAN CULTIVARS TO ORGANIC AND INORGANIC NITROGEN SOURCES

Name of Reviewer: A

(The reviewers' identities remain anonymous to author/s)

==========

Specific comments (strengths and shortcomings).

1 Abstract (Adequacy of abstract & key word)

- concise and compact, but does not provide a clear initial conclusion about the source of inorganic and organic N
- see comment in keywords

2 Introduction (Background and Significance of the study)

See comment

3 Methodology (Validity of experimental design and parameters)

Ok, but the placement of the experimental design sentences needs to be moved (see comment)

4 Results (Interpretation of data) and Discussion (Relevance of discussion)

- The way the treatment combination table is read needs to be improved, this has an impact on the form of the sentence in the discussion.
- In general, the discussion has fulfilled the rules, but the implications of the research results have not been discussed, and this cannot be seen even in the conclusions.

5 Conclusion (Soundness of conclusion)

- The difference in effect of inorganic and organic N sources is not clearly stated
- Wordy

Clarity of Tables and Figures

See comments

References (more than 75% from the 10 past years).

Ok, but but there are some that are not cited in the document.

General Comments for Author

potentially published and cited

Recommendations (Choose One)

	Accept Submission [The submission will be accepted without revisions]
√	Revisions Required [The submission will be accepted after minor changes have been made]
	Resubmit for Review [The submission needs to be re-worked, but with significant changes, may be accepted. It will require a second round of review, however.]
	Resubmit Elsewhere [The submission looks good, but isn't suitable for this journal. Typically, it falls outside the scope of the journal]
	Decline Submission [The submission is too far below the standards of the journal and is beyond revision]

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THE GROWTH AND YIELD RESPONSES OF TWO BEAN CULTIVARS TO ORGANIC AND INORGANIC NITROGEN SOURCES

Abstract. The productivity of beans can be increased by selecting cultivars and applying fertilizers in accordance with the needs of the bean plants. The use of high yielding cultivar and the application of N fertilizers with the right dosage can overcome the low production. The purpose of this study was to determine the effect of N sources on the growth and production of two cultivar of beans. The study used a 5x2 factorial treatment design in a randomized block design with three replications. The first factor is the Perkasa cultivar and the Lebat-3 cultivar. The second factor is fertilizer (N), namely control, Urea 100 kg ha^{-1}, 10%, 20%, 30% concentration of liquid organic fertilizer (LOF). The results showed that the use of lamtoro leaf LOF with the right dose can be used as an alternative to N fertilization. Bean cultivar did not significantly affect the growth parameters of green beans. The effect of 20% LOF produced the highest number of trifoliate leaves (8.81 leaves) and plant dry weight (4.52 g), while Urea produced the highest plant height (171.48 cm), chlorophyll (15.93 mg g^{-1}FW), carotenoids (2.35 mg g^{-1}FW) and the number of stomata (22 / mm^2). The use of a combination of 20% LOF and Perkasa cultivar showed the best effect on the number of pods per plant (5.67) and the highest bean production (846.67 kg ha^{-1})

Key words:, chlorophyll, liquid organic fertilizers, stomata, urea, cultivar

Commented [T1]: Lamtoro is unknown word in English, preferred common name is leucaena (Leucaena leucocephala). It is better if you use leucaena, the international academic community does not know the lamtoro, especially since the Latin name is not mentioned at the beginning of this document.

Commented [T2]: Keywords

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I. INTRODUCTION

The green bean plant (*Phaseolus vulgaris* L.) is one of the legume group plants which is a source of vegetable protein which is widely consumed by the Indonesian people so that it has good potential to be developed because it has an important role in fulfilling health needs as a nutritious food ingredient. According to Rihana et al. (2013), beans are a vegetable source of vegetable protein and are rich in vitamins A, B, and C and can overcome several diseases such as oxidative stress, cardiovascular, cancer, diabetes and synromic metabolism (Camara et al., 2013). As the population increases, the need for fresh food and vegetables also continues to increase. To increase the production of green beans, it is necessary to apply good cultivation techniques and environmental management for plant growth. One of the efforts that can be done is balanced fertilization and match with the needs of the plants. The productivity of green beans can be increased by using improved cultivar and cultivation systems. There are many cultivars of green beans. According to Ratnasari et al. (2015), each cultivar has different genetic characteristics, which cause differences in appearance and character as well as different responses to production factors.

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Fertilization is one way to meet the nutrient needs of nitrogen in green beans. Fertilization of N derived from inorganic and organic fertilizers. Nitrogen is a major nutrient needed by green beans, which plays an important role in the formation of chlorophyll, protoplasm, protein, and nucleic acids (Fahmi et al., 2010). The plant's need for N is higher than other nutrients. Pahlevi et al. (2016) said that the nutrient N affects the photosynthetic process of plants and the resulting photosynthate. According to Maghfoer et al. (2018), inorganic fertilizers can produce large growth and yields for plants. However, the continuous use of inorganic fertilizers can interfere with soil fertility and productivity. Therefore an alternative is needed to reduce the use of inorganic fertilizers, namely using organic fertilizers.

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Availability of nitrogen could be supplied with liquid organic fertilizers (LOF). Liquid organic fertilizer is an organic fertilizer that is available in liquid form, which contains nutrients in the form of a solution so that it is very easily absorbed by plants. Liquid organic fertilizer can be utilized by sprinkling it on plants or spraying on the leaves or stems of plants. Organic fertilizers can be made from plant waste available in the surrounding environment. The advantage of using liquid organic fertilizers is that their distribution can be adjusted to the needs of plants (Ginandjar et al., 2019). One example of organic matter that can be used as liquid organic fertilizer source of N is lamtoro leaf. Liquid organic fertilizer derived from lamtoro leaves contains nitrogen nutrients needed for plants (Jeksen and Mutiara, 2017). The N content in lamtoro leaves is quite high, namely 3.84% so ~~that~~ it can be a source of organic N to increase the growth and production of green beans (Palimbungan et al., 2006). Research results by Rizqiani et al. (2007) stated that the application of liquid organic fertilizers increased the fresh weight of pods in green beans and in Duaja's (2013) research, liquid organic fertilizer of kirinyuh (*Chromolaena odorata* L.) provided the highest yield of pods and bean yields per plant.

Plant cultivar is a factor that greatly determines the quality of agricultural products. The use of high-yielding cultivar of beans is expected to increase productivity and yield quality of beans. Each cultivar has different genetic characteristics and traits. Based on genetic characteristics, there will be differences in the character and appearance of each

cultivar. Examples of high yielding cultivar of beans are Lebat-3 and Perkasa. The advantages of Perkasa cultivar according to the description are having resistance to leaf rust disease, early maturity and having large and long pods. The superiority of Lebat-3 cultivar based on its description is that it is well adapted to the low-highlands, has early maturity and has high yield potential. The results by Sinaga et al. (2017) showed that the use of cultivar had a significant effect on the growth and yield of beans. According to Duaja (2013), there is an interaction between the use of bean cultivar and liquid organic fertilizers on the number of pods and the yield of beans.

The fertilizer requirement by each cultivar is different. This is due to the genetic characteristics of these cultivar, so that the selection of fertilizer types and fertilizer requirements need to be considered. The proper doses of liquid organic fertilizers as needed is also a factor that affects plant growth. According to Ratnasari et al. (2015), differences in genetic traits of cultivar may show different responses to the environment and production factors. Based on this, it is hypothesized that there will be a different response of two beans cultivar to the treatment of different types and doses of fertilizers sources, because each cultivar has different genetic and character traits towards environmental influences and existing production factors. This study aims to determine the effect of nitrogen sources on the growth and production of two cultivar of beans.

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II. MATERIALS AND METHODS

This research was conducted on the experimental research area of the City of Sepang Jaya, Labuhan Ratu District, Bandar Lampung from January to March 2020. The research began with soil cultivation using hoes. The land is loosened with a depth of 20-30 cm and evenly processed and an experimental plot is made with a size of 3 x 2.5 m. The planting of the Perkasa and Lebat-3 cultivar was carried out by drilling the planting holes. The seeds given to each planting hole are 2 seeds with a spacing of 40 cm x 40 cm.

Preparation of liquid fertilizer is done by mixing the chopped lamtoro leaves (1 kg of lamtoro leaves: 2 liters of water), with 200 ml of molasses and 200 ml of EM4 in a drum then fermenting for 15 days. The liquid is filtered and ready to be applied to plants. Inorganic fertilizers given were Urea 100 kg ha^{-1} (75 g / plot) given at the beginning of planting and 30 day after planting (DAP), SP-36 200 kg ha^{-1} (150 g $plot^{-1}$), and KCL 100 kg ha^{-1} (75 g $plot^{-1}$). Fertilization is done in an strip with a distance of 5 cm from the plant.

The application of liquid organic fertilizer is conducted by spraying it on the top of the plant and the bottom of the plant (60:40). This LOF spraying is carried out once a week using a concentration of 10% (100 ml LOF solution + 900 ml water), 20% (200 ml LOF solution + 800 ml water), and 30% (300 ml LOF solution + 700 ml water).

Plant maintenance includes weeding manually and thinning. Harvesting is carried out in stages according to the harvest age of each cultivar. The characteristics of the beans that are ready to be harvested, the color of the pods is rather young and gloomy, the skin surface is a bit rough, the seeds in the pods are not yet prominent, and when the pods are broken, they will usually make a popping sound that usually occurs 2-3 weeks after the flowers bloom.

The parameters observed were plant height, number of trifoliate leaves, chlorophyll, carotenoids, number of stomata, greenness of leaves, symptoms of N deficiency, number of pods per plant, dry weight, and production. The method used to observe the stomata on the leaf surface is the replica method, in which the leaves are first cleaned with a tissue to remove dust or dirt, then rubbed with a transparent nail polish. The nail polish is allowed to dry for a few minutes, after which the nail polish is applied dry with a transparent strip of tape measuring 1 cm x 1 cm in size and smoothed, then peeled off slowly. The result of the peel is then attached to the slide and observed under a microscope.

Measurement of chlorophyll and carotenoid content was carried out using the spectophotometric method. The green beans are crushed using a mortar and 100 ml of 70% alcohol solution is added. Then the extract was filtered and the filtrate was placed in a cuvet to measure the total chlorophyll and carotenoid content using a spectophotometer. According to Rahimi et al. (2019) the chlorophyll and carotenoid content was calculated using the formula:

Chlorophyll *a* = 11,24 x A_{662} - 2,04 x A_{645}
Chlorophyll *b* = 20,13 x A_{645} - 4,19 x A_{662}
Chlorophyll total = 7,05 x A_{662} + 18,09 x A_{645}

$$\text{Carotenoid} = \frac{(1000 \times A470 - 1{,}90 \text{ x klorofil a} - 63{,}14 \times \text{klorofil b})}{214}$$

Data analysis

The treatment design used was factorial (2 x 5) in a randomized block design (RBD) with three replications in order to obtain 30 experimental units. The first factor is the bean cultivars, namely Perkasa and Lebat-3. The second factor is the source of nitrogen, namely control, Urea 100 kg ha^{-1}, LOF 10%, LOF 20%, and LOF 30%. Data were tested by Tukey's test. If the assumption of variance is met, the data is analyzed for variance, then the comparison of the mean between treatments is tested using the Honestly Significant Difference (HSD) 5%.

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III RESULTS AND DISCUSSION

The results of LOF analysis showed that the N content in the LOF of lamtoro leaves was 0.16%, had a C-Organic content of 3.08%, N-total was 0.16%, P-total was 0.18% and K was 0.56% with a pH of 3.64. The results of the analysis showed that the C/N of the lamtoro LOF ratio was 19.25. C/N ratio has met the standard of organic fertilizer. A good C/N ratio is between 15-20%. A high C/N ratio causes the biological activity of microorganisms to decrease, while a C/N ratio that is too low will cause denitrification.

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Table 1. Effects of treatment nitrogen source and cultivar on plant height, number of trifoliate leaves, and dry weight plant.

Treatment	Plant height (cm)	Number of trifoliate leaves 6 weeks after planting	Dry weight plant (g)
Perkasa Cultivar	133.60 a	7.20 a	3.21 a
Lebat-3 Cultivar	137.63 a	8.11 a	3.17 a
$HSD_{0,05}$	18.47	1.43	0.92
Control	94.71 c	5.57 b	1.95 b
Urea	171.48 a	8.50 ab	3.78 ab
LOF 10%	150.60 ab	9.11 a	3.13 ab
LOF 20%	148.02 ab	8.81 ab	4.52 a
LOF 30%	113.29 bc	6.30 ab	2.58 ab
$HSD_{0,05}$	42.11	3.25	2.09

In a colum, common values letter(s) do not differ significantly at $p \leq 0,05$ as per HSD

The results showed that the application of N sources and cultivar did not affect plant height, number of trifoliate leaves, and dry weight. In plant height, the number of plant height in the control was shorter than the treatment of urea, 10% LOF, 20% LOF, and 30% LOF. The application of N sources to Urea, LOF 10%, LOF 20%, and LOF 30% did not differ (Table 1). The number of trifoliate leaves given control was less than LOF 10%, while the number of trifoliate leaves treated with Urea, LOF 20%, and LOF 30% had relatively the same results (Table 1). Provision of 20% N LOF source resulted in heavier dry stover weight than control, while the distribution of Urea, 10% LOF, and 20% LOF was not different. Giving source of N between controls, Urea, LOF 10%, and LOF 30% resulted in no different dry weight (Table 1).

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Table 2. Effects of treatment nitrogen source and cultivar on, chlorophyll, carotenoid of leaves, and number of stomata.

Treatment	Chlorophyll (mg g^{-1} FW)	Carotenoid (mg g^{-1} FW)	The number of stomata (/mm^2)
Perkasa Cultivar	12.92 a	1.59 a	14.40 a
Lebat-3 Cultivar	13.24 a	1.88 a	14.67 a
$HSD_{0,05}$	1.16	0.29	3.50
Control	9.68 b	1.38 b	8.50 c
Urea	15.93 a	2.35 a	22.00 a
LOF 10%	15.56 a	1.69 ab	11.50 bc
LOF 20%	13.77 a	1.76 ab	17.83 ab
LOF 30%	10.46 b	1.47 b	12.83 bc
$HSD_{0,05}$	2.64	0.67	8.05

In a columb, common values letter(s) do not differ significantly at $p \leq 0,05$ as per HSD

The results showed that the provision of N sources and cultivar did not affect chlorophyll, carotenoids, and the number of stomata in green beans. In chlorophyll, carotenoids, and the number of leaf stomata of Perkasa Cultivar did not differ compared to Cultivar Lebat-3. The chlorophyll content given the control was lower than Urea, while the control chlorophyll was not different compared to the LOF 30%. Chlorophyll treated with Urea did not differ compared to LOF 10% and LOF 20% (Table 2). The provision of N Urea sources resulted in a higher carotenoid content than the control, while the application of Urea, 10% LOF, and 30% LOF was not different (Table 2). The application of N source between controls, LOF 10%, LOF 20%, and LOF 30% resulted in no different carotenoid content. The provision of N Urea source produced the highest number of stomata compared to the control, while the provision of Urea and 20% LOF was not different. LOF application of 10%, 20%, and 30% also produced no different numbers of stomata (Table 2).

Commented [T10]: false statement? In fact, N source from Urea is significantly different from LOF 30% in chlorophyll, carotenoids, and the number of stomata in green beans.

Table 3. Effects of treatment nitrogen source and cultivar on dry weight plant,number of pods, greeness leaves and yield two cultivar bean.

Parameter	Source N	Cultivar		$HSD_{0,05}$
		Perkasa	Lebat-3	
Greeness of the leaves	Control	18.31 Ab	17.54 Ab	9.34
	Urea	27.79 Aa	28.91 Aa	
	LOF 10%	20.13 Aab	28.11 Aa	
	LOF 20%	24.06 Aab	24.19 Aa	
	LOF 30%	28.96 Aa	21.81 Aab	
Number of pods	Control	5.46 Ac	2.50 Ab	4.40
	Urea	9.13 Aab	9.05 Aa	
	LOF 10%	9.96 Aab	12.13 Aa	
	LOF 20%	13.38 Aa	4.67 Bab	
	LOF 30%	6.92 Abc	3.75 Ab	
Yield of green bean (kg ha^{-1})	Control	231.11 Ac	113.33 Ab	220.24
	Urea	720.89 Aab	429.78 Aa	
	LOF 10%	565.33 Ab	515.56 Aa	
	LOF 20%	846.67 Aa	181.33 Bb	
	LOF 30%	333.78 Ac	148.00 Ab	

Mean followed by the same letter (Capital horizontal and small letter read vertically) do not differ significantly at $p \leq 0,05$ as per HSD

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The results showed that the level of leaf greenness, number of pods, and bean production were significantly affected by the interaction of N sources and bean cultivar (Table 3). The results showed that the interaction between Perkasa cultivar and 20% LOF resulted in the highest number of bean pods per plant and was not significantly different from the treatment of 10% liquid organic fertilizer and urea. The effect of the combination treatment of Lebat-3 cultivar with 10% LOF resulted in the largest number of bean pods and was not significantly different from the treatment of Urea

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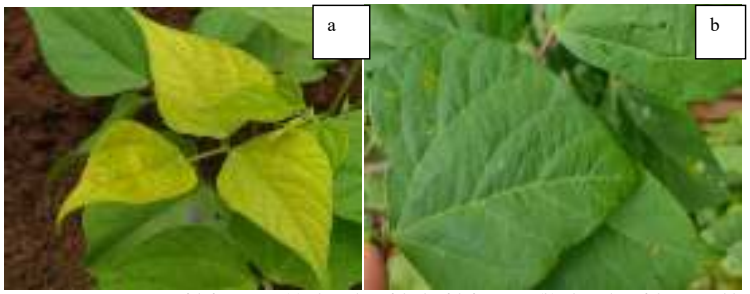
and 20% LOF (Table 3). In the Perkasa cultivar, the plants treated with Urea and LOF 20% fert had a higher production, while for the green level of the leaves, the 30% LOF treatment produced the highest level of leaf greenness compared to the others but was still relatively the same as the other treatments of N sources. In Lebat-3 cultivar, 10% Urea and LOF treatment had high leaf greenness and production compared to other treatments (Table 3).

Symptoms of N Deficiency (Figure 1.)

Symptoms of nitrogen nutrient deficiency occur in green bean leaves. Symptoms of deficiency of nitrogen nutrients occur in the leaves of plants without treatment (control), with the characteristic that the green bean leaves appear yellowish compared to the leaves treated with nitrogen fertilizer. Normal leaves have a fresh green leaf color (Figure 1). Santosa et al. (2017) stated that the use of chemical fertilizers not only increases production costs but also decreases productivity and leads to gradually higher risks. Nitrogen for plants must be in accordance with the needs of the plant. According to Zainal et al. (2014). Lack of this nutrient will cause the leaves to experience chlorosis which is indicated by yellowing of the leaves, whereas if excess Nitrogen will accelerate plant growth, especially on the stems, the leaves will turn dark green and the plants become secondary.

Figure 1. Effects of treatment nitrogen source and cultivar on deficiency N



Description: Comparison of deficiency N (a) The color of the leaf deficient N (b) The color of the normal leaf

Discussion

The application of N fertilizers affected plant height (Table 2). This is supported by the research of Pamungkas and Supijatno (2017) which states that nitrogen fertilizer has a significant effect and results in the growth of tea plants. Nitrogen can increase plant height due to increased leaf area and the rate of photosynthesis so that the production of assimilation and dry matter also increases (Chaturdevi, 2005).

The results showed that the Perkasa and Lebat-3 cultivar had no different effect on the number of trifoliate leaves. It is assumed that the source of N is more dominant in increasing the number of trifoliate leaves and weight of dry stems. At 10% LOF treatment produced the highest number of trifoliate leaves and was not different from LOF 20%, LOF 30%, and Urea. The number of trifoliate leaves in green beans is influenced by the availability of N nutrients. According to Pramitasari et al. (2016), the more N is absorbed by the plant, the leaves will grow larger and larger. The effect of LOF lamtoro leaves in increasing plant yields was also stated by Pary (2015) which stated that giving LOF of lamtoro leaves showed significant plant growth in the parameters of plant height, number of leaves, and fresh weight of mustard greens, by Hidayat and Suharyana (2019) which stated that giving LOF leaves lamtoro showed the highest yield on the number of pakcoy leaves, by Septirosya et al. (2019) which states that giving LOF lamtoro can increase the growth and number of fruit in tomato plants. The number of trifoliate leaves is a plant characteristic that affects the speed of photosynthesis to capture sunlight. The number of leaves increased significantly when fertilized with organic nitrogen sources. An increased number of leaves can be obtained at the N content in LOF. According to Amin (2011), Nitrogen will increase plant growth and height so that it will produce a lot of internodes and these will produce more leaves.

The results showed that the provision of N sources affected the dry weight of the plants. LOF 20% produced the highest dry weight of green beans and was not significantly different from Urea and LOF 10%. It is assumed that the availability of sufficient nutrients in an appropriate amount in the treatment affects plant growth and production. The high dry stover weight was influenced by the initial vegetative growth of green beans because the dry stover weight was related to the number of leaves and plant fresh weight. According to Arista et al. (2015) Nitrogen is an element that functions to

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Commented [T16]: The way the treatment combination table is read needs to be improved, this has an impact on the form of the sentence in the discussion.
In general, the discussion has fulfilled the rules, but the implications of the research results have not been discussed, and this cannot be seen in the conclusions also.

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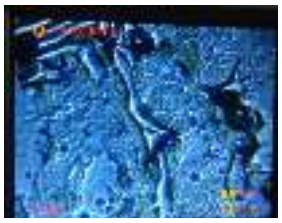
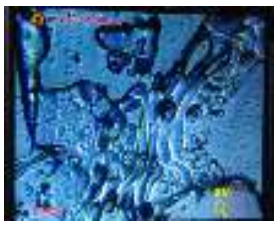
increase leaf size and increase the percentage of protein. The more leaves and this protein will increase the dry stover weight in plants. According to Madusari (2019) , liquid organic fertilizers tend to determine plant growth and good nutrient absorption which can increase plant stem diameter, so that liquid organic fertilizers can increase plant dry weight.

The results showed that the effect of urea fertilizer treatment produced the highest chlorophyll content and was not significantly different from the 20% and 10% liquid organic fertilizer treatments. In this study, Urea fertilizer treatment produced the highest carotenoid content and was not significantly different in the 10%, 20%, and 30% liquid organic fertilizer treatment. Chlorophyll and leaf carotenoids did not affect the leaf cultivar. According to Bojovic et al. (2005), the leaf color of each cultivar and certain cultivar did not directly correlate with leaf chlorophyll content. The content of chlorophyll and carotenoids can be affected by the availability of N nutrients. According to Wijiyanti (2019) nitrogen is the main nutrient needed for the formation of chlorophyll and carotenoids. This is also in line with the research of Razaq et al. (2017) synthesis of chlorophyll and carotenoids depends on optimal N availability so that N can play an important role in the formation of photosynthetic pigments. According to Hendriyani et al., (2018) carotenoids and chlorophyll are complementary pigments, but carotenoids have less numbers than chlorophyll because carotenoids play a role in helping the absorption of light by chlorophyll.

The results of observing the number of stomata in the two cultivar of green beans showed that nitrogen fertilizer affected the number of stomata (Table 1). The two cultivar of green beans gave the same response, and the application of inorganic fertilizers produced more stomata than the other treatments. Nitrogen fertilizer treatment on green beans had a significant effect on the number of stomata (Figure 1). Based on Figure 1, it can be seen that all treatments with source N have a higher number of stomata than those without N source (control). The number of stomata in plants affects the metabolic process in plants, namely photosynthesis. The rate of photosynthesis increases as the number of stomata increases so that plant production also increases. This is supported by Proklapmasiningsih et al. (2012), which states that the rate of photosynthesis in plants is closely related to the production of the resulting plant. According to Putri et al. (2017), stomata play an important role in the photosynthesis process because they function as a place to exchange CO_2 in the leaves. The highest number of stomata was found in urea treatment, both in Perkasa cultivar and thick-3 cultivar. In Figure 2, it can be seen that an increase in the number of stomata results in an increased stomata density.



Perkasa Cultivar (control)



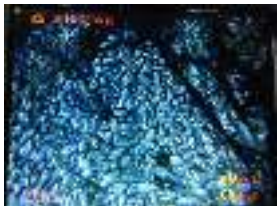
Lebat-3 Cultivar (control)

Perkasa Cultivar (Urea)

Lebat-3 Cultivar (Urea)

Perkasa Cultivar LOF 10%

Lebat-3 Cultivar LOF 10%



Perkasa Cultivar LOF 20%

Lebat-3 Cultivar LOF 20%

Perkasa Cultivar LOF 30%

Lebat-3 Cultivar LOF 30%

F

Figure 2. The number of stomata on Perkasa and Lebat-3

The application of nitrogen fertilizers also affects the greenness of the leaves. Nitrogen is an important part of increasing leaf greenness in plants (Faustina et al., 2015). According to Pramitasari et al. (2016) stated that the N nutrient affects plant growth, appearance, color so that the plant parts turn green because they contain chlorophyll. The results of Table 4 also show that the responses given to each cultivar to the N source are also different. According to Pamungkas and Supijatno (2017), the level of greenness of the leaves indicates that the plant has sufficient nitrogen levels and indicates healthy planting conditions. In Perkasa cultivar, the highest average leaf greenness was 30% LOF treatment and followed by Urea fertilizer treatment of 100 kg ha^{-1}, LOF 20% and LOF 30%. In Lebat-3 cultivar, the highest average leaf greenness was treated with Urea fertilizer 100 kg ha^{-1} and followed by LOF 10%, LOF 20% and LOF 30% treatment. The observations indicated that the average value of leaf greenness of plants treated with nitrogen fertilizers with organic and inorganic fertilizers was much higher than plants without nitrogen fertilizers. The treatment without N fertilizer had low greenness.

The results showed that the provision of N sources and cultivar affected the number of bean pods per plant. Perkasa cultivar with 20% LOF produced the highest number of bean pods per plant and was not significantly different from the treatment of 10% liquid organic fertilizer and urea. Cultivar Lebat-3 with LOF 10% produced the highest number of bean pods and was not significantly different from the urea fertilizer treatment. The use of bean cultivar in N fertilizer had a different effect on the number of bean pods. Perkasa cultivar with 20% LOF produced more number of bean pods compared to the Lebat-3 cultivar treatment. In this study, the provision of LOF 20% and LOF 10% was sufficient for the growth of green beans and was no different from urea. According to Permanasari et al. (2014) In generative plant growth, chlorophyll formation will play a very important role in the process of plant photosynthate formation. In addition, the use of cultivar and N also affects the genetic characteristics of plants in the number of pods. Based on the research results, it is suspected that nitrogen can increase the chlorophyll content of leaves, which is important for photosynthesis and has a role in the number of bean pods. In addition, plant genetic traits in the two cultivar influenced the different responses to N fertilization. According to Beshir et al. (2015) stated that different cultivars have an effect in increasing the photosynthetic area (leaf area index), so that more pods are formed.

The results showed that there was a symptom of N deficiency in green bean leaves without nitrogen fertilizer. Symptoms that arise are the color of old leaves that are yellowish green compared to normal leaves which are fresh green. According to Erythrina et al. (2016) Nitrogen is the main nutrient in the formation of leaf color because nitrogen will play a role in increasing leaf green matter and protein. Giving nitrogen will increase the green color of the leaves and if it is

deficient in nitrogen, it reduces the formation of chlorophyll, causing the leaves to appear yellowish. According to Bojovic et al. (2009) nitrogen deficiency causes a reduction in leaf greenish color, decreases leaf area, and reduces photosynthesis because nitrogen has a linear correlation with leaf chlorophyll formation.

Lebat-3 cultivar requires a lower LOF concentration compared to Perkasa cultivar. From the results in Table 4, it can be seen that the Perkasa Cultivar 20% LOF treatment resulted in higher production compared to other treatments and was not significantly different from the 100% recommended Urea treatment. This is thought to be due to the excess liquid organic fertilizer which does not undergo a dissolving process so that it can be easily absorbed by plants. (Ginandjar et al., 2019). In Lebat-3 cultivar, 10% LOF treatment resulted in higher production compared to other treatments and was not significantly different from the recommended 100% Urea treatment. According to Chaturdevi (2005) , nitrogen fertilization with the right dose can affect grain yield in rice and other parameters in each cultivar. The use of N sources for plants affects the results of the photosynthesis process. This is supported by Rathke (2005), who states that increasing the source of N can increase yield. This is due to the function of nitrogen which can increase the chlorophyll content so that the rate of photosynthesis also increases and produces high carbohydrates for plants (Chaudary et al., 2015). The production of Lebat-3 cultivar was lower than that of Perkasa cultivar in the recommended 100% Urea treatment and 20% LOF. Ratnasari et al. (2015), stated that the differences in the characters possessed by cultivar are caused by differences in genetic composition in each cultivar so that they show different responses to the environment and production factors. The positive effect of using liquid organic fertilizers from lamtoro leaves in increasing crop yields was also found by Duaja et al. (2013) on chickpeas, Palimbungan et al. (2006) on mustard plants, Septirosya et al. (2019) on tomato plants, and Ainiya et al. (2019) on sweet corn plants.

CONCLUSION

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~~Based on the research results, t~~The use of LOF lamtoro leaves with the right dose can be used as an alternative to N fertilization in plants. ~~Nitrogen is very influential on the growth and production of green beans.~~ Treatment of bean cultivar did not significantly affect the growth parameters of green beans. The effect of 20% LOF can increase the parameters of the number of trifoliate leaves (8.81 leaves) and plant dry weight (4.52 g), while Urea can increase the growth variable of plant height (171.48 cm), chlorophyll (15.93 mg). g-1FW), carotenoids (2.35 mg g-1FW) and the number of stomata (22/mm2). Treatment of Perkasa cultivar at 20% LOF resulted in the highest bean production of 846.67 kg ha^{-1}, while treatment of Lebat-3 cultivar at 10% LOF resulted in the highest bean production of 515.56 kg ha^{-1}.

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REFERENCES

Commented [T19]: The number of references is more than the standard, it has met the updatedness of the published year, but there are some that are not cited in the document.

Ainiya, M., M. Fadli, dan R. Despita. 2019. Peningkatan Pertumbuhan dan Hasil Jagung Manis dengan Pemanfaatan Trichokompos dan LOF Daun Lamtoro. *Agrotechnology Research Journal.* 3(2): 69-74.

Amin, M.E.H. 2011. Effect of Different Nitrogen Sources on Growth, Yield and Quality of Fodder Maize (*Zea mays* L.). *Journal of the Saudi Societyof Agricultural Sciences*. 10 (1): 17-23.

Arista, D., Suryono, dan Sudadi. 2015. Efek dari Kombinasi Pupuk N, P dan K terhadap Pertumbuhan dan Hasil Kacang Tanah pada Lahan Kering Alfisol. *Jurnal Agrosains*. 17(2): 49-52.

Beshir, H.M., B. Tesfaye, R. Bueckert and B. Tar'an. 2015. Pod Quality of Snap Bean as Affected by Nitrogen Fixation, Cultivar and Climate Zone under Dryland Agriculture. *African Journal of Agricultural Research*. 10(32): 3157-3169.

Bojovic, B. and A. Markovic. 2009. Correlation Between Nitrogen and Chlorophyll Content in Wheat (*Triticum aestivum* L.). *Kragujevac Journal Science.* 31(1): 69-74.

Bojovic, B. and J. Stojanovic. 2005. Chlorophyll and Carotenoid Content in Wheat Cultivars as a Function of Mineral Nutrition. *Archives of Biological Science Belrgade*. 57 (4): 283-290.

Camara, C.R.S., C.A. Urrea, dan Vicki Sichlegel. 2013. Pinto Beans (*Phaseolus vulgaris* L.) as a Functional Food: Implications of Human Health. *Agriculture.* 3(1): 90-110.

Chaturdevi, I. 2005. Effect of Nitrogen Fertilizers on Growth, Yield and Quality of Hybrid Rice (Oryza Sativa). *Journal Central European Agriculture.* 6(4): 611-618.

Chaudhary, M.M., A.S. Bhanvadia, dan P.N. Parmar. 2015. Effect of Integrated Nutrient Management on Growth, Yield Attributes and Yield of Cabbage (Brassica oleracea Var. Capitata L.) Under Middle Gujarat Conditions. *Trends in Bioscience.* 8(8): 2164-2168.

Duaja, M.D. 2013. Pengaruh Jenis Bahan Dasar dan Dosis Pupuk Organik Cair terhadap Pertumbuhan dan Hasil Buncis (Phaseolus vulgaris L.*)*. *Bioplantae.* 2(1): 47-54.

Duaja, M.D., Mukhsin, dan R. Sijabat. 2013. Analisis Pertumbuhan dan Hasil Dua Varietas Buncis (*Phaseolus vulgaris* L.) pada Perbedaan Jenis Pupuk Organik Cair. *Program Studi Agroekoteknologi, Fakultas Pertanian Universitas Jambi.* 2(1): 47-54.

Erythrina. 2016. Bagan Warna Daun: Alat untuk Meningkatkan Efisiensi Pemupukan Nitrogen pada Tanaman Padi. *Jurnal Litbang Pertanian*. 35(1): 1-10.

Fahmi, A., Syamsudin, S.N.H. Utami., dan B. Radjagukguk. 2010. Pengaruh Interaksi Hara Nitrogen dan Fosfor terhadap Pertumbuhan Tanaman Jagung (Zea mays L.) pada Tanah Regosol dan Latosol. Berita Biologi. 10(3): 297-304.Faustina, E., Sudrajat, dan Supijatno. 2015. Optimization of Nitrogen and Phosphorus Fertilizer on Two Years Old of Oil Palm (Elaeis guineensis Jacq.). *Asian Journal of Applied Sciences.* 3(3): 421-428.

Faustina, E., Sudradjat, dan Supijatno. 2015. Optimization of Nitrogen and Phosphorus Fertilizer on Two Years Old of Oil Palm (*Elaeis guineensis* jacq.). *Asian Journal of Applied Sciences*. 3(3): 421-428.

Ginandjar, S., B. Prasetya, W. Nugraha, dan M. Subandi. 2019. The Effect of Liquid Organic Fertilizer of Vegetable Waste and planting Media on Growth and Yield of Strawberry (Fragaria spp.) Earlibrite Cultivar.

Hendriyani, I.K., Y. Nurchayati, dan N. Setiari. 2018. Kandungan Klorofil dan Karotenoid Kacang Tunggak (*Vigna unguiculata* (L.) Walp.) pada Umur Tanaman yang Berbeda. *Jurnal Biologi Tropika.* 1(2): 38-43.

Hidayat, O. dan Suharyana, A. 2019. Pengaruh Dosis Pupuk Organik Cair Daun Lamtoro terhadap Pertumbuhan dan HAsil Tanaman Pakcoy (*Brassica rapa* L.) Varietas Nauli-F1. *Jurnal Ilmiah Pertanian.* 7(2): 57-63.

Iriyani, D. dan P. Nugrahani. 2014. Kandungan Klorofil, Karotenoid dan Vitamin C Beberapa Jenis Sayuran Daun pada Pertanian Periurban di Kota Surabaya. *Jurnal Mtematika, Sains, dan Teknologi.* 15(2): 84-90.

Jeksen, J., dan C. Mutiara. 2017. Analisis Kualitas Pupuk Organik Cair dari Beberapa Jenis Tanaman Leguminosa. Jurnal Pendidikan MIPA. 7(2): 124-130.

Madusari, S. 2019. Processing of Fibre and Its Application as Liuid Organic Fertilizer in Oil Palm (*Elaeis guineensis* Jacq.) Seedling for Sustainable Agriculture. *Joulnal of Applied Science and Advanced Technology*. 1 (3): 81-90.

Maghfoer, M.D., Koesriharti, dan T. Islami, dan N.D.S. Kanwal. 2018. A Study of the Efficacy of Various Nutrient Sources on the Growth and Yield of Cabbage. *AGRIVITA Journal of Agricultural Science.* 40(1): 168-176.

Pahlevi, R. W., B. Guritno, dan N.E. Suminarti. 2016. Pengaruh Kombinasi Proporsi Pemupukan Nireogen dan Kalium Pada Pertumbuhan, Hasil dan Kualitas Tanaman Ubi Jalar (Ipomoea batatas (L.) Lamb) Verietas Cilembu pada Dataran Rendah. *Jurnal Produksi Tanaman*. 4(1): 16-22.

Palimbungan, N., R. Labatar dan F. Hamzah. 2006. Pengaruh Ekstrak Daun Lamtoro sebagai Pupuk Organik Cair terhadap Pertumbuhan dan Hasil Produksi Tanaman Sawi. *Jurnal Agrisitem*. 2(2): 96-101.

Pamungkas, M.A., dan Supijatno. 2017. Pengaruh Pemupukan Nitrogen terhadap Percabangan Tanaman Teh (Camelia sinensis (L.) O. Kuntze) untuk Pembentukan Bidang Petik. *Buletin Agronomi*. 5(2): 234-41.

Pary, C. 2015. Pengaruh Pupuk Organik (Daun Lamtoro) dalam berbagai konsentrasi terhadap Pertumbuhan Tanaman Sawi. *Jurnal Fikratuna.* 7(2): 247-255.

Permanasari, I., M. Irfan, dan Abizar. 2014. Pertumbuhan dan Hasil Kedelai (*Glycine max (*L.) Merill) dengan Pemberian *Rhizobium* dan Pupuk Urea pada Media Gambut. *Jurnal Agroteknologi.* 5(1) ; 29-34.

Pramitasari, H.E., T. Wardiyanti, dan M. Nawawi. 2016. Pengaruh Dosis Pupuk Nitrogen dan Tingkat Kepadatan Tanaman terhadap Pertumbuhan dan Hasil Tanaman Kailan (*Brassica oleraceae* L.). *Jurnal Produksi Tanaman.* 4(1): 49-56.

Proklalmasiningsih, E., I.D. Prijambada, D. Rachmawati, dan R.P. Sancaningsih. 2012. Laju Fotosintesi dan Kandungan Klorofil Kedelai pada Media Tanam Masam Masam dengan Pemberian Garam Aluminium. *AGROTROP.* 2(1): 17-24.

Putri, F.M., S.W.A. Suedy., dan S. Darmanti. 2017. Pengaruh Pupuk Nanosiliki terhadap Jumlah Stomata, Kandungan Klorofil dan Pertumbuhan Padi Hitam (Oryza sativa L. cv. japonica). *Buletin Anatomi dan Fisiologi*. 2(1): 72-79.

Rahimi, A., S.S. Moghaddam, M. Ghiyasi, S. Heydarzadeh, K. Ghazizadeh and J. Popovi´c-Djordjevi´c. 2019. The Influence of Chemical, Organic and Biological Fertilizers on Agrobiological and Antioxidant Properties of Syrian Cephalaria (*Cephalaria Syriaca* L.). *Journal Agriculture.* 9 (122): 1-13.

Rathke, G.W., O. Christen, dan W. Diepenbrock. 2005. Effects of nitrogen source and rate on productivity and quality of winter oilseed rape (Brassica napus L.) grown in different crop rotations. *Field Crops Research*. 94 (1) 103–113.

Ratnasari, D., M.K. Bangun, dan R.I.M. Damanik. 2015. Respon Dua Varietas Kedelai (Glycine max (L.) Merrill.) pada Pemberian Pupuk Hayati dan NPK Majemuk. *Jurnal Oline Agroteknologi*. 3(1): 276-82.

Razaq, M., P. Zhang, H. Shen, and Salahuddin. 2017. Influence of Nitrogen and Phosphorous on The Growth and Root Morphology of Acer Mono. *Journal PLoS ONE*. 12(2): 1-13.

Rihana, S., Y.B.S. Heddy, dan M.D. Maghfoer. 2013. Pertumbuhan dan Hasil Tanaman Buncis (*Phaseolus viulgaris* L.) pada berbagai Dosis Pupuk Kotoran Kambing dan Konsentrasi Zat Pengatur Tumbuh Dekamon. *Jurnal Produksi Tanaman*. 1(4): 369-377.

Rizqiani, N.F., E. Ambarwati, dan N.W. Yuwono. 2007. Pengaruh Dosis dan Frekuensi Pemberian Pupuk Organik Cair Terhadap Pertumbuhan dan Hasil Buncis (*Phaseolus vulgaris* L.) Dataran Rendah. *Jurnal Ilmu Tanah dan Lingkungan*. 7(1): 43-53.

Santosa, M., M.D. Magfoer, dan H. Tarno. 2017. The Influence of Organic and Inorganic Fertilizers on the Growth and Yield of Green Bean, *Phaseolus vulgaris* L. Gron in Dry and Rainy Season. *AGRIVITA Journal of Agricultural Science*. 39(3): 296-302.

Septirosya, T., R. Hartono, dan T. Aulawi. 2019. Aplikasi Pupuk Organik Cair Daun Lamtoro pada Pertumbuhan Hasil Tanaman Tomat. *Agroscript*. 1(1): 1-8.

Sinaga, A.S., B. Guritno, dan Sudiarso. 2017. Pengaruh Dosis Kompos Sampah Rumah Tangga Terhadap Pertumbuhan dan Hasil Tiga Varietas Buncis Tipe Tegak (*Phaseolus vulgaris* L.). *Jurnal Produksi Tanaman*. 5(6):947-956.

Syaifudin, Dahlan dan Buhaerah. 2013. Pengaruh Urea terhadap Produksi Tanaman Tomat. *Jurnal Agrisistem.* 9(1): 1-9.

Wijiyanti, P., E.D. Hastuti, dan S. Haryanti. 2019. Pengaruh Masa Inkubasi Pupuk dari Air Cucian Beras terhadap Pertumbuhan Tanaman Sawi Hijau (*Brassica juncea* L.). *Buletin Anatomi dan Fisiologi.* 4(1): 41-28.

Zainal, M., A. Nugroho, dan N.E. Suminarti. 2014. Respon Pertumbuhan dan Hasil Tanman Kedelai (*Glycine max* (L.) Merill) pada Berbagai Tingkat Pemupukan N dan Pupuk Kandang Ayam. *Jurnal Produksi Tanaman.* 2(6): 484-490.

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THE GROWTH AND YIELD RESPONSES OF TWO BEAN CULTIVARS TO ORGANIC AND INORGANIC NITROGEN SOURCES

Abstract. The productivity of beans can be increased by selecting cultivars and applying fertilizers in accordance with the needs of the bean plants. The use of high yielding cultivar and the application of N fertilizers with the right dosage can overcome the low production. The purpose of this study was to determine the effect of N sources on the growth and production of two cultivar of beans. The study used a 5x2 factorial treatment design in a randomized block design with three replications. The first factor is the Perkasa cultivar and the Lebat-3 cultivar. The second factor is fertilizer (N), namely control, Urea 100 kg ha^{-1}, 10%, 20%, 30% concentration of liquid organic fertilizer (LOF). The results showed that the use of lamtoro leaf LOF with the right dose can be used as an alternative to N fertilization. Bean cultivar did not significantly affect the growth parameters of green beans. The effect of 20% LOF produced the highest number of trifoliate leaves (8.81 leaves) and plant dry weight (4.52 g), while Urea produced the highest plant height (171.48 cm), chlorophyll (15.93 mg g^{-1}FW), carotenoids (2.35 mg g^{-1}FW) and the number of stomata (22 / mm^2). The use of a combination of 20% LOF and Perkasa cultivar showed the best effect on the number of pods per plant (5.67) and the highest bean production (846.67 kg ha^{-1})

Key words:, chlorophyll, liquid organic fertilizers, stomata, urea, cultivar

Commented [T1]: Lamtoro is unknown word in English, preferred common name is leucaena (Leucaena leucocephala). It is better if you use leucaena, the international academic community does not know the lamtoro, especially since the Latin name is not mentioned at the beginning of this document.

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I. INTRODUCTION

The green bean plant (*Phaseolus vulgaris* L.) is one of the legume group plants which is a source of vegetable protein which is widely consumed by the Indonesian people so that it has good potential to be developed because it has an important role in fulfilling health needs as a nutritious food ingredient. According to Rihana et al. (2013), beans are a vegetable source of vegetable protein and are rich in vitamins A, B, and C and can overcome several diseases such as oxidative stress, cardiovascular, cancer, diabetes and synromic metabolism (Camara et al., 2013). As the population increases, the need for fresh food and vegetables also continues to increase. To increase the production of green beans, it is necessary to apply good cultivation techniques and environmental management for plant growth. One of the efforts that can be done is balanced fertilization and match with the needs of the plants. The productivity of green beans can be increased by using improved cultivar and cultivation systems. There are many cultivars of green beans. According to Ratnasari et al. (2015), each cultivar has different genetic characteristics, which cause differences in appearance and character as well as different responses to production factors.

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Fertilization is one way to meet the nutrient needs of nitrogen in green beans. Fertilization of N derived from inorganic and organic fertilizers. Nitrogen is a major nutrient needed by green beans, which plays an important role in the formation of chlorophyll, protoplasm, protein, and nucleic acids (Fahmi et al., 2010). The plant's need for N is higher than other nutrients. Pahlevi et al. (2016) said that the nutrient N affects the photosynthetic process of plants and the resulting photosynthate. According to Maghfoer et al. (2018), inorganic fertilizers can produce large growth and yields for plants. However, the continuous use of inorganic fertilizers can interfere with soil fertility and productivity. Therefore an alternative is needed to reduce the use of inorganic fertilizers, namely using organic fertilizers.

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Availability of nitrogen could be supplied with liquid organic fertilizers (LOF). Liquid organic fertilizer is an organic fertilizer that is available in liquid form, which contains nutrients in the form of a solution so that it is very easily absorbed by plants. Liquid organic fertilizer can be utilized by sprinkling it on plants or spraying on the leaves or stems of plants. Organic fertilizers can be made from plant waste available in the surrounding environment. The advantage of using liquid organic fertilizers is that their distribution can be adjusted to the needs of plants (Ginandjar et al., 2019). One example of organic matter that can be used as liquid organic fertilizer source of N is lamtoro leaf. Liquid organic fertilizer derived from lamtoro leaves contains nitrogen nutrients needed for plants (Jeksen and Mutiara, 2017). The N content in lamtoro leaves is quite high, namely 3.84% so ~~that~~ it can be a source of organic N to increase the growth and production of green beans (Palimbungan et al., 2006). Research results by Rizqiani et al. (2007) stated that the application of liquid organic fertilizers increased the fresh weight of pods in green beans and in Duaja's (2013) research, liquid organic fertilizer of kirinyuh (*Chromolaena odorata* L.) provided the highest yield of pods and bean yields per plant.

Plant cultivar is a factor that greatly determines the quality of agricultural products. The use of high-yielding cultivar of beans is expected to increase productivity and yield quality of beans. Each cultivar has different genetic characteristics and traits. Based on genetic characteristics, there will be differences in the character and appearance of each

cultivar. Examples of high yielding cultivar of beans are Lebat-3 and Perkasa. The advantages of Perkasa cultivar according to the description are having resistance to leaf rust disease, early maturity and having large and long pods. The superiority of Lebat-3 cultivar based on its description is that it is well adapted to the low-highlands, has early maturity and has high yield potential. The results by Sinaga et al. (2017) showed that the use of cultivar had a significant effect on the growth and yield of beans. According to Duaja (2013), there is an interaction between the use of bean cultivar and liquid organic fertilizers on the number of pods and the yield of beans.

The fertilizer requirement by each cultivar is different. This is due to the genetic characteristics of these cultivar, so that the selection of fertilizer types and fertilizer requirements need to be considered. The proper doses of liquid organic fertilizers as needed is also a factor that affects plant growth. According to Ratnasari et al. (2015), differences in genetic traits of cultivar may show different responses to the environment and production factors. Based on this, it is hypothesized that there will be a different response of two beans cultivar to the treatment of different types and doses of fertilizers sources, because each cultivar has different genetic and character traits towards environmental influences and existing production factors. This study aims to determine the effect of nitrogen sources on the growth and production of two cultivar of beans.

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II. MATERIALS AND METHODS

This research was conducted on the experimental research area of the City of Sepang Jaya, Labuhan Ratu District, Bandar Lampung from January to March 2020. The research began with soil cultivation using hoes. The land is loosened with a depth of 20-30 cm and evenly processed and an experimental plot is made with a size of 3 x 2.5 m. The planting of the Perkasa and Lebat-3 cultivar was carried out by drilling the planting holes. The seeds given to each planting hole are 2 seeds with a spacing of 40 cm x 40 cm.

Preparation of liquid fertilizer is done by mixing the chopped lamtoro leaves (1 kg of lamtoro leaves: 2 liters of water), with 200 ml of molasses and 200 ml of EM4 in a drum then fermenting for 15 days. The liquid is filtered and ready to be applied to plants. Inorganic fertilizers given were Urea 100 kg ha^{-1} (75 g / plot) given at the beginning of planting and 30 day after planting (DAP), SP-36 200 kg ha^{-1} (150 g $plot^{-1}$), and KCL 100 kg ha^{-1} (75 g $plot^{-1}$). Fertilization is done in an strip with a distance of 5 cm from the plant.

The application of liquid organic fertilizer is conducted by spraying it on the top of the plant and the bottom of the plant (60:40). This LOF spraying is carried out once a week using a concentration of 10% (100 ml LOF solution + 900 ml water), 20% (200 ml LOF solution + 800 ml water), and 30% (300 ml LOF solution + 700 ml water).

Plant maintenance includes weeding manually and thinning. Harvesting is carried out in stages according to the harvest age of each cultivar. The characteristics of the beans that are ready to be harvested, the color of the pods is rather young and gloomy, the skin surface is a bit rough, the seeds in the pods are not yet prominent, and when the pods are broken, they will usually make a popping sound that usually occurs 2-3 weeks after the flowers bloom.

The parameters observed were plant height, number of trifoliate leaves, chlorophyll, carotenoids, number of stomata, greenness of leaves, symptoms of N deficiency, number of pods per plant, dry weight, and production. The method used to observe the stomata on the leaf surface is the replica method, in which the leaves are first cleaned with a tissue to remove dust or dirt, then rubbed with a transparent nail polish. The nail polish is allowed to dry for a few minutes, after which the nail polish is applied dry with a transparent strip of tape measuring 1 cm x 1 cm in size and smoothed, then peeled off slowly. The result of the peel is then attached to the slide and observed under a microscope.

Measurement of chlorophyll and carotenoid content was carried out using the spectophotometric method. The green beans are crushed using a mortar and 100 ml of 70% alcohol solution is added. Then the extract was filtered and the filtrate was placed in a cuvet to measure the total chlorophyll and carotenoid content using a spectophotometer. According to Rahimi et al. (2019) the chlorophyll and carotenoid content was calculated using the formula:

Chlorophyll *a* = 11,24 x A_{662} - 2,04 x A_{645}
Chlorophyll *b* = 20,13 x A_{645} - 4,19 x A_{662}
Chlorophyll total = 7,05 x A_{662} + 18,09 x A_{645}
Carotenoid $= \frac{(1000 \times A470 - 1{,}90 \text{ x klorofil a} - 63{,}14 \times \text{klorofil b})}{214}$

Data analysis

The treatment design used was factorial (2 x 5) in a randomized block design (RBD) with three replications in order to obtain 30 experimental units. The first factor is the bean cultivars, namely Perkasa and Lebat-3. The second factor is the source of nitrogen, namely control, Urea 100 kg ha^{-1}, LOF 10%, LOF 20%, and LOF 30%. Data were tested by Tukey's test. If the assumption of variance is met, the data is analyzed for variance, then the comparison of the mean between treatments is tested using the Honestly Significant Difference (HSD) 5%.

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III RESULTS AND DISCUSSION

The results of LOF analysis showed that the N content in the LOF of lamtoro leaves was 0.16%, had a C-Organic content of 3.08%, N-total was 0.16%, P-total was 0.18% and K was 0.56% with a pH of 3.64. The results of the analysis showed that the C/N of the lamtoro LOF ratio was 19.25. C/N ratio has met the standard of organic fertilizer. A good C/N ratio is between 15-20%. A high C/N ratio causes the biological activity of microorganisms to decrease, while a C/N ratio that is too low will cause denitrification.

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Table 1. Effects of treatment nitrogen source and cultivar on plant height, number of trifoliate leaves, and dry weight plant.

Treatment	Plant height (cm)	Number of trifoliate leaves 6 weeks after planting	Dry weight plant (g)
Perkasa Cultivar	133.60 a	7.20 a	3.21 a
Lebat-3 Cultivar	137.63 a	8.11 a	3.17 a
$HSD_{0,05}$	18.47	1.43	0.92
Control	94.71 c	5.57 b	1.95 b
Urea	171.48 a	8.50 ab	3.78 ab
LOF 10%	150.60 ab	9.11 a	3.13 ab
LOF 20%	148.02 ab	8.81 ab	4.52 a
LOF 30%	113.29 bc	6.30 ab	2.58 ab
$HSD_{0,05}$	42.11	3.25	2.09

In a colum, common values letter(s) do not differ significantly at $p \leq 0,05$ as per HSD

The results showed that the application of N sources and cultivar did not affect plant height, number of trifoliate leaves, and dry weight. In plant height, the number of plant height in the control was shorter than the treatment of urea, 10% LOF, 20% LOF, and 30% LOF. The application of N sources to Urea, LOF 10%, LOF 20%, and LOF 30% did not differ (Table 1). The number of trifoliate leaves given control was less than LOF 10%, while the number of trifoliate leaves treated with Urea, LOF 20%, and LOF 30% had relatively the same results (Table 1). Provision of 20% N LOF source resulted in heavier dry stover weight than control, while the distribution of Urea, 10% LOF, and 20% LOF was not different. Giving source of N between controls, Urea, LOF 10%, and LOF 30% resulted in no different dry weight (Table 1).

Commented [T9]: Did you mean the combination of treatments?

Table 2. Effects of treatment nitrogen source and cultivar on, chlorophyll, carotenoid of leaves, and number of stomata.

Treatment	Chlorophyll (mg g^{-1} FW)	Carotenoid (mg g^{-1} FW)	The number of stomata (/mm^2)
Perkasa Cultivar	12.92 a	1.59 a	14.40 a
Lebat-3 Cultivar	13.24 a	1.88 a	14.67 a
$HSD_{0,05}$	1.16	0.29	3.50
Control	9.68 b	1.38 b	8.50 c
Urea	15.93 a	2.35 a	22.00 a
LOF 10%	15.56 a	1.69 ab	11.50 bc
LOF 20%	13.77 a	1.76 ab	17.83 ab
LOF 30%	10.46 b	1.47 b	12.83 bc
$HSD_{0,05}$	2.64	0.67	8.05

In a columb, common values letter(s) do not differ significantly at $p \leq 0,05$ as per HSD

The results showed that the provision of N sources and cultivar did not affect chlorophyll, carotenoids, and the number of stomata in green beans. In chlorophyll, carotenoids, and the number of leaf stomata of Perkasa Cultivar did not differ compared to Cultivar Lebat-3. The chlorophyll content given the control was lower than Urea, while the control chlorophyll was not different compared to the LOF 30%. Chlorophyll treated with Urea did not differ compared to LOF 10% and LOF 20% (Table 2). The provision of N Urea sources resulted in a higher carotenoid content than the control, while the application of Urea, 10% LOF, and 30% LOF was not different (Table 2). The application of N source between controls, LOF 10%, LOF 20%, and LOF 30% resulted in no different carotenoid content. The provision of N Urea source produced the highest number of stomata compared to the control, while the provision of Urea and 20% LOF was not different. LOF application of 10%, 20%, and 30% also produced no different numbers of stomata (Table 2).

Commented [T10]: false statement? In fact, N source from Urea is significantly different from LOF 30% in chlorophyll, carotenoids, and the number of stomata in green beans.

Table 3. Effects of treatment nitrogen source and cultivar on dry weight plant,number of pods, greeness leaves and yield two cultivar bean.

Parameter	Source N	Cultivar		$HSD_{0,05}$
		Perkasa	Lebat-3	
Greeness of the leaves	Control	18.31 Ab	17.54 Ab	9.34
	Urea	27.79 Aa	28.91 Aa	
	LOF 10%	20.13 Aab	28.11 Aa	
	LOF 20%	24.06 Aab	24.19 Aa	
	LOF 30%	28.96 Aa	21.81 Aab	
Number of pods	Control	5.46 Ac	2.50 Ab	4.40
	Urea	9.13 Aab	9.05 Aa	
	LOF 10%	9.96 Aab	12.13 Aa	
	LOF 20%	13.38 Aa	4.67 Bab	
	LOF 30%	6.92 Abc	3.75 Ab	
Yield of green bean (kg ha^{-1})	Control	231.11 Ac	113.33 Ab	220.24
	Urea	720.89 Aab	429.78 Aa	
	LOF 10%	565.33 Ab	515.56 Aa	
	LOF 20%	846.67 Aa	181.33 Bb	
	LOF 30%	333.78 Ac	148.00 Ab	

Mean followed by the same letter (Capital horizontal and small letter read vertically) do not differ significantly at $p \leq 0,05$ as per HSD

Commented [T11]: This is a table of treatment combinations, so read the notation not vertically, but as a whole.

The results showed that the level of leaf greenness, number of pods, and bean production were significantly affected by the interaction of N sources and bean cultivar (Table 3). The results showed that the interaction between Perkasa cultivar and 20% LOF resulted in the highest number of bean pods per plant and was not significantly different from the treatment of 10% liquid organic fertilizer and urea. The effect of the combination treatment of Lebat-3 cultivar with 10% LOF resulted in the largest number of bean pods and was not significantly different from the treatment of Urea

Commented [T12]: combination

Commented [T13]: but

and 20% LOF (Table 3). In the Perkasa cultivar, the plants treated with Urea and LOF 20% fert had a higher production, while for the green level of the leaves, the 30% LOF treatment produced the highest level of leaf greenness compared to the others but was still relatively the same as the other treatments of N sources. In Lebat-3 cultivar, 10% Urea and LOF treatment had high leaf greenness and production compared to other treatments (Table 3).

Symptoms of N Deficiency (Figure 1.)

Symptoms of nitrogen nutrient deficiency occur in green bean leaves. Symptoms of deficiency of nitrogen nutrients occur in the leaves of plants without treatment (control), with the characteristic that the green bean leaves appear yellowish compared to the leaves treated with nitrogen fertilizer. Normal leaves have a fresh green leaf color (Figure 1). Santosa et al. (2017) stated that the use of chemical fertilizers not only increases production costs but also decreases productivity and leads to gradually higher risks. Nitrogen for plants must be in accordance with the needs of the plant. According to Zainal et al. (2014). Lack of this nutrient will cause the leaves to experience chlorosis which is indicated by yellowing of the leaves, whereas if excess Nitrogen will accelerate plant growth, especially on the stems, the leaves will turn dark green and the plants become secondary.

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Figure 1. Effects of treatment nitrogen source and cultivar on deficiency N

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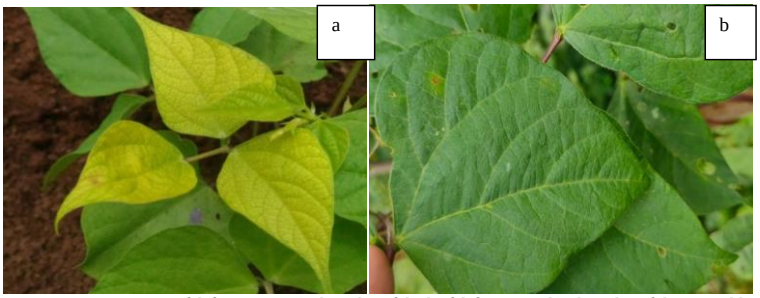

Description: Comparison of deficiency N (a) The color of the leaf deficient N (b) The color of the normal leaf

Discussion

Commented [T16]: The way the treatment combination table is read needs to be improved, this has an impact on the form of the sentence in the discussion.
In general, the discussion has fulfilled the rules, but the implications of the research results have not been discussed, and this cannot be seen in the conclusions also.

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The application of N fertilizers affected plant height (Table 2). This is supported by the research of Pamungkas and Supijatno (2017) which states that nitrogen fertilizer has a significant effect and results in the growth of tea plants. Nitrogen can increase plant height due to increased leaf area and the rate of photosynthesis so that the production of assimilation and dry matter also increases (Chaturdevi, 2005).

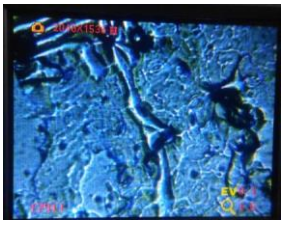
The results showed that the Perkasa and Lebat-3 cultivar had no different effect on the number of trifoliate leaves. It is assumed that the source of N is more dominant in increasing the number of trifoliate leaves and weight of dry stems. At 10% LOF treatment produced the highest number of trifoliate leaves and was not different from LOF 20%, LOF 30%, and Urea. The number of trifoliate leaves in green beans is influenced by the availability of N nutrients. According to Pramitasari et al. (2016), the more N is absorbed by the plant, the leaves will grow larger and larger. The effect of LOF lamtoro leaves in increasing plant yields was also stated by Pary (2015) which stated that giving LOF of lamtoro leaves showed significant plant growth in the parameters of plant height, number of leaves, and fresh weight of mustard greens, by Hidayat and Suharyana (2019) which stated that giving LOF leaves lamtoro showed the highest yield on the number of pakcoy leaves, by Septirosya et al. (2019) which states that giving LOF lamtoro can increase the growth and number of fruit in tomato plants. The number of trifoliate leaves is a plant characteristic that affects the speed of photosynthesis to capture sunlight. The number of leaves increased significantly when fertilized with organic nitrogen sources. An increased number of leaves can be obtained at the N content in LOF. According to Amin (2011), Nitrogen will increase plant growth and height so that it will produce a lot of internodes and these will produce more leaves.

The results showed that the provision of N sources affected the dry weight of the plants. LOF 20% produced the highest dry weight of green beans and was not significantly different from Urea and LOF 10%. It is assumed that the availability of sufficient nutrients in an appropriate amount in the treatment affects plant growth and production. The high dry stover weight was influenced by the initial vegetative growth of green beans because the dry stover weight was related to the number of leaves and plant fresh weight. According to Arista et al. (2015) Nitrogen is an element that functions to

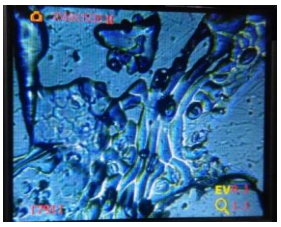
increase leaf size and increase the percentage of protein. The more leaves and this protein will increase the dry stover weight in plants. According to Madusari (2019) , liquid organic fertilizers tend to determine plant growth and good nutrient absorption which can increase plant stem diameter, so that liquid organic fertilizers can increase plant dry weight.

The results showed that the effect of urea fertilizer treatment produced the highest chlorophyll content and was not significantly different from the 20% and 10% liquid organic fertilizer treatments. In this study, Urea fertilizer treatment produced the highest carotenoid content and was not significantly different in the 10%, 20%, and 30% liquid organic fertilizer treatment. Chlorophyll and leaf carotenoids did not affect the leaf cultivar. According to Bojovic et al. (2005), the leaf color of each cultivar and certain cultivar did not directly correlate with leaf chlorophyll content. The content of chlorophyll and carotenoids can be affected by the availability of N nutrients. According to Wijiyanti (2019) nitrogen is the main nutrient needed for the formation of chlorophyll and carotenoids. This is also in line with the research of Razaq et al. (2017) synthesis of chlorophyll and carotenoids depends on optimal N availability so that N can play an important role in the formation of photosynthetic pigments. According to Hendriyani et al., (2018) carotenoids and chlorophyll are complementary pigments, but carotenoids have less numbers than chlorophyll because carotenoids play a role in helping the absorption of light by chlorophyll.

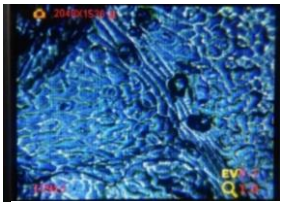
The results of observing the number of stomata in the two cultivar of green beans showed that nitrogen fertilizer affected the number of stomata (Table 1). The two cultivar of green beans gave the same response, and the application of inorganic fertilizers produced more stomata than the other treatments. Nitrogen fertilizer treatment on green beans had a significant effect on the number of stomata (Figure 1). Based on Figure 1, it can be seen that all treatments with source N have a higher number of stomata than those without N source (control). The number of stomata in plants affects the metabolic process in plants, namely photosynthesis. The rate of photosynthesis increases as the number of stomata increases so that plant production also increases. This is supported by Proklapmasiningsih et al. (2012), which states that the rate of photosynthesis in plants is closely related to the production of the resulting plant. According to Putri et al. (2017), stomata play an important role in the photosynthesis process because they function as a place to exchange CO_2 in the leaves. The highest number of stomata was found in urea treatment, both in Perkasa cultivar and thick-3 cultivar. In Figure 2, it can be seen that an increase in the number of stomata results in an increased stomata density.



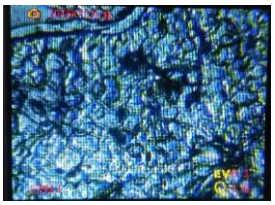
Perkasa Cultivar (control)



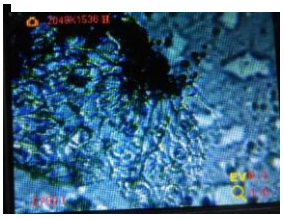
Lebat-3 Cultivar (control)



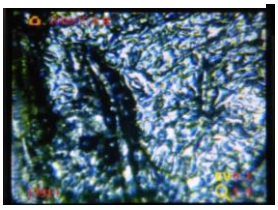
Perkasa Cultivar (Urea)



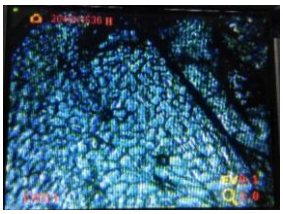
Lebat-3 Cultivar (Urea)



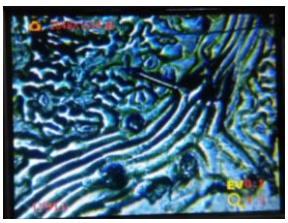
Perkasa Cultivar LOF 10%



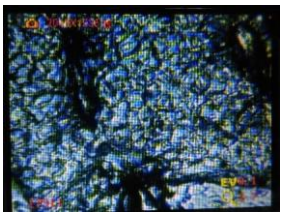
Lebat-3 Cultivar LOF 10%



Perkasa Cultivar LOF 20%



Lebat-3 Cultivar LOF 20%



Perkasa Cultivar LOF 30%

Lebat-3 Cultivar LOF 30%

F

Figure 2. The number of stomata on Perkasa and Lebat-3

The application of nitrogen fertilizers also affects the greenness of the leaves. Nitrogen is an important part of increasing leaf greenness in plants (Faustina et al., 2015). According to Pramitasari et al. (2016) stated that the N nutrient affects plant growth, appearance, color so that the plant parts turn green because they contain chlorophyll. The results of Table 4 also show that the responses given to each cultivar to the N source are also different. According to Pamungkas and Supijatno (2017), the level of greenness of the leaves indicates that the plant has sufficient nitrogen levels and indicates healthy planting conditions. In Perkasa cultivar, the highest average leaf greenness was 30% LOF treatment and followed by Urea fertilizer treatment of 100 kg ha^{-1}, LOF 20% and LOF 30%. In Lebat-3 cultivar, the highest average leaf greenness was treated with Urea fertilizer 100 kg ha^{-1} and followed by LOF 10%, LOF 20% and LOF 30% treatment. The observations indicated that the average value of leaf greenness of plants treated with nitrogen fertilizers with organic and inorganic fertilizers was much higher than plants without nitrogen fertilizers. The treatment without N fertilizer had low greenness.

The results showed that the provision of N sources and cultivar affected the number of bean pods per plant. Perkasa cultivar with 20% LOF produced the highest number of bean pods per plant and was not significantly different from the treatment of 10% liquid organic fertilizer and urea. Cultivar Lebat-3 with LOF 10% produced the highest number of bean pods and was not significantly different from the urea fertilizer treatment. The use of bean cultivar in N fertilizer had a different effect on the number of bean pods. Perkasa cultivar with 20% LOF produced more number of bean pods compared to the Lebat-3 cultivar treatment. In this study, the provision of LOF 20% and LOF 10% was sufficient for the growth of green beans and was no different from urea. According to Permanasari et al. (2014) In generative plant growth, chlorophyll formation will play a very important role in the process of plant photosynthate formation. In addition, the use of cultivar and N also affects the genetic characteristics of plants in the number of pods. Based on the research results, it is suspected that nitrogen can increase the chlorophyll content of leaves, which is important for photosynthesis and has a role in the number of bean pods. In addition, plant genetic traits in the two cultivar influenced the different responses to N fertilization. According to Beshir et al. (2015) stated that different cultivars have an effect in increasing the photosynthetic area (leaf area index), so that more pods are formed.

The results showed that there was a symptom of N deficiency in green bean leaves without nitrogen fertilizer. Symptoms that arise are the color of old leaves that are yellowish green compared to normal leaves which are fresh green. According to Erythrina et al. (2016) Nitrogen is the main nutrient in the formation of leaf color because nitrogen will play a role in increasing leaf green matter and protein. Giving nitrogen will increase the green color of the leaves and if it is

deficient in nitrogen, it reduces the formation of chlorophyll, causing the leaves to appear yellowish. According to Bojovic et al. (2009) nitrogen deficiency causes a reduction in leaf greenish color, decreases leaf area, and reduces photosynthesis because nitrogen has a linear correlation with leaf chlorophyll formation.

Lebat-3 cultivar requires a lower LOF concentration compared to Perkasa cultivar. From the results in Table 4, it can be seen that the Perkasa Cultivar 20% LOF treatment resulted in higher production compared to other treatments and was not significantly different from the 100% recommended Urea treatment. This is thought to be due to the excess liquid organic fertilizer which does not undergo a dissolving process so that it can be easily absorbed by plants. (Ginandjar et al., 2019). In Lebat-3 cultivar, 10% LOF treatment resulted in higher production compared to other treatments and was not significantly different from the recommended 100% Urea treatment. According to Chaturdevi (2005) , nitrogen fertilization with the right dose can affect grain yield in rice and other parameters in each cultivar. The use of N sources for plants affects the results of the photosynthesis process. This is supported by Rathke (2005), who states that increasing the source of N can increase yield. This is due to the function of nitrogen which can increase the chlorophyll content so that the rate of photosynthesis also increases and produces high carbohydrates for plants (Chaudary et al., 2015). The production of Lebat-3 cultivar was lower than that of Perkasa cultivar in the recommended 100% Urea treatment and 20% LOF. Ratnasari et al. (2015), stated that the differences in the characters possessed by cultivar are caused by differences in genetic composition in each cultivar so that they show different responses to the environment and production factors. The positive effect of using liquid organic fertilizers from lamtoro leaves in increasing crop yields was also found by Duaja et al. (2013) on chickpeas, Palimbungan et al. (2006) on mustard plants, Septirosya et al. (2019) on tomato plants, and Ainiya et al. (2019) on sweet corn plants.

CONCLUSION

Commented [T18]: conclude the difference in effect of inorganic and organic N sources!

~~Based on the research results,~~ ~~t~~The use of LOF lamtoro leaves with the right dose can be used as an alternative to N fertilization in plants. ~~Nitrogen is very influential on the growth and production of green beans.~~ Treatment of bean cultivar did not significantly affect the growth parameters of green beans. The effect of 20% LOF can increase the parameters of the number of trifoliate leaves (8.81 leaves) and plant dry weight (4.52 g), while Urea can increase the growth variable of plant height (171.48 cm), chlorophyll (15.93 mg). g-1FW), carotenoids (2.35 mg g-1FW) and the number of stomata (22/mm2). Treatment of Perkasa cultivar at 20% LOF resulted in the highest bean production of 846.67 kg ha^{-1}, while treatment of Lebat-3 cultivar at 10% LOF resulted in the highest bean production of 515.56 kg ha^{-1}.

ACKNOWLEDGMENT

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REFERENCES

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Ainiya, M., M. Fadli, dan R. Despita. 2019. Peningkatan Pertumbuhan dan Hasil Jagung Manis dengan Pemanfaatan Trichokompos dan LOF Daun Lamtoro. *Agrotechnology Research Journal.* 3(2): 69-74.

Amin, M.E.H. 2011. Effect of Different Nitrogen Sources on Growth, Yield and Quality of Fodder Maize (*Zea mays* L.). *Journal of the Saudi Societyof Agricultural Sciences*. 10 (1): 17-23.

Arista, D., Suryono, dan Sudadi. 2015. Efek dari Kombinasi Pupuk N, P dan K terhadap Pertumbuhan dan Hasil Kacang Tanah pada Lahan Kering Alfisol. *Jurnal Agrosains*. 17(2): 49-52.

Beshir, H.M., B. Tesfaye, R. Bueckert and B. Tar'an. 2015. Pod Quality of Snap Bean as Affected by Nitrogen Fixation, Cultivar and Climate Zone under Dryland Agriculture. *African Journal of Agricultural Research*. 10(32): 3157-3169.

Bojovic, B. and A. Markovic. 2009. Correlation Between Nitrogen and Chlorophyll Content in Wheat (*Triticum aestivum* L.). *Kragujevac Journal Science.* 31(1): 69-74.

Bojovic, B. and J. Stojanovic. 2005. Chlorophyll and Carotenoid Content in Wheat Cultivars as a Function of Mineral Nutrition. *Archives of Biological Science Belrgade*. 57 (4): 283-290.

Camara, C.R.S., C.A. Urrea, dan Vicki Sichlegel. 2013. Pinto Beans (*Phaseolus vulgaris* L.) as a Functional Food: Implications of Human Health. *Agriculture.* 3(1): 90-110.

Chaturdevi, I. 2005. Effect of Nitrogen Fertilizers on Growth, Yield and Quality of Hybrid Rice (Oryza Sativa). *Journal Central European Agriculture.* 6(4): 611-618.

Chaudhary, M.M., A.S. Bhanvadia, dan P.N. Parmar. 2015. Effect of Integrated Nutrient Management on Growth, Yield Attributes and Yield of Cabbage (Brassica oleracea Var. Capitata L.) Under Middle Gujarat Conditions. *Trends in Bioscience.* 8(8): 2164-2168.

Duaja, M.D. 2013. Pengaruh Jenis Bahan Dasar dan Dosis Pupuk Organik Cair terhadap Pertumbuhan dan Hasil Buncis (Phaseolus vulgaris L.*). Bioplantae.* 2(1): 47-54.

Duaja, M.D., Mukhsin, dan R. Sijabat. 2013. Analisis Pertumbuhan dan Hasil Dua Varietas Buncis (*Phaseolus vulgaris* L.) pada Perbedaan Jenis Pupuk Organik Cair. *Program Studi Agroekoteknologi, Fakultas Pertanian Universitas Jambi.* 2(1): 47-54.

Erythrina. 2016. Bagan Warna Daun: Alat untuk Meningkatkan Efisiensi Pemupukan Nitrogen pada Tanaman Padi. *Jurnal Litbang Pertanian*. 35(1): 1-10.

Fahmi, A., Syamsudin, S.N.H. Utami., dan B. Radjagukguk. 2010. Pengaruh Interaksi Hara Nitrogen dan Fosfor terhadap Pertumbuhan Tanaman Jagung (Zea mays L.) pada Tanah Regosol dan Latosol. Berita Biologi. 10(3): 297-304.Faustina, E., Sudrajat, dan Supijatno. 2015. Optimization of Nitrogen and Phosphorus Fertilizer on Two Years Old of Oil Palm (Elaeis guineensis Jacq.). *Asian Journal of Applied Sciences.* 3(3): 421-428.

Faustina, E., Sudradjat, dan Supijatno. 2015. Optimization of Nitrogen and Phosphorus Fertilizer on Two Years Old of Oil Palm (*Elaeis guineensis* jacq.). *Asian Journal of Applied Sciences*. 3(3): 421-428.

Ginandjar, S., B. Prasetya, W. Nugraha, dan M. Subandi. 2019. The Effect of Liquid Organic Fertilizer of Vegetable Waste and planting Media on Growth and Yield of Strawberry (Fragaria spp.) Earlibrite Cultivar.

Hendriyani, I.K., Y. Nurchayati, dan N. Setiari. 2018. Kandungan Klorofil dan Karotenoid Kacang Tunggak (*Vigna unguiculata* (L.) Walp.) pada Umur Tanaman yang Berbeda. *Jurnal Biologi Tropika.* 1(2): 38-43.

Hidayat, O. dan Suharyana, A. 2019. Pengaruh Dosis Pupuk Organik Cair Daun Lamtoro terhadap Pertumbuhan dan HAsil Tanaman Pakcoy (*Brassica rapa* L.) Varietas Nauli-F1. *Jurnal Ilmiah Pertanian.* 7(2): 57-63.

Iriyani, D. dan P. Nugrahani. 2014. Kandungan Klorofil, Karotenoid dan Vitamin C Beberapa Jenis Sayuran Daun pada Pertanian Periurban di Kota Surabaya. *Jurnal Mtematika, Sains, dan Teknologi.* 15(2): 84-90.

Jeksen, J., dan C. Mutiara. 2017. Analisis Kualitas Pupuk Organik Cair dari Beberapa Jenis Tanaman Leguminosa. Jurnal Pendidikan MIPA. 7(2): 124-130.

Madusari, S. 2019. Processing of Fibre and Its Application as Liuid Organic Fertilizer in Oil Palm (*Elaeis guineensis* Jacq.) Seedling for Sustainable Agriculture. *Joulnal of Applied Science and Advanced Technology*. 1 (3): 81-90.

Maghfoer, M.D., Koesriharti, dan T. Islami, dan N.D.S. Kanwal. 2018. A Study of the Efficacy of Various Nutrient Sources on the Growth and Yield of Cabbage. *AGRIVITA Journal of Agricultural Science.* 40(1): 168-176.

Pahlevi, R. W., B. Guritno, dan N.E. Suminarti. 2016. Pengaruh Kombinasi Proporsi Pemupukan Nireogen dan Kalium Pada Pertumbuhan, Hasil dan Kualitas Tanaman Ubi Jalar (Ipomoea batatas (L.) Lamb) Verietas Cilembu pada Dataran Rendah. *Jurnal Produksi Tanaman*. 4(1): 16-22.

Palimbungan, N., R. Labatar dan F. Hamzah. 2006. Pengaruh Ekstrak Daun Lamtoro sebagai Pupuk Organik Cair terhadap Pertumbuhan dan Hasil Produksi Tanaman Sawi. *Jurnal Agrisitem*. 2(2): 96-101.

Pamungkas, M.A., dan Supijatno. 2017. Pengaruh Pemupukan Nitrogen terhadap Percabangan Tanaman Teh (Camelia sinensis (L.) O. Kuntze) untuk Pembentukan Bidang Petik. *Buletin Agronomi*. 5(2): 234-41.

Pary, C. 2015. Pengaruh Pupuk Organik (Daun Lamtoro) dalam berbagai konsentrasi terhadap Pertumbuhan Tanaman Sawi. *Jurnal Fikratuna.* 7(2): 247-255.

Permanasari, I., M. Irfan, dan Abizar. 2014. Pertumbuhan dan Hasil Kedelai (*Glycine max (*L.) Merill) dengan Pemberian *Rhizobium* dan Pupuk Urea pada Media Gambut. *Jurnal Agroteknologi.* 5(1) ; 29-34.

Pramitasari, H.E., T. Wardiyanti, dan M. Nawawi. 2016. Pengaruh Dosis Pupuk Nitrogen dan Tingkat Kepadatan Tanaman terhadap Pertumbuhan dan Hasil Tanaman Kailan (*Brassica oleraceae* L.). *Jurnal Produksi Tanaman.* 4(1): 49-56.

Proklalmasiningsih, E., I.D. Prijambada, D. Rachmawati, dan R.P. Sancaningsih. 2012. Laju Fotosintesi dan Kandungan Klorofil Kedelai pada Media Tanam Masam Masam dengan Pemberian Garam Aluminium. *AGROTROP*. 2(1): 17-24.

Putri, F.M., S.W.A. Suedy., dan S. Darmanti. 2017. Pengaruh Pupuk Nanosiliki terhadap Jumlah Stomata, Kandungan Klorofil dan Pertumbuhan Padi Hitam (Oryza sativa L. cv. japonica). *Buletin Anatomi dan Fisiologi*. 2(1): 72-79.

Rahimi, A., S.S. Moghaddam, M. Ghiyasi, S. Heydarzadeh, K. Ghazizadeh and J. Popovi´c-Djordjevi´c. 2019. The Influence of Chemical, Organic and Biological Fertilizers on Agrobiological and Antioxidant Properties of Syrian Cephalaria (*Cephalaria Syriaca* L.). *Journal Agriculture.* 9 (122): 1-13.

Rathke, G.W., O. Christen, dan W. Diepenbrock. 2005. Effects of nitrogen source and rate on productivity and quality of winter oilseed rape (Brassica napus L.) grown in different crop rotations. *Field Crops Research*. 94 (1) 103–113.

Ratnasari, D., M.K. Bangun, dan R.I.M. Damanik. 2015. Respon Dua Varietas Kedelai (Glycine max (L.) Merrill.) pada Pemberian Pupuk Hayati dan NPK Majemuk. *Jurnal Oline Agroteknologi*. 3(1): 276-82.

Razaq, M., P. Zhang, H. Shen, and Salahuddin. 2017. Influence of Nitrogen and Phosphorous on The Growth and Root Morphology of Acer Mono. *Journal PLoS ONE*. 12(2): 1-13.

Rihana, S., Y.B.S. Heddy, dan M.D. Maghfoer. 2013. Pertumbuhan dan Hasil Tanaman Buncis (*Phaseolus viulgaris* L.) pada berbagai Dosis Pupuk Kotoran Kambing dan Konsentrasi Zat Pengatur Tumbuh Dekamon. *Jurnal Produksi Tanaman*. 1(4): 369-377.

Rizqiani, N.F., E. Ambarwati, dan N.W. Yuwono. 2007. Pengaruh Dosis dan Frekuensi Pemberian Pupuk Organik Cair Terhadap Pertumbuhan dan Hasil Buncis (*Phaseolus vulgaris* L.) Dataran Rendah. *Jurnal Ilmu Tanah dan Lingkungan*. 7(1): 43-53.

Santosa, M., M.D. Magfoer, dan H. Tarno. 2017. The Influence of Organic and Inorganic Fertilizers on the Growth and Yield of Green Bean, *Phaseolus vulgaris* L. Gron in Dry and Rainy Season. *AGRIVITA Journal of Agricultural Science*. 39(3): 296-302.

Septirosya, T., R. Hartono, dan T. Aulawi. 2019. Aplikasi Pupuk Organik Cair Daun Lamtoro pada Pertumbuhan Hasil Tanaman Tomat. *Agroscript*. 1(1): 1-8.

Sinaga, A.S., B. Guritno, dan Sudiarso. 2017. Pengaruh Dosis Kompos Sampah Rumah Tangga Terhadap Pertumbuhan dan Hasil Tiga Varietas Buncis Tipe Tegak (*Phaseolus vulgaris* L.). *Jurnal Produksi Tanaman*. 5(6):947-956.

Syaifudin, Dahlan dan Buhaerah. 2013. Pengaruh Urea terhadap Produksi Tanaman Tomat. *Jurnal Agrisistem.* 9(1): 1-9.

Wijiyanti, P., E.D. Hastuti, dan S. Haryanti. 2019. Pengaruh Masa Inkubasi Pupuk dari Air Cucian Beras terhadap Pertumbuhan Tanaman Sawi Hijau (*Brassica juncea* L.). *Buletin Anatomi dan Fisiologi.* 4(1): 41-28.

Zainal, M., A. Nugroho, dan N.E. Suminarti. 2014. Respon Pertumbuhan dan Hasil Tanman Kedelai (*Glycine max* (L.) Merill) pada Berbagai Tingkat Pemupukan N dan Pupuk Kandang Ayam. *Jurnal Produksi Tanaman.* 2(6): 484-490.

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Reviewer Evaluation

Title: THE GROWTH AND YIELD RESPONSES OF TWO BEAN CULTIVARS TO ORGANIC AND INORGANIC NITROGEN SOURCES

Name of Reviewer: B

(The reviewers' identities remain anonymous to author/s)

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Specific comments (strengths and shortcomings).

1 Abstract (Adequacy of abstract & key word)

The abstract meets the IMRAD structure, just need few words for conclusion

2 Introduction (Background and Significance of the study)

Use the scientific name instead of generic name of plant as a source of Nitrogen.

State briefly about Synromic metabolism

3 Methodology (Validity of experimental design and parameters)

Research design method should be put in this section

Please read the comments in the manuscript

4 Results (Interpretation of data) and Discussion (Relevance of discussion)

Why the different cultivar need the different dose of N fertilizer? In which way the genetic characteristic will support this conclusion?

5 Conclusion (Soundness of conclusion)

What is the right dose? Is it related to the high yield of bean?

Please check your data stated there is no significant effect on inorganic fertilizer

Clarity of Tables and Figures

Figure of stomata:Resolution need to be increased so the clear picture will be produced

References (more than 75% from the 10 past years).

Ok, but use reference manager

General Comments for Author

Recommendations (Choose One)

	Accept Submission [The submission will be accepted without revisions]
x	Revisions Required [The submission will be accepted after minor changes have been made]
	Resubmit for Review [The submission needs to be re-worked, but with significant changes, may be accepted. It will require a second round of review, however.]
	Resubmit Elsewhere [The submission looks good, but isn't suitable for this journal. Typically, it falls outside the scope of the journal]
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THE GROWTH AND YIELD RESPONSES OF TWO BEAN CULTIVARS TO ORGANIC AND INORGANIC NITROGEN SOURCES

Abstract. The productivity of beans can be increased by selecting cultivars and applying fertilizers in accordance with the needs of the bean plants. The use of high yielding cultivar and the application of N fertilizers with the right dosage can overcome the low production. The purpose of this study was to determine the effect of N sources on the growth and production of two cultivar of beans. The study used a 5x2 factorial treatment design in a randomized block design with three replications. The first factor is the Perkasa cultivar and the Lebat-3 cultivar. The second factor is fertilizer (N), namely control, Urea 100 kg ha^{-1}, 10%, 20%, 30% concentration of liquid organic fertilizer (LOF). The results showed that the use of lamtoro leaf LOF with the right dose can be used as an alternative to N fertilization. Bean cultivar did not significantly affect the growth parameters of green beans. The effect of 20% LOF produced the highest number of trifoliate leaves (8.81 leaves) and plant dry weight (4.52 g), while Urea produced the highest plant height (171.48 cm), chlorophyll (15.93 mg g^{-1}FW), carotenoids (2.35 mg g^{-1}FW) and the number of stomata (22 / mm^2). The use of a combination of 20% LOF and Perkasa cultivar showed the best effect on the number of pods per plant (5.67) and the highest bean production (846.67 kg ha^{-1})

Key words:, chlorophyll, liquid organic fertilizers, stomata, urea, cultivar

I. INTRODUCTION

The green bean plant (*Phaseolus vulgaris* L.) is one of the legume group plants which is a source of vegetable protein which is widely consumed by the Indonesian people so that it has good potential to be developed because it has an important role in fulfilling health needs as a nutritious food ingredient. According to Rihana et al. (2013), beans are a vegetable source of vegetable protein and are rich in vitamins A, B, and C and can overcome several diseases such as oxidative stress, cardiovascular, cancer, diabetes and synromic metabolism (Camara et al., 2013). As the population increases, the need for fresh food and vegetables also continues to increase. To increase the production of green beans, it is necessary to apply good cultivation techniques and environmental management for plant growth. One of the efforts that can be done is balanced fertilization and match with the needs of the plants. The productivity of green beans can be increased by using improved cultivar and cultivation systems. There are many cultivars of green beans. According to Ratnasari et al. (2015), each cultivar has different genetic characteristics, which cause differences in appearance and character as well as different responses to production factors.

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Fertilization is one way to meet the nutrient needs of nitrogen (N) in green beans. Fertilization of N derived from inorganic and organic fertilizers. Nitrogen is a major nutrient needed by green beans, which plays an important role in the formation of chlorophyll, protoplasm, protein, and nucleic acids (Fahmi et al., 2010). The plant's need for N is higher than other nutrients. Pahlevi et al. (2016) said that the nutrient N affects the photosynthetic process of plants and the resulting photosynthate. According to Maghfoer et al. (2018), inorganic fertilizers can produce large growth and yields for plants. However, the continuous use of inorganic fertilizers can interfere with soil fertility and productivity. Therefore an alternative is needed to reduce the use of inorganic fertilizers, namely using organic fertilizers.

Availability of nitrogen could be supplied with liquid organic fertilizers (LOF). Liquid organic fertilizer is an organic fertilizer that is available in liquid form, which contains nutrients in the form of a solution so that it is very easily absorbed by plants. Liquid organic fertilizer can be utilized by sprinkling it on plants or spraying on the leaves or stems of plants. Organic fertilizers can be made from plant waste available in the surrounding environment. The advantage of using liquid organic fertilizers is that their distribution can be adjusted to the needs of plants (Ginandjar et al., 2019). One example of organic matter that can be used as liquid organic fertilizer source of N is lamtoro leaf. Liquid organic fertilizer derived from lamtoro leaves contains nitrogen nutrients needed for plants (Jeksen and Mutiara, 2017). The N content in lamtoro leaves is quite high, namely 3.84% so that it can be a source of organic N to increase the growth and production of green beans (Palimbungan et al., 2006). Research results by Rizqiani et al. (2007) stated that the application of liquid organic fertilizers increased the fresh weight of pods in green beans and in Duaja's (2013) research, liquid organic fertilizer of kirinyuh (*Chromolaena odorata* L.) provided the highest yield of pods and bean yields per plant.

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Plant cultivar is a factor that greatly determines the quality of agricultural products. The use of high-yielding cultivar of beans is expected to increase productivity and yield quality of beans. Each cultivar has different genetic characteristics and traits. Based on genetic characteristics, there will be differences in the character and appearance of each

cultivar. Examples of high yielding cultivar of beans are Lebat-3 and Perkasa. The advantages of Perkasa cultivar according to the description are having resistance to leaf rust disease, early maturity and having large and long pods. The superiority of Lebat-3 cultivar based on its description is that it is well adapted to the low-highlands, has early maturity and has high yield potential. The results by Sinaga et al. (2017) showed that the use of cultivar had a significant effect on the growth and yield of beans. According to Duaja (2013), there is an interaction between the use of bean cultivar and liquid organic fertilizers on the number of pods and the yield of beans.

The fertilizer requirement by each cultivar is different. This is due to the genetic characteristics of these cultivar, so that the selection of fertilizer types and fertilizer requirements need to be considered. The proper doses of liquid organic fertilizers as needed is also a factor that affects plant growth. According to Ratnasari et al. (2015), differences in genetic traits of cultivar may show different responses to the environment and production factors. Based on this, it is hypothesized that there will be a different response of two beans cultivar to the treatment of different types and doses of fertilizers sources, because each cultivar has different genetic and character traits towards environmental influences and existing production factors. This study aims to determine the effect of nitrogen sources on the growth and production of two cultivar of beans.

II. MATERIALS AND METHODS

This research was conducted on the experimental research area of the City of Sepang Jaya, Labuhan Ratu District, Bandar Lampung from January to March 2020. The research began with soil cultivation using hoes. The land is loosened with a depth of 20-30 cm and evenly processed and an experimental plot is made with a size of 3 x 2.5 m. The planting of the Perkasa and Lebat-3 cultivar was carried out by drilling the planting holes. The seeds given to each planting hole are 2 seeds with a spacing of 40 cm x 40 cm.

Preparation of liquid fertilizer is done by mixing the chopped lamtoro leaves (1 kg of lamtoro leaves: 2 liters of water), with 200 ml of molasses and 200 ml of EM4 in a drum then fermenting for 15 days. The liquid is filtered and ready to be applied to plants. Inorganic fertilizers given were Urea 100 kg ha^{-1} (75 g / plot) given at the beginning of planting and 30 day after planting (DAP), SP-36 200 kg ha^{-1} (150 g $plot^{-1}$), and KCL 100 kg ha^{-1} (75 g $plot^{-1}$). Fertilization is done in an strip with a distance of 5 cm from the plant.

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The application of liquid organic fertilizer is conducted by spraying it on the top of the plant and the bottom of the plant (60:40). This LOF spraying is carried out once a week using a concentration of 10% (100 ml LOF solution + 900 ml water), 20% (200 ml LOF solution + 800 ml water), and 30% (300 ml LOF solution + 700 ml water).

Plant maintenance includes weeding manually and thinning. Harvesting is carried out in stages according to the harvest age of each cultivar. The characteristics of the beans that are ready to be harvested, the color of the pods is rather young and gloomy, the skin surface is a bit rough, the seeds in the pods are not yet prominent, and when the pods are broken, they will usually make a popping sound that usually occurs 2-3 weeks after the flowers bloom.

The parameters observed were plant height, number of trifoliate leaves, chlorophyll, carotenoids, number of stomata, greenness of leaves, symptoms of N deficiency, number of pods per plant, dry weight, and production. The method used to observe the stomata on the leaf surface is the replica method, in which the leaves are first cleaned with a tissue to remove dust or dirt, then rubbed with a transparent nail polish. The nail polish is allowed to dry for a few minutes, after which the nail polish is applied dry with a transparent strip of tape measuring 1 cm x 1 cm in size and smoothed, then peeled off slowly. The result of the peel is then attached to the slide and observed under a microscope.

Measurement of chlorophyll and carotenoid content was carried out using the spectophotometric method. The green beans are crushed using a mortar and 100 ml of 70% alcohol solution is added. Then the extract was filtered and the filtrate was placed in a cuvet to measure the total chlorophyll and carotenoid content using a spectophotometer. According to Rahimi et al. (2019) the chlorophyll and carotenoid content was calculated using the formula:

Chlorophyll *a* = 11,24 x A_{662} - 2,04 x A_{645}
Chlorophyll *b* = 20,13 x A_{645} - 4,19 x A_{662}
Chlorophyll total = 7,05 x A_{662} + 18,09 x A_{645}

$$\text{Carotenoid} = \frac{(1000 \times A470 - 1{,}90 \text{ x klorofil a} - 63{,}14 \times \text{klorofil b})}{214}$$

Data analysis

The treatment design used was factorial (2 x 5) in a randomized block design (RBD) with three replications in order to obtain 30 experimental units. The first factor is the bean cultivars, namely Perkasa and Lebat-3. The second factor is the source of nitrogen, namely control, Urea 100 kg ha^{-1}, LOF 10%, LOF 20%, and LOF 30%. Data were tested by Tukey's test. If the assumption of variance is met, the data is analyzed for variance, then the comparison of the mean between treatments is tested using the Honestly Significant Difference (HSD) 5%.

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III RESULTS AND DISCUSSION

The results of LOF analysis showed that the N content in the LOF of lamtoro leaves was 0.16%, had a C-Organic content of 3.08%, N-total was 0.16%, P-total was 0.18% and K was 0.56% with a pH of 3.64. The results of the analysis showed that the C/N of the lamtoro LOF ratio was 19.25. C/N ratio has met the standard of organic fertilizer. A good C/N ratio is between 15-20%. A high C/N ratio causes the biological activity of microorganisms to decrease, while a C/N ratio that is too low will cause denitrification.

Table 1. Effects of treatment nitrogen source and cultivar on plant height, number of trifoliate leaves, and dry weight plant.

Treatment	Plant height (cm)	Number of trifoliate leaves 6 weeks after planting	Dry weight plant (g)
Perkasa Cultivar	133.60 a	7.20 a	3.21 a
Lebat-3 Cultivar	137.63 a	8.11 a	3.17 a
$HSD_{0,05}$	18.47	1.43	0.92
Control	94.71 c	5.57 b	1.95 b
Urea	171.48 a	8.50 ab	3.78 ab
LOF 10%	150.60 ab	9.11 a	3.13 ab
LOF 20%	148.02 ab	8.81 ab	4.52 a
LOF 30%	113.29 bc	6.30 ab	2.58 ab
$HSD_{0,05}$	42.11	3.25	2.09

In a colum, common values letter(s) do not differ significantly at $p \leq 0,05$ as per HSD

The results showed that the application of N sources and cultivar did not affect plant height, number of trifoliate leaves, and dry weight. In plant height, the number of plant height in the control was shorter than the treatment of urea, 10% LOF, 20% LOF, and 30% LOF. The application of N sources to Urea, LOF 10%, LOF 20%, and LOF 30% did not differ (Table 1). The number of trifoliate leaves given control was less than LOF 10%, while the number of trifoliate leaves treated with Urea, LOF 20%, and LOF 30% had relatively the same results (Table 1). Provision of 20% N LOF source resulted in heavier dry stover weight than control, while the distribution of Urea, 10% LOF, and 20% LOF was not different. Giving source of N between controls, Urea, LOF 10%, and LOF 30% resulted in no different dry weight (Table 1).

Table 2. Effects of treatment nitrogen source and cultivar on, chlorophyll, carotenoid of leaves, and number of stomata.

Treatment	Chlorophyll (mg g^{-1} FW)	Carotenoid (mg g^{-1} FW)	The number of stomata (/mm^2)
Perkasa Cultivar	12.92 a	1.59 a	14.40 a
Lebat-3 Cultivar	13.24 a	1.88 a	14.67 a
$HSD_{0,05}$	1.16	0.29	3.50
Control	9.68 b	1.38 b	8.50 c
Urea	15.93 a	2.35 a	22.00 a
LOF 10%	15.56 a	1.69 ab	11.50 bc
LOF 20%	13.77 a	1.76 ab	17.83 ab
LOF 30%	10.46 b	1.47 b	12.83 bc
$HSD_{0,05}$	2.64	0.67	8.05

In a columb, common values letter(s) do not differ significantly at $p \leq 0,05$ as per HSD

The results showed that the provision of N sources and cultivar did not affect chlorophyll, carotenoids, and the number of stomata in green beans. In chlorophyll, carotenoids, and the number of leaf stomata of Perkasa Cultivar did not differ compared to Cultivar Lebat-3. The chlorophyll content given the control was lower than Urea, while the control chlorophyll was not different compared to the LOF 30%. Chlorophyll treated with Urea did not differ compared to LOF 10% and LOF 20% (Table 2). The provision of N Urea sources resulted in a higher carotenoid content than the control, while the application of Urea, 10% LOF, and 30% LOF was not different (Table 2). The application of N source between controls, LOF 10%, LOF 20%, and LOF 30% resulted in no different carotenoid content. The provision of N Urea source produced the highest number of stomata compared to the control, while the provision of Urea and 20% LOF was not different. LOF application of 10%, 20%, and 30% also produced no different numbers of stomata (Table 2).

Table 3. Effects of treatment nitrogen source and cultivar on dry weight plant,number of pods, greeness leaves and yield two cultivar bean.

Parameter	Source N	Cultivar		$HSD_{0,05}$
		Perkasa	Lebat-3	
Greeness of the leaves	Control	18.31 Ab	17.54 Ab	9.34
	Urea	27.79 Aa	28.91 Aa	
	LOF 10%	20.13 Aab	28.11 Aa	
	LOF 20%	24.06 Aab	24.19 Aa	
	LOF 30%	28.96 Aa	21.81 Aab	
Number of pods	Control	5.46 Ac	2.50 Ab	4.40
	Urea	9.13 Aab	9.05 Aa	
	LOF 10%	9.96 Aab	12.13 Aa	
	LOF 20%	13.38 Aa	4.67 Bab	
	LOF 30%	6.92 Abc	3.75 Ab	
Yield of green bean (kg ha^{-1})	Control	231.11 Ac	113.33 Ab	220.24
	Urea	720.89 Aab	429.78 Aa	
	LOF 10%	565.33 Ab	515.56 Aa	
	LOF 20%	846.67 Aa	181.33 Bb	
	LOF 30%	333.78 Ac	148.00 Ab	

Mean followed by the same letter (Capital horizontal and small letter read vertically) do not differ significantly at $p \leq 0,05$ as per HSD

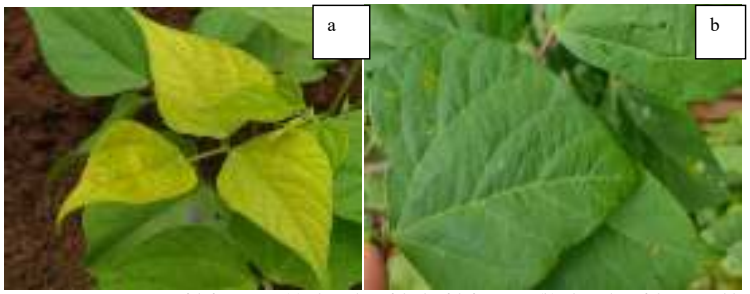
The results showed that the level of leaf greenness, number of pods, and bean production were significantly affected by the interaction of N sources and bean cultivar (Table 3). The results showed that the interaction between Perkasa cultivar and 20% LOF resulted in the highest number of bean pods per plant and was not significantly different from the treatment of 10% liquid organic fertilizer and urea. The effect of the combination treatment of Lebat-3 cultivar with 10% LOF resulted in the largest number of bean pods and was not significantly different from the treatment of Urea

and 20% LOF (Table 3). In the Perkasa cultivar, the plants treated with Urea and LOF 20% fert had a higher production, while for the green level of the leaves, the 30% LOF treatment produced the highest level of leaf greenness compared to the others but was still relatively the same as the other treatments of N sources. In Lebat-3 cultivar, 10% Urea and LOF treatment had high leaf greenness and production compared to other treatments (Table 3).

Symptoms of N Deficiency (Figure 1.)

Symptoms of nitrogen nutrient deficiency occur in green bean leaves. Symptoms of deficiency of nitrogen nutrients occur in the leaves of plants without treatment (control), with the characteristic that the green bean leaves appear yellowish compared to the leaves treated with nitrogen fertilizer. Normal leaves have a fresh green leaf color (Figure 1). Santosa et al. (2017) stated that the use of chemical fertilizers not only increases production costs but also decreases productivity and leads to gradually higher risks. Nitrogen for plants must be in accordance with the needs of the plant. According to Zainal et al. (2014). Lack of this nutrient will cause the leaves to experience chlorosis which is indicated by yellowing of the leaves, whereas if excess Nitrogen will accelerate plant growth, especially on the stems, the leaves will turn dark green and the plants become secondary.

Figure 1. Effects of treatment nitrogen source and cultivar on deficiency N



Description: Comparison of deficiency N (a) The color of the leaf deficient N (b) The color of the normal leaf

Discussion

The application of N fertilizers affected plant height (Table 2). This is supported by the research of Pamungkas and Supijatno (2017) which states that nitrogen fertilizer has a significant effect and results in the growth of tea plants. Nitrogen can increase plant height due to increased leaf area and the rate of photosynthesis so that the production of assimilation and dry matter also increases (Chaturdevi, 2005).

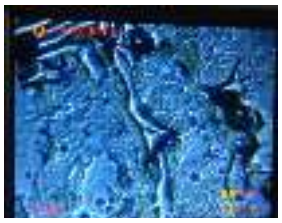
The results showed that the Perkasa and Lebat-3 cultivar had no different effect on the number of trifoliate leaves. It is assumed that the source of N is more dominant in increasing the number of trifoliate leaves and weight of dry stems. At 10% LOF treatment produced the highest number of trifoliate leaves and was not different from LOF 20%, LOF 30%, and Urea. The number of trifoliate leaves in green beans is influenced by the availability of N nutrients. According to Pramitasari et al. (2016), the more N is absorbed by the plant, the leaves will grow larger. The effect of LOF lamtoro leaves in increasing plant yields was also stated by Pary (2015) which stated that giving LOF of lamtoro leaves showed significant plant growth in the parameters of plant height, number of leaves, and fresh weight of mustard greens, by Hidayat and Suharyana (2019) which stated that giving LOF leaves lamtoro showed the highest yield on the number of pakcoy leaves, by Septirosya et al. (2019) which states that giving LOF lamtoro can increase the growth and number of fruit in tomato plants. The number of trifoliate leaves is a plant characteristic that affects the speed of photosynthesis to capture sunlight. The number of leaves increased significantly when fertilized with organic nitrogen sources. An increased number of leaves can be obtained at the N content in LOF. According to Amin (2011), Nitrogen will increase plant growth and height so that it will produce a lot of internodes and these will produce more leaves.

The results showed that the provision of N sources affected the dry weight of the plants. LOF 20% produced the highest dry weight of green beans and was not significantly different from Urea and LOF 10%. It is assumed that the availability of sufficient nutrients in an appropriate amount in the treatment affects plant growth and production. The high dry stover weight was influenced by the initial vegetative growth of green beans because the dry stover weight was related to the number of leaves and plant fresh weight. According to Arista et al. (2015) Nitrogen is an element that functions to

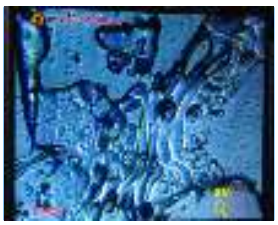
increase leaf size and increase the percentage of protein. The more leaves and this protein will increase the dry stover weight in plants. According to Madusari (2019) , liquid organic fertilizers tend to determine plant growth and good nutrient absorption which can increase plant stem diameter, so that liquid organic fertilizers can increase plant dry weight.

The results showed that the effect of urea fertilizer treatment produced the highest chlorophyll content and was not significantly different from the 20% and 10% liquid organic fertilizer treatments. In this study, Urea fertilizer treatment produced the highest carotenoid content and was not significantly different in the 10%, 20%, and 30% liquid organic fertilizer treatment. Chlorophyll and leaf carotenoids did not affect the leaf cultivar. According to Bojovic et al. (2005), the leaf color of each cultivar and certain cultivar did not directly correlate with leaf chlorophyll content. The content of chlorophyll and carotenoids can be affected by the availability of N nutrients. According to Wijiyanti (2019) nitrogen is the main nutrient needed for the formation of chlorophyll and carotenoids. This is also in line with the research of Razaq et al. (2017) synthesis of chlorophyll and carotenoids depends on optimal N availability so that N can play an important role in the formation of photosynthetic pigments. According to Hendriyani et al., (2018) carotenoids and chlorophyll are complementary pigments, but carotenoids have less numbers than chlorophyll because carotenoids play a role in helping the absorption of light by chlorophyll.

The results of observing the number of stomata in the two cultivar of green beans showed that nitrogen fertilizer affected the number of stomata (Table 1). The two cultivar of green beans gave the same response, and the application of inorganic fertilizers produced more stomata than the other treatments. Nitrogen fertilizer treatment on green beans had a significant effect on the number of stomata (Figure 1). Based on Figure 1, it can be seen that all treatments with source N have a higher number of stomata than those without N source (control). The number of stomata in plants affects the metabolic process in plants, namely photosynthesis. The rate of photosynthesis increases as the number of stomata increases so that plant production also increases. This is supported by Proklapmasiningsih et al. (2012), which states that the rate of photosynthesis in plants is closely related to the production of the resulting plant. According to Putri et al. (2017), stomata play an important role in the photosynthesis process because they function as a place to exchange CO_2 in the leaves. The highest number of stomata was found in urea treatment, both in Perkasa cultivar and thick-3 cultivar. In Figure 2, it can be seen that an increase in the number of stomata results in an increased stomata density.



Perkasa Cultivar (control)



Lebat-3 Cultivar (control)

Perkasa Cultivar (Urea)

Lebat-3 Cultivar (Urea)

Perkasa Cultivar LOF 10%

Lebat-3 Cultivar LOF 10%

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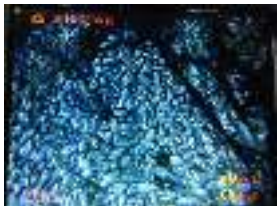

Perkasa Cultivar LOF 20%

Lebat-3 Cultivar LOF 20%

Perkasa Cultivar LOF 30%

Lebat-3 Cultivar LOF 30%

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Figure 2. stomata on Perkasa and Lebat-3

The application of nitrogen fertilizers also affects the greenness of the leaves. Nitrogen is an important part of increasing leaf greenness in plants (Faustina et al., 2015). According to Pramitasari et al. (2016) stated that the N nutrient affects plant growth, appearance, color so that the plant parts turn green because they contain chlorophyll. The results of Table 4 also show that the responses given to each cultivar to the N source are also different. According to Pamungkas and Supijatno (2017), the level of greenness of the leaves indicates that the plant has sufficient nitrogen levels and indicates healthy planting conditions. In Perkasa cultivar, the highest average leaf greenness was 30% LOF treatment and followed by Urea fertilizer treatment of 100 kg ha^{-1}, LOF 20% and LOF 30%. In Lebat-3 cultivar, the highest average leaf greenness was treated with Urea fertilizer 100 kg ha^{-1} and followed by LOF 10%, LOF 20% and LOF 30% treatment. The observations indicated that the average value of leaf greenness of plants treated with nitrogen fertilizers with organic and inorganic fertilizers was much higher than plants without nitrogen fertilizers. The treatment without N fertilizer had low greenness.

The results showed that the provision of N sources and cultivar affected the number of bean pods per plant. Perkasa cultivar with 20% LOF produced the highest number of bean pods per plant and was not significantly different from the treatment of 10% liquid organic fertilizer and urea. Cultivar Lebat-3 with LOF 10% produced the highest number of bean pods and was not significantly different from the urea fertilizer treatment. The use of bean cultivar in N fertilizer had a different effect on the number of bean pods. Perkasa cultivar with 20% LOF produced more number of bean pods compared to the Lebat-3 cultivar treatment. In this study, the provision of LOF 20% and LOF 10% was sufficient for the growth of green beans and was no different from urea. According to Permanasari et al. (2014) In generative plant growth, chlorophyll formation will play a very important role in the process of plant photosynthate formation. In addition, the use of cultivar and N also affects the genetic characteristics of plants in the number of pods. Based on the research results, it is suspected that nitrogen can increase the chlorophyll content of leaves, which is important for photosynthesis and has a role in the number of bean pods. In addition, plant genetic traits in the two cultivar influenced the different responses to N fertilization. According to Beshir et al. (2015) stated that different cultivars have an effect in increasing the photosynthetic area (leaf area index), so that more pods are formed.

The results showed that there was a symptom of N deficiency in green bean leaves without nitrogen fertilizer. Symptoms that arise are the color of old leaves that are yellowish green compared to normal leaves which are fresh green. According to Erythrina et al. (2016) Nitrogen is the main nutrient in the formation of leaf color because nitrogen will play a role in increasing leaf green matter and protein. Giving nitrogen will increase the green color of the leaves and if it is

deficient in nitrogen, it reduces the formation of chlorophyll, causing the leaves to appear yellowish. According to Bojovic et al. (2009) nitrogen deficiency causes a reduction in leaf greenish color, decreases leaf area, and reduces photosynthesis because nitrogen has a linear correlation with leaf chlorophyll formation.

Lebat-3 cultivar requires a lower LOF concentration compared to Perkasa cultivar. From the results in Table 4, it can be seen that the Perkasa Cultivar 20% LOF treatment resulted in higher production compared to other treatments and was not significantly different from the 100% recommended Urea treatment. This is thought to be due to the excess liquid organic fertilizer which does not undergo a dissolving process so that it can be easily absorbed by plants. (Ginandjar et al., 2019). In Lebat-3 cultivar, 10% LOF treatment resulted in higher production compared to other treatments and was not significantly different from the recommended 100% Urea treatment. According to Chaturdevi (2005) , nitrogen fertilization with the right dose can affect grain yield in rice and other parameters in each cultivar. The use of N sources for plants affects the results of the photosynthesis process. This is supported by Rathke (2005), who states that increasing the source of N can increase yield. This is due to the function of nitrogen which can increase the chlorophyll content so that the rate of photosynthesis also increases and produces high carbohydrates for plants (Chaudary et al., 2015). The production of Lebat-3 cultivar was lower than that of Perkasa cultivar in the recommended 100% Urea treatment and 20% LOF. Ratnasari et al. (2015), stated that the differences in the characters possessed by cultivar are caused by differences in genetic composition in each cultivar so that they show different responses to the environment and production factors. The positive effect of using liquid organic fertilizers from lamtoro leaves in increasing crop yields was also found by Duaja et al. (2013) on chickpeas, Palimbungan et al. (2006) on mustard plants, Septirosya et al. (2019) on tomato plants, and Ainiya et al. (2019) on sweet corn plants.

CONCLUSION

Based on the research results, the use of LOF lamtoro leaves with the right dose can be used as an alternative to N fertilization in plants. Nitrogen is very influential on the growth and production of green beans. Treatment of bean cultivar did not significantly affect the growth parameters of green beans. The effect of 20% LOF can increase the parameters of the number of trifoliate leaves (8.81 leaves) and plant dry weight (4.52 g), while Urea can increase the growth variable of plant height (171.48 cm), chlorophyll (15.93 mg). g-1FW), carotenoids (2.35 mg g-1FW) and the number of stomata (22/mm2). Treatment of Perkasa cultivar at 20% LOF resulted in the highest bean production of 846.67 kg ha^{-1}, while treatment of Lebat-3 cultivar at 10% LOF resulted in the highest bean production of 515.56 kg ha^{-1}.

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ACKNOWLEDGMENT

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REFERENCES

Ainiya, M., M. Fadli, dan R. Despita. 2019. Peningkatan Pertumbuhan dan Hasil Jagung Manis dengan Pemanfaatan Trichokompos dan LOF Daun Lamtoro. *Agrotechnology Research Journal.* 3(2): 69-74.

Amin, M.E.H. 2011. Effect of Different Nitrogen Sources on Growth, Yield and Quality of Fodder Maize (*Zea mays* L.). *Journal of the Saudi Societyof Agricultural Sciences*. 10 (1): 17-23.

Arista, D., Suryono, dan Sudadi. 2015. Efek dari Kombinasi Pupuk N, P dan K terhadap Pertumbuhan dan Hasil Kacang Tanah pada Lahan Kering Alfisol. *Jurnal Agrosains*. 17(2): 49-52.

Beshir, H.M., B. Tesfaye, R. Bueckert and B. Tar'an. 2015. Pod Quality of Snap Bean as Affected by Nitrogen Fixation, Cultivar and Climate Zone under Dryland Agriculture. *African Journal of Agricultural Research*. 10(32): 3157-3169.

Bojovic, B. and A. Markovic. 2009. Correlation Between Nitrogen and Chlorophyll Content in Wheat (*Triticum aestivum* L.). *Kragujevac Journal Science.* 31(1): 69-74.

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Bojovic, B. and J. Stojanovic. 2005. Chlorophyll and Carotenoid Content in Wheat Cultivars as a Function of Mineral Nutrition. *Archives of Biological Science Belrgade*. 57 (4): 283-290.

Camara, C.R.S., C.A. Urrea, dan Vicki Sichlegel. 2013. Pinto Beans (*Phaseolus vulgaris* L.) as a Functional Food: Implications of Human Health. *Agriculture.* 3(1): 90-110.

Chaturdevi, I. 2005. Effect of Nitrogen Fertilizers on Growth, Yield and Quality of Hybrid Rice (Oryza Sativa). *Journal Central European Agriculture.* 6(4): 611-618.

Chaudhary, M.M., A.S. Bhanvadia, dan P.N. Parmar. 2015. Effect of Integrated Nutrient Management on Growth, Yield Attributes and Yield of Cabbage (Brassica oleracea Var. Capitata L.) Under Middle Gujarat Conditions. *Trends in Bioscience.* 8(8): 2164-2168.

Duaja, M.D. 2013. Pengaruh Jenis Bahan Dasar dan Dosis Pupuk Organik Cair terhadap Pertumbuhan dan Hasil Buncis (Phaseolus vulgaris L.*)*. *Bioplantae.* 2(1): 47-54.

Duaja, M.D., Mukhsin, dan R. Sijabat. 2013. Analisis Pertumbuhan dan Hasil Dua Varietas Buncis (*Phaseolus vulgaris* L.) pada Perbedaan Jenis Pupuk Organik Cair. *Program Studi Agroekoteknologi, Fakultas Pertanian Universitas Jambi.* 2(1): 47-54.

Erythrina. 2016. Bagan Warna Daun: Alat untuk Meningkatkan Efisiensi Pemupukan Nitrogen pada Tanaman Padi. *Jurnal Litbang Pertanian*. 35(1): 1-10.

Fahmi, A., Syamsudin, S.N.H. Utami., dan B. Radjagukguk. 2010. Pengaruh Interaksi Hara Nitrogen dan Fosfor terhadap Pertumbuhan Tanaman Jagung (Zea mays L.) pada Tanah Regosol dan Latosol. Berita Biologi. 10(3): 297-304.Faustina, E., Sudrajat, dan Supijatno. 2015. Optimization of Nitrogen and Phosphorus Fertilizer on Two Years Old of Oil Palm (Elaeis guineensis Jacq.). *Asian Journal of Applied Sciences.* 3(3): 421-428.

Faustina, E., Sudradjat, dan Supijatno. 2015. Optimization of Nitrogen and Phosphorus Fertilizer on Two Years Old of Oil Palm (*Elaeis guineensis* jacq.). *Asian Journal of Applied Sciences*. 3(3): 421-428.

Ginandjar, S., B. Prasetya, W. Nugraha, dan M. Subandi. 2019. The Effect of Liquid Organic Fertilizer of Vegetable Waste and planting Media on Growth and Yield of Strawberry (Fragaria spp.) Earlibrite Cultivar.

Hendriyani, I.K., Y. Nurchayati, dan N. Setiari. 2018. Kandungan Klorofil dan Karotenoid Kacang Tunggak (*Vigna unguiculata* (L.) Walp.) pada Umur Tanaman yang Berbeda. *Jurnal Biologi Tropika.* 1(2): 38-43.

Hidayat, O. dan Suharyana, A. 2019. Pengaruh Dosis Pupuk Organik Cair Daun Lamtoro terhadap Pertumbuhan dan HAsil Tanaman Pakcoy (*Brassica rapa* L.) Varietas Nauli-F1. *Jurnal Ilmiah Pertanian.* 7(2): 57-63.

Iriyani, D. dan P. Nugrahani. 2014. Kandungan Klorofil, Karotenoid dan Vitamin C Beberapa Jenis Sayuran Daun pada Pertanian Periurban di Kota Surabaya. *Jurnal Mtematika, Sains, dan Teknologi.* 15(2): 84-90.

Jeksen, J., dan C. Mutiara. 2017. Analisis Kualitas Pupuk Organik Cair dari Beberapa Jenis Tanaman Leguminosa. Jurnal Pendidikan MIPA. 7(2): 124-130.

Madusari, S. 2019. Processing of Fibre and Its Application as Liuid Organic Fertilizer in Oil Palm (*Elaeis guineensis* Jacq.) Seedling for Sustainable Agriculture. *Joulnal of Applied Science and Advanced Technology*. 1 (3): 81-90.

Maghfoer, M.D., Koesriharti, dan T. Islami, dan N.D.S. Kanwal. 2018. A Study of the Efficacy of Various Nutrient Sources on the Growth and Yield of Cabbage. *AGRIVITA Journal of Agricultural Science.* 40(1): 168-176.

Pahlevi, R. W., B. Guritno, dan N.E. Suminarti. 2016. Pengaruh Kombinasi Proporsi Pemupukan Nireogen dan Kalium Pada Pertumbuhan, Hasil dan Kualitas Tanaman Ubi Jalar (Ipomoea batatas (L.) Lamb) Verietas Cilembu pada Dataran Rendah. *Jurnal Produksi Tanaman*. 4(1): 16-22.

Palimbungan, N., R. Labatar dan F. Hamzah. 2006. Pengaruh Ekstrak Daun Lamtoro sebagai Pupuk Organik Cair terhadap Pertumbuhan dan Hasil Produksi Tanaman Sawi. *Jurnal Agrisitem*. 2(2): 96-101.

Pamungkas, M.A., dan Supijatno. 2017. Pengaruh Pemupukan Nitrogen terhadap Percabangan Tanaman Teh (Camelia sinensis (L.) O. Kuntze) untuk Pembentukan Bidang Petik. *Buletin Agronomi*. 5(2): 234-41.

Pary, C. 2015. Pengaruh Pupuk Organik (Daun Lamtoro) dalam berbagai konsentrasi terhadap Pertumbuhan Tanaman Sawi. *Jurnal Fikratuna.* 7(2): 247-255.

Permanasari, I., M. Irfan, dan Abizar. 2014. Pertumbuhan dan Hasil Kedelai (*Glycine max (*L.) Merill) dengan Pemberian *Rhizobium* dan Pupuk Urea pada Media Gambut. *Jurnal Agroteknologi.* 5(1) ; 29-34.

Pramitasari, H.E., T. Wardiyanti, dan M. Nawawi. 2016. Pengaruh Dosis Pupuk Nitrogen dan Tingkat Kepadatan Tanaman terhadap Pertumbuhan dan Hasil Tanaman Kailan (*Brassica oleraceae* L.). *Jurnal Produksi Tanaman.* 4(1): 49-56.

Proklalmasiningsih, E., I.D. Prijambada, D. Rachmawati, dan R.P. Sancaningsih. 2012. Laju Fotosintesi dan Kandungan Klorofil Kedelai pada Media Tanam Masam Masam dengan Pemberian Garam Aluminium. *AGROTROP.* 2(1): 17-24.

Putri, F.M., S.W.A. Suedy., dan S. Darmanti. 2017. Pengaruh Pupuk Nanosiliki terhadap Jumlah Stomata, Kandungan Klorofil dan Pertumbuhan Padi Hitam (Oryza sativa L. cv. japonica). *Buletin Anatomi dan Fisiologi*. 2(1): 72-79.

Rahimi, A., S.S. Moghaddam, M. Ghiyasi, S. Heydarzadeh, K. Ghazizadeh and J. Popovi´c-Djordjevi´c. 2019. The Influence of Chemical, Organic and Biological Fertilizers on Agrobiological and Antioxidant Properties of Syrian Cephalaria (*Cephalaria Syriaca* L.). *Journal Agriculture.* 9 (122): 1-13.

Rathke, G.W., O. Christen, dan W. Diepenbrock. 2005. Effects of nitrogen source and rate on productivity and quality of winter oilseed rape (Brassica napus L.) grown in different crop rotations. *Field Crops Research*. 94 (1) 103–113.

Ratnasari, D., M.K. Bangun, dan R.I.M. Damanik. 2015. Respon Dua Varietas Kedelai (Glycine max (L.) Merrill.) pada Pemberian Pupuk Hayati dan NPK Majemuk. *Jurnal Oline Agroteknologi*. 3(1): 276-82.

Razaq, M., P. Zhang, H. Shen, and Salahuddin. 2017. Influence of Nitrogen and Phosphorous on The Growth and Root Morphology of Acer Mono. *Journal PLoS ONE*. 12(2): 1-13.

Rihana, S., Y.B.S. Heddy, dan M.D. Maghfoer. 2013. Pertumbuhan dan Hasil Tanaman Buncis (*Phaseolus viulgaris* L.) pada berbagai Dosis Pupuk Kotoran Kambing dan Konsentrasi Zat Pengatur Tumbuh Dekamon. *Jurnal Produksi Tanaman*. 1(4): 369-377.

Rizqiani, N.F., E. Ambarwati, dan N.W. Yuwono. 2007. Pengaruh Dosis dan Frekuensi Pemberian Pupuk Organik Cair Terhadap Pertumbuhan dan Hasil Buncis (*Phaseolus vulgaris* L.) Dataran Rendah. *Jurnal Ilmu Tanah dan Lingkungan*. 7(1): 43-53.

Santosa, M., M.D. Magfoer, dan H. Tarno. 2017. The Influence of Organic and Inorganic Fertilizers on the Growth and Yield of Green Bean, *Phaseolus vulgaris* L. Gron in Dry and Rainy Season. *AGRIVITA Journal of Agricultural Science*. 39(3): 296-302.

Septirosya, T., R. Hartono, dan T. Aulawi. 2019. Aplikasi Pupuk Organik Cair Daun Lamtoro pada Pertumbuhan Hasil Tanaman Tomat. *Agroscript*. 1(1): 1-8.

Sinaga, A.S., B. Guritno, dan Sudiarso. 2017. Pengaruh Dosis Kompos Sampah Rumah Tangga Terhadap Pertumbuhan dan Hasil Tiga Varietas Buncis Tipe Tegak (*Phaseolus vulgaris* L.). *Jurnal Produksi Tanaman*. 5(6):947-956.

Syaifudin, Dahlan dan Buhaerah. 2013. Pengaruh Urea terhadap Produksi Tanaman Tomat. *Jurnal Agrisistem.* 9(1): 1-9.

Wijiyanti, P., E.D. Hastuti, dan S. Haryanti. 2019. Pengaruh Masa Inkubasi Pupuk dari Air Cucian Beras terhadap Pertumbuhan Tanaman Sawi Hijau (*Brassica juncea* L.). *Buletin Anatomi dan Fisiologi.* 4(1): 41-28.

Zainal, M., A. Nugroho, dan N.E. Suminarti. 2014. Respon Pertumbuhan dan Hasil Tanman Kedelai (*Glycine max* (L.) Merill) pada Berbagai Tingkat Pemupukan N dan Pupuk Kandang Ayam. *Jurnal Produksi Tanaman.* 2(6): 484-490.

THE GROWTH AND YIELD RESPONSES OF TWO BEAN CULTIVARS TO ORGANIC AND INORGANIC NITROGEN SOURCES

Abstract. The productivity of beans can be increased by selecting cultivars and applying fertilizers in accordance with the needs of the bean plants. The use of high yielding cultivar and the application of N fertilizers with the right dosage can overcome the low production. The purpose of this study was to determine the effect of N sources on the growth and production of two cultivar of beans. The study used a 5x2 factorial treatment design in a randomized block design with three replications. The first factor is the Perkasa cultivar and the Lebat-3 cultivar. The second factor is fertilizer (N), namely control, Urea 100 kg ha^{-1}, 10%, 20%, 30% concentration of liquid organic fertilizer (LOF). The results showed that the use of lamtoro leaf LOF with the right dose can be used as an alternative to N fertilization. Bean cultivar did not significantly affect the growth parameters of green beans. The effect of 20% LOF produced the highest number of trifoliate leaves (8.81 leaves) and plant dry weight (4.52 g), while Urea produced the highest plant height (171.48 cm), chlorophyll (15.93 mg g^{-1}FW), carotenoids (2.35 mg g^{-1}FW) and the number of stomata (22 / mm^2). The use of a combination of 20% LOF and Perkasa cultivar showed the best effect on the number of pods per plant (5.67) and the highest bean production (846.67 kg ha^{-1})

Key words:, chlorophyll, liquid organic fertilizers, stomata, urea, cultivar

I. INTRODUCTION

The green bean plant (*Phaseolus vulgaris* L.) is one of the legume group plants which is a source of vegetable protein which is widely consumed by the Indonesian people so that it has good potential to be developed because it has an important role in fulfilling health needs as a nutritious food ingredient. According to Rihana et al. (2013), beans are a vegetable source of vegetable protein and are rich in vitamins A, B, and C and can overcome several diseases such as oxidative stress, cardiovascular, cancer, diabetes and synromic metabolism (Camara et al., 2013). As the population increases, the need for fresh food and vegetables also continues to increase. To increase the production of green beans, it is necessary to apply good cultivation techniques and environmental management for plant growth. One of the efforts that can be done is balanced fertilization and match with the needs of the plants. The productivity of green beans can be increased by using improved cultivar and cultivation systems. There are many cultivars of green beans. According to Ratnasari et al. (2015), each cultivar has different genetic characteristics, which cause differences in appearance and character as well as different responses to production factors.

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Fertilization is one way to meet the nutrient needs of nitrogen (N) in green beans. Fertilization of N derived from inorganic and organic fertilizers. Nitrogen is a major nutrient needed by green beans, which plays an important role in the formation of chlorophyll, protoplasm, protein, and nucleic acids (Fahmi et al., 2010). The plant's need for N is higher than other nutrients. Pahlevi et al. (2016) said that the nutrient N affects the photosynthetic process of plants and the resulting photosynthate. According to Maghfoer et al. (2018), inorganic fertilizers can produce large growth and yields for plants. However, the continuous use of inorganic fertilizers can interfere with soil fertility and productivity. Therefore an alternative is needed to reduce the use of inorganic fertilizers, namely using organic fertilizers.

Availability of nitrogen could be supplied with liquid organic fertilizers (LOF). Liquid organic fertilizer is an organic fertilizer that is available in liquid form, which contains nutrients in the form of a solution so that it is very easily absorbed by plants. Liquid organic fertilizer can be utilized by sprinkling it on plants or spraying on the leaves or stems of plants. Organic fertilizers can be made from plant waste available in the surrounding environment. The advantage of using liquid organic fertilizers is that their distribution can be adjusted to the needs of plants (Ginandjar et al., 2019). One example of organic matter that can be used as liquid organic fertilizer source of N is lamtoro leaf. Liquid organic fertilizer derived from lamtoro leaves contains nitrogen nutrients needed for plants (Jeksen and Mutiara, 2017). The N content in lamtoro leaves is quite high, namely 3.84% so that it can be a source of organic N to increase the growth and production of green beans (Palimbungan et al., 2006). Research results by Rizqiani et al. (2007) stated that the application of liquid organic fertilizers increased the fresh weight of pods in green beans and in Duaja's (2013) research, liquid organic fertilizer of kirinyuh (*Chromolaena odorata* L.) provided the highest yield of pods and bean yields per plant.

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Plant cultivar is a factor that greatly determines the quality of agricultural products. The use of high-yielding cultivar of beans is expected to increase productivity and yield quality of beans. Each cultivar has different genetic characteristics and traits. Based on genetic characteristics, there will be differences in the character and appearance of each

cultivar. Examples of high yielding cultivar of beans are Lebat-3 and Perkasa. The advantages of Perkasa cultivar according to the description are having resistance to leaf rust disease, early maturity and having large and long pods. The superiority of Lebat-3 cultivar based on its description is that it is well adapted to the low-highlands, has early maturity and has high yield potential. The results by Sinaga et al. (2017) showed that the use of cultivar had a significant effect on the growth and yield of beans. According to Duaja (2013), there is an interaction between the use of bean cultivar and liquid organic fertilizers on the number of pods and the yield of beans.

The fertilizer requirement by each cultivar is different. This is due to the genetic characteristics of these cultivar, so that the selection of fertilizer types and fertilizer requirements need to be considered. The proper doses of liquid organic fertilizers as needed is also a factor that affects plant growth. According to Ratnasari et al. (2015), differences in genetic traits of cultivar may show different responses to the environment and production factors. Based on this, it is hypothesized that there will be a different response of two beans cultivar to the treatment of different types and doses of fertilizers sources, because each cultivar has different genetic and character traits towards environmental influences and existing production factors. This study aims to determine the effect of nitrogen sources on the growth and production of two cultivar of beans.

II. MATERIALS AND METHODS

This research was conducted on the experimental research area of the City of Sepang Jaya, Labuhan Ratu District, Bandar Lampung from January to March 2020. The research began with soil cultivation using hoes. The land is loosened with a depth of 20-30 cm and evenly processed and an experimental plot is made with a size of 3 x 2.5 m. The planting of the Perkasa and Lebat-3 cultivar was carried out by drilling the planting holes. The seeds given to each planting hole are 2 seeds with a spacing of 40 cm x 40 cm.

Preparation of liquid fertilizer is done by mixing the chopped lamtoro leaves (1 kg of lamtoro leaves: 2 liters of water), with 200 ml of molasses and 200 ml of EM4 in a drum then fermenting for 15 days. The liquid is filtered and ready to be applied to plants. Inorganic fertilizers given were Urea 100 kg ha^{-1} (75 g / plot) given at the beginning of planting and 30 day after planting (DAP), SP-36 200 kg ha^{-1} (150 g plot^{-1}), and KCL 100 kg ha^{-1} (75 g plot^{-1}). Fertilization is done in an strip with a distance of 5 cm from the plant.

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The application of liquid organic fertilizer is conducted by spraying it on the top of the plant and the bottom of the plant (60:40). This LOF spraying is carried out once a week using a concentration of 10% (100 ml LOF solution + 900 ml water), 20% (200 ml LOF solution + 800 ml water), and 30% (300 ml LOF solution + 700 ml water).

Plant maintenance includes weeding manually and thinning. Harvesting is carried out in stages according to the harvest age of each cultivar. The characteristics of the beans that are ready to be harvested, the color of the pods is rather young and gloomy, the skin surface is a bit rough, the seeds in the pods are not yet prominent, and when the pods are broken, they will usually make a popping sound that usually occurs 2-3 weeks after the flowers bloom.

The parameters observed were plant height, number of trifoliate leaves, chlorophyll, carotenoids, number of stomata, greenness of leaves, symptoms of N deficiency, number of pods per plant, dry weight, and production. The method used to observe the stomata on the leaf surface is the replica method, in which the leaves are first cleaned with a tissue to remove dust or dirt, then rubbed with a transparent nail polish. The nail polish is allowed to dry for a few minutes, after which the nail polish is applied dry with a transparent strip of tape measuring 1 cm x 1 cm in size and smoothed, then peeled off slowly. The result of the peel is then attached to the slide and observed under a microscope.

Measurement of chlorophyll and carotenoid content was carried out using the spectophotometric method. The green beans are crushed using a mortar and 100 ml of 70% alcohol solution is added. Then the extract was filtered and the filtrate was placed in a cuvet to measure the total chlorophyll and carotenoid content using a spectophotometer. According to Rahimi et al. (2019) the chlorophyll and carotenoid content was calculated using the formula:

Chlorophyll *a* = 11,24 x A_{662} - 2,04 x A_{645}
Chlorophyll *b* = 20,13 x A_{645} - 4,19 x A_{662}
Chlorophyll total = 7,05 x A_{662} + 18,09 x A_{645}
Carotenoid $= \frac{(1000 \times A470 - 1{,}90 \times \text{klorofil a} - 63{,}14 \times \text{klorofil b})}{214}$

Data analysis

The treatment design used was factorial (2 x 5) in a randomized block design (RBD) with three replications in order to obtain 30 experimental units. The first factor is the bean cultivars, namely Perkasa and Lebat-3. The second factor is the source of nitrogen, namely control, Urea 100 kg ha^{-1}, LOF 10%, LOF 20%, and LOF 30%. Data were tested by Tukey's test. If the assumption of variance is met, the data is analyzed for variance, then the comparison of the mean between treatments is tested using the Honestly Significant Difference (HSD) 5%.

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III RESULTS AND DISCUSSION

The results of LOF analysis showed that the N content in the LOF of lamtoro leaves was 0.16%, had a C-Organic content of 3.08%, N-total was 0.16%, P-total was 0.18% and K was 0.56% with a pH of 3.64. The results of the analysis showed that the C/N of the lamtoro LOF ratio was 19.25. C/N ratio has met the standard of organic fertilizer. A good C/N ratio is between 15-20%. A high C/N ratio causes the biological activity of microorganisms to decrease, while a C/N ratio that is too low will cause denitrification.

Table 1. Effects of treatment nitrogen source and cultivar on plant height, number of trifoliate leaves, and dry weight plant.

Treatment	Plant height (cm)	Number of trifoliate leaves 6 weeks after planting	Dry weight plant (g)
Perkasa Cultivar	133.60 a	7.20 a	3.21 a
Lebat-3 Cultivar	137.63 a	8.11 a	3.17 a
$HSD_{0,05}$	18.47	1.43	0.92
Control	94.71 c	5.57 b	1.95 b
Urea	171.48 a	8.50 ab	3.78 ab
LOF 10%	150.60 ab	9.11 a	3.13 ab
LOF 20%	148.02 ab	8.81 ab	4.52 a
LOF 30%	113.29 bc	6.30 ab	2.58 ab
$HSD_{0,05}$	42.11	3.25	2.09

In a colum, common values letter(s) do not differ significantly at $p \leq 0,05$ as per HSD

The results showed that the application of N sources and cultivar did not affect plant height, number of trifoliate leaves, and dry weight. In plant height, the number of plant height in the control was shorter than the treatment of urea, 10% LOF, 20% LOF, and 30% LOF. The application of N sources to Urea, LOF 10%, LOF 20%, and LOF 30% did not differ (Table 1). The number of trifoliate leaves given control was less than LOF 10%, while the number of trifoliate leaves treated with Urea, LOF 20%, and LOF 30% had relatively the same results (Table 1). Provision of 20% N LOF source resulted in heavier dry stover weight than control, while the distribution of Urea, 10% LOF, and 20% LOF was not different. Giving source of N between controls, Urea, LOF 10%, and LOF 30% resulted in no different dry weight (Table 1).

Table 2. Effects of treatment nitrogen source and cultivar on, chlorophyll, carotenoid of leaves, and number of stomata.

Treatment	Chlorophyll (mg g^{-1} FW)	Carotenoid (mg g^{-1} FW)	The number of stomata (/mm^2)
Perkasa Cultivar	12.92 a	1.59 a	14.40 a
Lebat-3 Cultivar	13.24 a	1.88 a	14.67 a
$HSD_{0,05}$	1.16	0.29	3.50
Control	9.68 b	1.38 b	8.50 c
Urea	15.93 a	2.35 a	22.00 a
LOF 10%	15.56 a	1.69 ab	11.50 bc
LOF 20%	13.77 a	1.76 ab	17.83 ab
LOF 30%	10.46 b	1.47 b	12.83 bc
$HSD_{0,05}$	2.64	0.67	8.05

In a columb, common values letter(s) do not differ significantly at $p \leq 0,05$ as per HSD

The results showed that the provision of N sources and cultivar did not affect chlorophyll, carotenoids, and the number of stomata in green beans. In chlorophyll, carotenoids, and the number of leaf stomata of Perkasa Cultivar did not differ compared to Cultivar Lebat-3. The chlorophyll content given the control was lower than Urea, while the control chlorophyll was not different compared to the LOF 30%. Chlorophyll treated with Urea did not differ compared to LOF 10% and LOF 20% (Table 2). The provision of N Urea sources resulted in a higher carotenoid content than the control, while the application of Urea, 10% LOF, and 30% LOF was not different (Table 2). The application of N source between controls, LOF 10%, LOF 20%, and LOF 30% resulted in no different carotenoid content. The provision of N Urea source produced the highest number of stomata compared to the control, while the provision of Urea and 20% LOF was not different. LOF application of 10%, 20%, and 30% also produced no different numbers of stomata (Table 2).

Table 3. Effects of treatment nitrogen source and cultivar on dry weight plant,number of pods, greeness leaves and yield two cultivar bean.

Parameter	Source N	Cultivar		$HSD_{0,05}$
		Perkasa	Lebat-3	
Greeness of the leaves	Control	18.31 Ab	17.54 Ab	9.34
	Urea	27.79 Aa	28.91 Aa	
	LOF 10%	20.13 Aab	28.11 Aa	
	LOF 20%	24.06 Aab	24.19 Aa	
	LOF 30%	28.96 Aa	21.81 Aab	
Number of pods	Control	5.46 Ac	2.50 Ab	4.40
	Urea	9.13 Aab	9.05 Aa	
	LOF 10%	9.96 Aab	12.13 Aa	
	LOF 20%	13.38 Aa	4.67 Bab	
	LOF 30%	6.92 Abc	3.75 Ab	
Yield of green bean (kg ha^{-1})	Control	231.11 Ac	113.33 Ab	220.24
	Urea	720.89 Aab	429.78 Aa	
	LOF 10%	565.33 Ab	515.56 Aa	
	LOF 20%	846.67 Aa	181.33 Bb	
	LOF 30%	333.78 Ac	148.00 Ab	

Mean followed by the same letter (Capital horizontal and small letter read vertically) do not differ significantly at $p \leq 0,05$ as per HSD

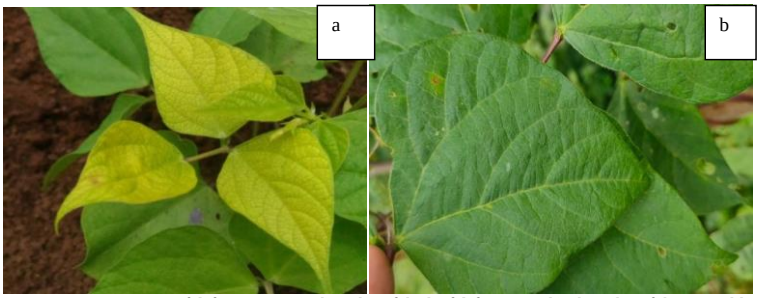
The results showed that the level of leaf greenness, number of pods, and bean production were significantly affected by the interaction of N sources and bean cultivar (Table 3). The results showed that the interaction between Perkasa cultivar and 20% LOF resulted in the highest number of bean pods per plant and was not significantly different from the treatment of 10% liquid organic fertilizer and urea. The effect of the combination treatment of Lebat-3 cultivar with 10% LOF resulted in the largest number of bean pods and was not significantly different from the treatment of Urea

and 20% LOF (Table 3). In the Perkasa cultivar, the plants treated with Urea and LOF 20% fert had a higher production, while for the green level of the leaves, the 30% LOF treatment produced the highest level of leaf greenness compared to the others but was still relatively the same as the other treatments of N sources. In Lebat-3 cultivar, 10% Urea and LOF treatment had high leaf greenness and production compared to other treatments (Table 3).

Symptoms of N Deficiency (Figure 1.)

Symptoms of nitrogen nutrient deficiency occur in green bean leaves. Symptoms of deficiency of nitrogen nutrients occur in the leaves of plants without treatment (control), with the characteristic that the green bean leaves appear yellowish compared to the leaves treated with nitrogen fertilizer. Normal leaves have a fresh green leaf color (Figure 1). Santosa et al. (2017) stated that the use of chemical fertilizers not only increases production costs but also decreases productivity and leads to gradually higher risks. Nitrogen for plants must be in accordance with the needs of the plant. According to Zainal et al. (2014). Lack of this nutrient will cause the leaves to experience chlorosis which is indicated by yellowing of the leaves, whereas if excess Nitrogen will accelerate plant growth, especially on the stems, the leaves will turn dark green and the plants become secondary.

Figure 1. Effects of treatment nitrogen source and cultivar on deficiency N



Description: Comparison of deficiency N (a) The color of the leaf deficient N (b) The color of the normal leaf

Discussion

The application of N fertilizers affected plant height (Table 2). This is supported by the research of Pamungkas and Supijatno (2017) which states that nitrogen fertilizer has a significant effect and results in the growth of tea plants. Nitrogen can increase plant height due to increased leaf area and the rate of photosynthesis so that the production of assimilation and dry matter also increases (Chaturdevi, 2005).

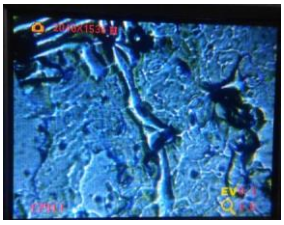
The results showed that the Perkasa and Lebat-3 cultivar had no different effect on the number of trifoliate leaves. It is assumed that the source of N is more dominant in increasing the number of trifoliate leaves and weight of dry stems. At 10% LOF treatment produced the highest number of trifoliate leaves and was not different from LOF 20%, LOF 30%, and Urea. The number of trifoliate leaves in green beans is influenced by the availability of N nutrients. According to Pramitasari et al. (2016), the more N is absorbed by the plant, the leaves will grow larger. The effect of LOF lamtoro leaves in increasing plant yields was also stated by Pary (2015) which stated that giving LOF of lamtoro leaves showed significant plant growth in the parameters of plant height, number of leaves, and fresh weight of mustard greens, by Hidayat and Suharyana (2019) which stated that giving LOF leaves lamtoro showed the highest yield on the number of pakcoy leaves, by Septirosya et al. (2019) which states that giving LOF lamtoro can increase the growth and number of fruit in tomato plants. The number of trifoliate leaves is a plant characteristic that affects the speed of photosynthesis to capture sunlight. The number of leaves increased significantly when fertilized with organic nitrogen sources. An increased number of leaves can be obtained at the N content in LOF. According to Amin (2011), Nitrogen will increase plant growth and height so that it will produce a lot of internodes and these will produce more leaves.

The results showed that the provision of N sources affected the dry weight of the plants. LOF 20% produced the highest dry weight of green beans and was not significantly different from Urea and LOF 10%. It is assumed that the availability of sufficient nutrients in an appropriate amount in the treatment affects plant growth and production. The high dry stover weight was influenced by the initial vegetative growth of green beans because the dry stover weight was related to the number of leaves and plant fresh weight. According to Arista et al. (2015) Nitrogen is an element that functions to

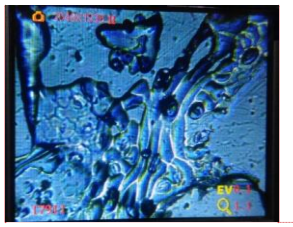
increase leaf size and increase the percentage of protein. The more leaves and this protein will increase the dry stover weight in plants. According to Madusari (2019) , liquid organic fertilizers tend to determine plant growth and good nutrient absorption which can increase plant stem diameter, so that liquid organic fertilizers can increase plant dry weight.

The results showed that the effect of urea fertilizer treatment produced the highest chlorophyll content and was not significantly different from the 20% and 10% liquid organic fertilizer treatments. In this study, Urea fertilizer treatment produced the highest carotenoid content and was not significantly different in the 10%, 20%, and 30% liquid organic fertilizer treatment. Chlorophyll and leaf carotenoids did not affect the leaf cultivar. According to Bojovic et al. (2005), the leaf color of each cultivar and certain cultivar did not directly correlate with leaf chlorophyll content. The content of chlorophyll and carotenoids can be affected by the availability of N nutrients. According to Wijiyanti (2019) nitrogen is the main nutrient needed for the formation of chlorophyll and carotenoids. This is also in line with the research of Razaq et al. (2017) synthesis of chlorophyll and carotenoids depends on optimal N availability so that N can play an important role in the formation of photosynthetic pigments. According to Hendriyani et al., (2018) carotenoids and chlorophyll are complementary pigments, but carotenoids have less numbers than chlorophyll because carotenoids play a role in helping the absorption of light by chlorophyll.

The results of observing the number of stomata in the two cultivar of green beans showed that nitrogen fertilizer affected the number of stomata (Table 1). The two cultivar of green beans gave the same response, and the application of inorganic fertilizers produced more stomata than the other treatments. Nitrogen fertilizer treatment on green beans had a significant effect on the number of stomata (Figure 1). Based on Figure 1, it can be seen that all treatments with source N have a higher number of stomata than those without N source (control). The number of stomata in plants affects the metabolic process in plants, namely photosynthesis. The rate of photosynthesis increases as the number of stomata increases so that plant production also increases. This is supported by Proklapmasiningsih et al. (2012), which states that the rate of photosynthesis in plants is closely related to the production of the resulting plant. According to Putri et al. (2017), stomata play an important role in the photosynthesis process because they function as a place to exchange CO_2 in the leaves. The highest number of stomata was found in urea treatment, both in Perkasa cultivar and thick-3 cultivar. In Figure 2, it can be seen that an increase in the number of stomata results in an increased stomata density.



Perkasa Cultivar (control)



Lebat-3 Cultivar (control)

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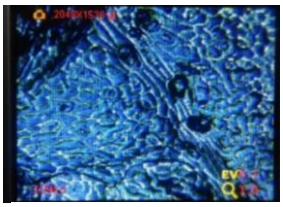
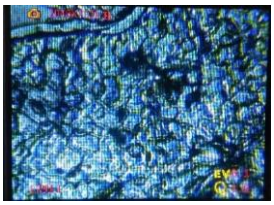
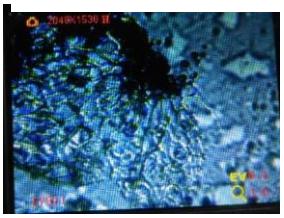


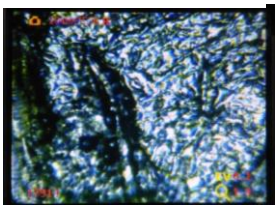
Perkasa Cultivar (Urea)



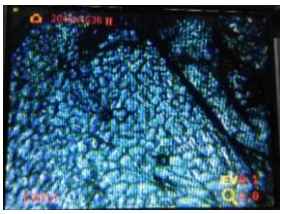
Lebat-3 Cultivar (Urea)



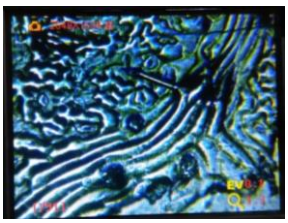
Perkasa Cultivar LOF 10%



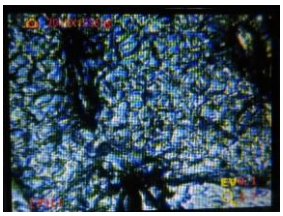
Lebat-3 Cultivar LOF 10%



Perkasa Cultivar LOF 20%



Lebat-3 Cultivar LOF 20%



Perkasa Cultivar LOF 30%

Lebat-3 Cultivar LOF 30%

F

Figure 2. stomata on Perkasa and Lebat-3

The application of nitrogen fertilizers also affects the greenness of the leaves. Nitrogen is an important part of increasing leaf greenness in plants (Faustina et al., 2015). According to Pramitasari et al. (2016) stated that the N nutrient affects plant growth, appearance, color so that the plant parts turn green because they contain chlorophyll. The results of Table 4 also show that the responses given to each cultivar to the N source are also different. According to Pamungkas and Supijatno (2017), the level of greenness of the leaves indicates that the plant has sufficient nitrogen levels and indicates healthy planting conditions. In Perkasa cultivar, the highest average leaf greenness was 30% LOF treatment and followed by Urea fertilizer treatment of 100 kg ha^{-1}, LOF 20% and LOF 30%. In Lebat-3 cultivar, the highest average leaf greenness was treated with Urea fertilizer 100 kg ha^{-1} and followed by LOF 10%, LOF 20% and LOF 30% treatment. The observations indicated that the average value of leaf greenness of plants treated with nitrogen fertilizers with organic and inorganic fertilizers was much higher than plants without nitrogen fertilizers. The treatment without N fertilizer had low greenness.

The results showed that the provision of N sources and cultivar affected the number of bean pods per plant. Perkasa cultivar with 20% LOF produced the highest number of bean pods per plant and was not significantly different from the treatment of 10% liquid organic fertilizer and urea. Cultivar Lebat-3 with LOF 10% produced the highest number of bean pods and was not significantly different from the urea fertilizer treatment. The use of bean cultivar in N fertilizer had a different effect on the number of bean pods. Perkasa cultivar with 20% LOF produced more number of bean pods compared to the Lebat-3 cultivar treatment. In this study, the provision of LOF 20% and LOF 10% was sufficient for the growth of green beans and was no different from urea. According to Permanasari et al. (2014) In generative plant growth, chlorophyll formation will play a very important role in the process of plant photosynthate formation. In addition, the use of cultivar and N also affects the genetic characteristics of plants in the number of pods. Based on the research results, it is suspected that nitrogen can increase the chlorophyll content of leaves, which is important for photosynthesis and has a role in the number of bean pods. In addition, plant genetic traits in the two cultivar influenced the different responses to N fertilization. According to Beshir et al. (2015) stated that different cultivars have an effect in increasing the photosynthetic area (leaf area index), so that more pods are formed.

The results showed that there was a symptom of N deficiency in green bean leaves without nitrogen fertilizer. Symptoms that arise are the color of old leaves that are yellowish green compared to normal leaves which are fresh green. According to Erythrina et al. (2016) Nitrogen is the main nutrient in the formation of leaf color because nitrogen will play a role in increasing leaf green matter and protein. Giving nitrogen will increase the green color of the leaves and if it is

deficient in nitrogen, it reduces the formation of chlorophyll, causing the leaves to appear yellowish. According to Bojovic et al. (2009) nitrogen deficiency causes a reduction in leaf greenish color, decreases leaf area, and reduces photosynthesis because nitrogen has a linear correlation with leaf chlorophyll formation.

Lebat-3 cultivar requires a lower LOF concentration compared to Perkasa cultivar. From the results in Table 4, it can be seen that the Perkasa Cultivar 20% LOF treatment resulted in higher production compared to other treatments and was not significantly different from the 100% recommended Urea treatment. This is thought to be due to the excess liquid organic fertilizer which does not undergo a dissolving process so that it can be easily absorbed by plants. (Ginandjar et al., 2019). In Lebat-3 cultivar, 10% LOF treatment resulted in higher production compared to other treatments and was not significantly different from the recommended 100% Urea treatment. According to Chaturdevi (2005) , nitrogen fertilization with the right dose can affect grain yield in rice and other parameters in each cultivar. The use of N sources for plants affects the results of the photosynthesis process. This is supported by Rathke (2005), who states that increasing the source of N can increase yield. This is due to the function of nitrogen which can increase the chlorophyll content so that the rate of photosynthesis also increases and produces high carbohydrates for plants (Chaudary et al., 2015). The production of Lebat-3 cultivar was lower than that of Perkasa cultivar in the recommended 100% Urea treatment and 20% LOF. Ratnasari et al. (2015), stated that the differences in the characters possessed by cultivar are caused by differences in genetic composition in each cultivar so that they show different responses to the environment and production factors. The positive effect of using liquid organic fertilizers from lamtoro leaves in increasing crop yields was also found by Duaja et al. (2013) on chickpeas, Palimbungan et al. (2006) on mustard plants, Septirosya et al. (2019) on tomato plants, and Ainiya et al. (2019) on sweet corn plants.

CONCLUSION

Based on the research results, the use of LOF lamtoro leaves with the right dose can be used as an alternative to N fertilization in plants. Nitrogen is very influential on the growth and production of green beans. Treatment of bean cultivar did not significantly affect the growth parameters of green beans. The effect of 20% LOF can increase the parameters of the number of trifoliate leaves (8.81 leaves) and plant dry weight (4.52 g), while Urea can increase the growth variable of plant height (171.48 cm), chlorophyll (15.93 mg). g-1FW), carotenoids (2.35 mg g-1FW) and the number of stomata (22/mm2). Treatment of Perkasa cultivar at 20% LOF resulted in the highest bean production of 846.67 kg ha^{-1}, while treatment of Lebat-3 cultivar at 10% LOF resulted in the highest bean production of 515.56 kg ha^{-1}.

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ACKNOWLEDGMENT

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REFERENCES

Ainiya, M., M. Fadli, dan R. Despita. 2019. Peningkatan Pertumbuhan dan Hasil Jagung Manis dengan Pemanfaatan Trichokompos dan LOF Daun Lamtoro. *Agrotechnology Research Journal.* 3(2): 69-74.

Amin, M.E.H. 2011. Effect of Different Nitrogen Sources on Growth, Yield and Quality of Fodder Maize (*Zea mays* L.). *Journal of the Saudi Societyof Agricultural Sciences*. 10 (1): 17-23.

Arista, D., Suryono, dan Sudadi. 2015. Efek dari Kombinasi Pupuk N, P dan K terhadap Pertumbuhan dan Hasil Kacang Tanah pada Lahan Kering Alfisol. *Jurnal Agrosains*. 17(2): 49-52.

Beshir, H.M., B. Tesfaye, R. Bueckert and B. Tar'an. 2015. Pod Quality of Snap Bean as Affected by Nitrogen Fixation, Cultivar and Climate Zone under Dryland Agriculture. *African Journal of Agricultural Research*. 10(32): 3157-3169.

Bojovic, B. and A. Markovic. 2009. Correlation Between Nitrogen and Chlorophyll Content in Wheat (*Triticum aestivum* L.). *Kragujevac Journal Science.* 31(1): 69-74.

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Bojovic, B. and J. Stojanovic. 2005. Chlorophyll and Carotenoid Content in Wheat Cultivars as a Function of Mineral Nutrition. *Archives of Biological Science Belrgade*. 57 (4): 283-290.

Camara, C.R.S., C.A. Urrea, dan Vicki Sichlegel. 2013. Pinto Beans (*Phaseolus vulgaris* L.) as a Functional Food: Implications of Human Health. *Agriculture.* 3(1): 90-110.

Chaturdevi, I. 2005. Effect of Nitrogen Fertilizers on Growth, Yield and Quality of Hybrid Rice (Oryza Sativa). *Journal Central European Agriculture.* 6(4): 611-618.

Chaudhary, M.M., A.S. Bhanvadia, dan P.N. Parmar. 2015. Effect of Integrated Nutrient Management on Growth, Yield Attributes and Yield of Cabbage (Brassica oleracea Var. Capitata L.) Under Middle Gujarat Conditions. *Trends in Bioscience.* 8(8): 2164-2168.

Duaja, M.D. 2013. Pengaruh Jenis Bahan Dasar dan Dosis Pupuk Organik Cair terhadap Pertumbuhan dan Hasil Buncis (Phaseolus vulgaris L.*). Bioplantae.* 2(1): 47-54.

Duaja, M.D., Mukhsin, dan R. Sijabat. 2013. Analisis Pertumbuhan dan Hasil Dua Varietas Buncis (*Phaseolus vulgaris* L.) pada Perbedaan Jenis Pupuk Organik Cair. *Program Studi Agroekoteknologi, Fakultas Pertanian Universitas Jambi.* 2(1): 47-54.

Erythrina. 2016. Bagan Warna Daun: Alat untuk Meningkatkan Efisiensi Pemupukan Nitrogen pada Tanaman Padi. *Jurnal Litbang Pertanian*. 35(1): 1-10.

Fahmi, A., Syamsudin, S.N.H. Utami., dan B. Radjagukguk. 2010. Pengaruh Interaksi Hara Nitrogen dan Fosfor terhadap Pertumbuhan Tanaman Jagung (Zea mays L.) pada Tanah Regosol dan Latosol. Berita Biologi. 10(3): 297-304.Faustina, E., Sudrajat, dan Supijatno. 2015. Optimization of Nitrogen and Phosphorus Fertilizer on Two Years Old of Oil Palm (Elaeis guineensis Jacq.). *Asian Journal of Applied Sciences.* 3(3): 421-428.

Faustina, E., Sudradjat, dan Supijatno. 2015. Optimization of Nitrogen and Phosphorus Fertilizer on Two Years Old of Oil Palm (*Elaeis guineensis* jacq.). *Asian Journal of Applied Sciences*. 3(3): 421-428.

Ginandjar, S., B. Prasetya, W. Nugraha, dan M. Subandi. 2019. The Effect of Liquid Organic Fertilizer of Vegetable Waste and planting Media on Growth and Yield of Strawberry (Fragaria spp.) Earlibrite Cultivar.

Hendriyani, I.K., Y. Nurchayati, dan N. Setiari. 2018. Kandungan Klorofil dan Karotenoid Kacang Tunggak (*Vigna unguiculata* (L.) Walp.) pada Umur Tanaman yang Berbeda. *Jurnal Biologi Tropika.* 1(2): 38-43.

Hidayat, O. dan Suharyana, A. 2019. Pengaruh Dosis Pupuk Organik Cair Daun Lamtoro terhadap Pertumbuhan dan HAsil Tanaman Pakcoy (*Brassica rapa* L.) Varietas Nauli-F1. *Jurnal Ilmiah Pertanian.* 7(2): 57-63.

Iriyani, D. dan P. Nugrahani. 2014. Kandungan Klorofil, Karotenoid dan Vitamin C Beberapa Jenis Sayuran Daun pada Pertanian Periurban di Kota Surabaya. *Jurnal Mtematika, Sains, dan Teknologi.* 15(2): 84-90.

Jeksen, J., dan C. Mutiara. 2017. Analisis Kualitas Pupuk Organik Cair dari Beberapa Jenis Tanaman Leguminosa. Jurnal Pendidikan MIPA. 7(2): 124-130.

Madusari, S. 2019. Processing of Fibre and Its Application as Liuid Organic Fertilizer in Oil Palm (*Elaeis guineensis* Jacq.) Seedling for Sustainable Agriculture. *Joulnal of Applied Science and Advanced Technology*. 1 (3): 81-90.

Maghfoer, M.D., Koesriharti, dan T. Islami, dan N.D.S. Kanwal. 2018. A Study of the Efficacy of Various Nutrient Sources on the Growth and Yield of Cabbage. *AGRIVITA Journal of Agricultural Science.* 40(1): 168-176.

Pahlevi, R. W., B. Guritno, dan N.E. Suminarti. 2016. Pengaruh Kombinasi Proporsi Pemupukan Nireogen dan Kalium Pada Pertumbuhan, Hasil dan Kualitas Tanaman Ubi Jalar (Ipomoea batatas (L.) Lamb) Verietas Cilembu pada Dataran Rendah. *Jurnal Produksi Tanaman*. 4(1): 16-22.

Palimbungan, N., R. Labatar dan F. Hamzah. 2006. Pengaruh Ekstrak Daun Lamtoro sebagai Pupuk Organik Cair terhadap Pertumbuhan dan Hasil Produksi Tanaman Sawi. *Jurnal Agrisitem*. 2(2): 96-101.

Pamungkas, M.A., dan Supijatno. 2017. Pengaruh Pemupukan Nitrogen terhadap Percabangan Tanaman Teh (Camelia sinensis (L.) O. Kuntze) untuk Pembentukan Bidang Petik. *Buletin Agronomi*. 5(2): 234-41.

Pary, C. 2015. Pengaruh Pupuk Organik (Daun Lamtoro) dalam berbagai konsentrasi terhadap Pertumbuhan Tanaman Sawi. *Jurnal Fikratuna.* 7(2): 247-255.

Permanasari, I., M. Irfan, dan Abizar. 2014. Pertumbuhan dan Hasil Kedelai (*Glycine max (*L.) Merill) dengan Pemberian *Rhizobium* dan Pupuk Urea pada Media Gambut. *Jurnal Agroteknologi.* 5(1) ; 29-34.

Pramitasari, H.E., T. Wardiyanti, dan M. Nawawi. 2016. Pengaruh Dosis Pupuk Nitrogen dan Tingkat Kepadatan Tanaman terhadap Pertumbuhan dan Hasil Tanaman Kailan (*Brassica oleraceae* L.). *Jurnal Produksi Tanaman.* 4(1): 49-56.

Proklalmasiningsih, E., I.D. Prijambada, D. Rachmawati, dan R.P. Sancaningsih. 2012. Laju Fotosintesi dan Kandungan Klorofil Kedelai pada Media Tanam Masam Masam dengan Pemberian Garam Aluminium. *AGROTROP*. 2(1): 17-24.

Putri, F.M., S.W.A. Suedy., dan S. Darmanti. 2017. Pengaruh Pupuk Nanosiliki terhadap Jumlah Stomata, Kandungan Klorofil dan Pertumbuhan Padi Hitam (Oryza sativa L. cv. japonica). *Buletin Anatomi dan Fisiologi*. 2(1): 72-79.

Rahimi, A., S.S. Moghaddam, M. Ghiyasi, S. Heydarzadeh, K. Ghazizadeh and J. Popovi´c-Djordjevi´c. 2019. The Influence of Chemical, Organic and Biological Fertilizers on Agrobiological and Antioxidant Properties of Syrian Cephalaria (*Cephalaria Syriaca* L.). *Journal Agriculture.* 9 (122): 1-13.

Rathke, G.W., O. Christen, dan W. Diepenbrock. 2005. Effects of nitrogen source and rate on productivity and quality of winter oilseed rape (Brassica napus L.) grown in different crop rotations. *Field Crops Research*. 94 (1) 103–113.

Ratnasari, D., M.K. Bangun, dan R.I.M. Damanik. 2015. Respon Dua Varietas Kedelai (Glycine max (L.) Merrill.) pada Pemberian Pupuk Hayati dan NPK Majemuk. *Jurnal Oline Agroteknologi*. 3(1): 276-82.

Razaq, M., P. Zhang, H. Shen, and Salahuddin. 2017. Influence of Nitrogen and Phosphorous on The Growth and Root Morphology of Acer Mono. *Journal PLoS ONE*. 12(2): 1-13.

Rihana, S., Y.B.S. Heddy, dan M.D. Maghfoer. 2013. Pertumbuhan dan Hasil Tanaman Buncis (*Phaseolus viulgaris* L.) pada berbagai Dosis Pupuk Kotoran Kambing dan Konsentrasi Zat Pengatur Tumbuh Dekamon. *Jurnal Produksi Tanaman*. 1(4): 369-377.

Rizqiani, N.F., E. Ambarwati, dan N.W. Yuwono. 2007. Pengaruh Dosis dan Frekuensi Pemberian Pupuk Organik Cair Terhadap Pertumbuhan dan Hasil Buncis (*Phaseolus vulgaris* L.) Dataran Rendah. *Jurnal Ilmu Tanah dan Lingkungan*. 7(1): 43-53.

Santosa, M., M.D. Magfoer, dan H. Tarno. 2017. The Influence of Organic and Inorganic Fertilizers on the Growth and Yield of Green Bean, *Phaseolus vulgaris* L. Gron in Dry and Rainy Season. *AGRIVITA Journal of Agricultural Science*. 39(3): 296-302.

Septirosya, T., R. Hartono, dan T. Aulawi. 2019. Aplikasi Pupuk Organik Cair Daun Lamtoro pada Pertumbuhan Hasil Tanaman Tomat. *Agroscript*. 1(1): 1-8.

Sinaga, A.S., B. Guritno, dan Sudiarso. 2017. Pengaruh Dosis Kompos Sampah Rumah Tangga Terhadap Pertumbuhan dan Hasil Tiga Varietas Buncis Tipe Tegak (*Phaseolus vulgaris* L.). *Jurnal Produksi Tanaman*. 5(6):947-956.

Syaifudin, Dahlan dan Buhaerah. 2013. Pengaruh Urea terhadap Produksi Tanaman Tomat. *Jurnal Agrisistem.* 9(1): 1-9.

Wijiyanti, P., E.D. Hastuti, dan S. Haryanti. 2019. Pengaruh Masa Inkubasi Pupuk dari Air Cucian Beras terhadap Pertumbuhan Tanaman Sawi Hijau (*Brassica juncea* L.). *Buletin Anatomi dan Fisiologi.* 4(1): 41-28.

Zainal, M., A. Nugroho, dan N.E. Suminarti. 2014. Respon Pertumbuhan dan Hasil Tanman Kedelai (*Glycine max* (L.) Merill) pada Berbagai Tingkat Pemupukan N dan Pupuk Kandang Ayam. *Jurnal Produksi Tanaman*. 2(6): 484-490.

1

AUTHORS RESPOND

Section	Reviewers Comments	Author Respond
Abstract & Keywords	what is the right doses?	The right doses is deleted as it has explained in the next sentence
	Dry weight	It is dry weight of leaves and stem, and it has been explained in methods
	please, re-write it by avoiding words and sentences represented in the title.	The key words has been fixed it, and the key words were not using title words
Introduction		
	Change kirinyuh into English	Kirinyuh has been changed into English *slam weed*
	References are needed for both sentences.	The 2 references has been added
Materials method	Name of specto?	a spectrophotometer (Cary 100 UV-Vis)
Results and Discussion	LOF analyses in Results	LOF analyses has been moved to Method section, so it is more appropriate
	Revise Results and Discussion	Result and Discussion has been combined as one section only, and some discussion has been added

Conclusion		
Figure 1	Revise Fig 1 as one picture	Fig 1 has been consolidated as one figure
Figure 2	Well, but where are statistically treated data, while the photo doesn't provide any reliable information. It is just a case observation.	**.Figure of** *Comparison of deficiency N (a) The color of the leaf deficient N (b) The color of the normal leaf, has been deleted*
REFERENCES		References has been updated

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The growth and yield responses of two bean cultivars to organic and inorganic nitrogen sources

Abstract. The productivity of beans is increased by selecting the best cultivar and applying fertilizers according to the needs of the plant. In addition, the application of high-yielding cultivar and N fertilizers with the right dosage is used to improve low production. Therefore, this study aims to determine the effect of nitrogen sources on the growth and yield of two beans cultivars. A 5×2 factorial treatment was used in a randomized block design with three replications. The first factor is the Perkasa and Lebat-3 cultivar, while the second is organic and inorganic nitrogen fertilizer, namely control, urea 100 kg ha^{-1}, as well as 10, 20, and 30% concentrations of liquid organic fertilizer from lamtoro leaves. The results showed that the use of liquid organic fertilizers with the right dose is applicable as an alternative to nitrogen fertilization. Furthermore, the 20% concentration produced the highest number of trifoliate leaves (8.81 leaves) and dry weight (4.52 g), while urea produced the highest plant height (171.48 cm), chlorophyll (15.93 mg g^{-1} FW), carotenoids (2.35 mg g^{-1} FW) and the number of stomata (22 mm^{-2}). Based on the results, the use of 20% liquid organic fertilizer with Perkasa cultivar showed the best effect on the number of pods per plant (5.67), and yield (846.67 kg ha^{-1}).

Keywords: chlorophyll, cultivar, liquid organic fertilizers, stomata, urea,

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INTRODUCTION

Green bean (*Phaseolus vulgaris* L.) constitutes is one of the legume plants and servinge as a source of vegetable protein. The plant is widely consumed by the Indonesians due to its important role in fulfilling health needs as a nutritious food ingredient. Rihana et al. (2013), stated that beans are source of vegetable protein, rich in vitamins A, B, C and has great potential for the treatment of several diseases such as oxidative stress, cardiovascular disease, cancer, and diabetes (Camara et al., 2013). Furthermore, as the population grows, the need for in fresh food and vegetables continue to also increases. Therefore, to increase the production of green beans, it is necessary to apply good cultivation techniques such as applying a balanced fertilization that fulfills the nutritional needs for growth. The productivity of green beans is also increased by using improved cultivars. Meanwhile, there are numerous green beans cultivar available in the market. Ratnasari et al. (2015), stated that each cultivar has different genetic characteristics, which lead to differences in appearance, character, as well as responses to production factors.

Fertilization is one way to meet the nutritional needs of nitrogen in green beans. Meanwhile, nitrogen is an important nutrient required by green beans for the formation of chlorophyll, protoplasm, protein, and nucleic acids (Fahmi et al., 2010). Fertilization with nitrogen (N) is derived from organic and inorganic fertilizers such as uUrea. Furthermore, green bean nutritional need for N is higher than any other nutrients. Pahlevi et al. (2016) reported that nitrogen affects the photosynthetic process in plants as well as the photosynthate produced. Maghfoer et al. (2018), also stated that the application of inorganic fertilizers produced large growth and plant yield. However, the continueous use of inorganic fertilizers leads to low soil fertility and productivity. Therefore, an alternative approach is needed to reduce the use of inorganic fertilizers, via organic fertilization.

Nitrogen is commonly supplied alternatively to plants using Liquid Organic Fertilizers (LOF). It is an organic fertilizer available in liquid form and contains nutrients in the form of a solution.,, Therefore, it is easily absorbed by plants. Furthermore, it is applied via sprinkling or spraying on the leaves or stems of plants. Organic fertilizers are made from plant waste available in the environment. In particular, liquid organic fertilizers are more beneficial because its their distribution is adjustable to the needs of plants (Ginandjar et al., 2019). One example of organic matter widely used as a liquid organic fertilizer source of nitrogen is lamtoro leaves (*Leucaena leucocephala*). Liquid organic fertilizer derived from this plant contains nitrogen nutrients needed by plants (Jeksen and Mutiara, 2017). The N content in lamtoro leaves is quite high, namely 3.84%;, therefore, it is a source of organic nutrient to increase the growth and yield of green beans (Palimbungan et al., 2006). Furthermore, the application of liquid organic fertilizers increased the fresh weight of pods in green beans (Rizqiani et al., 2007), and provided the highest yield of pods and bean per plant in slam weed (*Chromolaena odorata* L.) (Duaja, 2013).

Plant cultivar is a factor that greatly determines the quality of agricultural products. The use of high-yielding beans cultivar increases productivity and yield quality. Each cultivar has specificdifferent genetic characteristics and traits which leads to differences in the respective character and appearance. Examples of high-yielding beans cultivar include Perkasa and Lebat-3. The advantages of Perkasa cultivar include resistance to leaf rust disease, early maturity as well as the large

and long pods. In contrast, the advantages of Lebat-3 cultivar include well adapted to the low-highlands, early maturity and has high yield potential. Sinaga et al. (2017) showed that the use of cultivars had a significant effect on the growth and yield of beans. Furthermore, Duaja (2013) stated that there is an interaction between the use of bean cultivar with liquid organic fertilizers doses on the number of pods and productivity.

The fertilizer requirement by each cultivar is usually different., Tthis is caused by due to the individual genetic characteristics. Hhence, the selection of fertilizer types and requirements need to be considered. Besides, the appropriate doses of liquid organic fertilizers also influence plant growth. Ratnasari et al. (2015), stated that variations in genetic traits of cultivar lead to different responses to environmental and production factors. There are only few studies on the different organic and inorganic nitrogen sources. In this study, two beans cultivars were hypothesized to produce different responses to treatments with various types and doses of inorganic-and-organic-sources-based nitrogen. Therefore, this study aims to determine the effect of inorganic and organic nitrogen sources on the growth and yield of two beans cultivars.

MATERIALS AND METHODS

This study was conducted at the experimental research area of Pemanggilan, Natar, Lampung province, Indonesia from January to March 2020. The soil was first cultivated using hoes, loosened to a depth of 20-30 cm, evenly processed and an experimental plot was made with a size of 3 x 2.5 m. Furthermore, the Perkasa and Lebat-3 cultivars were planted by drilling the planting holes, while two seeds each were planted with a spacing of 40 cm x 40 cm.

The (2 x 5) factorial treatment was used in a randomized block design (RBD) with three replications totaling 30 experimental units. The first factor was the bean cultivars, namely Perkasa and Lebat-3, while the second was the source of nitrogen, namely control, urea 100 kg ha^{-1}, as well as 10%, 20%, and 30% LOF. Furthermore, the data were analyzed using analysis of variance procedures, while the means were compared using the Honestly Significant Difference (HSD) of 5%.

The liquid fertilizer was prepared by mixing chopped lamtoro leaves (1 kg of lamtoro leaves: 2 liters of water), with 200 ml of molasses and 200 ml of EM4 in a drum, the mixture was then fermented for 15 days and the liquid was filtered. The inorganic fertilizers given include urea 100 kg ha^{-1} (75 g $plot^{-1}$) at the beginning and 4 weeks after planting (WAP), while SP-36 200 kg ha^{-1} (150 g $plot^{-1}$) and KCL 100 kg ha^{-1} (75 g $plot^{-1}$) were given at the beginning of planting. Fertilization was applied in a strip with a distance of 5 cm from the plant.

The liquid organic fertilizer was applied by spraying on the top and bottom of the plant (60:40). This was carried out once a week using a concentration of 10% (100 ml LOF solution + 900 ml water), 20% (200 ml LOF solution + 800 ml water), and 30% (300 ml LOF solution + 700 ml water).

Plant maintenance includes weeding manually and thinning, while the harvest was carried out in stages according to the age of each cultivar. The characteristics of beans ready for harvest include young and gloomy pod color, rough skin surface, less prominent seeds in the pods which usually make a popping sound when the pods are broken especially between 2-3 weeks after flowering.

The parameters observed include plant height (6 WAP), number of trifoliate leaves (6 WAP), chlorophyll, carotenoids (5 WAP), number of stomata (5 WAP), greenness of leaves (5 WAP), symptoms of N deficiency, number of pods per plant, dry weight, and yield. Furthermore, the replica method modified from Paul (2017) was used to observe the stomata on the leaf surface. The leaves were first cleaned with a tissue to remove dust or dirt and then rubbed with a transparent nail polish, and allowed to dry for a few minutes. A transparent strip tape measuring 1 cm x 1 cm in size was applied, smoothed, and then peeled off slowly. The sample produced was then attached to the slide and observed under a microscope.

The chlorophyll and carotenoid contents were measured using the spectrophotometric method. The green beans were crushed using a mortar and 100 ml of 70% alcohol solution was added. Furthermore, the extract was filtered and the filtrate was placed in a cuvet to measure the total chlorophyll and carotenoid contents using a spectrophotometer. The chlorophyll and carotenoid contents were calculated using the formula (Rahimi et al., 2019):

Chlorophyll *a* = 11,24 x A_{662} - 2,04 x A_{645}

Chlorophyll *b* = 20,13 x A_{645} - 4,19 x A_{662}

Chlorophyll total = 7,05 x A_{662} + 18,09 x A_{645}

$$\text{Carotenoid} = \frac{(1000 \times A470 - 1{,}90 \times \text{clorofil a} - 63{,}14 \times \text{clorofil b})}{214}$$

RESULTS AND DISCUSSION

The LOF analysis results showed that the N content in the lamtoro leaves was 0.16%, C-organic 3.08%, N-total 0.16%, P-total 0.18% and K 0.56% with a pH of 3.64. Furthermore, the C/N ratio was 19.25, which fulfills the standard of organic

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fertilizer. A good C/N ratio ranges between 15-20%, meanwhile, a high ratio decreases the biological activity of microorganisms, and a very low ratio causes denitrification (Watson et al., 2002)

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Table 1. Effects of treatment with different nitrogen sources and cultivar on plant height, number of trifoliate leaves, and dry weight.

Treatment	Plant height (cm)	Number of trifoliate leaves	Dry weight (g)
Perkasa Cultivar	133.60 a	7.20 a	3.21 a
Lebat-3 Cultivar	137.63 a	8.11 a	3.17 a
$HSD_{0,05}$	18.47	1.43	0.92
Control	94.71 c	5.57 b	1.95 b
Urea	171.48 a	8.50 ab	3.78 ab
10% LOF	150.60 ab	9.11 a	3.13 ab
20% LOF	148.02 ab	8.81 ab	4.52 a
30% LOF	113.29 bc	6.30 ab	2.58 ab
$HSD_{0,05}$	42.11	3.25	2.09

In a column, common values letter(s) do not differ significantly at $p \leq 0,05$ as per HSD

The results showed that the combination of N sources and cultivar did not affect plant height, numbers of trifoliate leaves, and dry weight. Plant height in the control was shorter than the treatment with urea, as well as 10, and 20% LOF, meanwhile, the application of N sources from urea, as well as 10, 20, and 30% LOF showed no significant differences (Table 1). Moreover, the numbers of trifoliate leaves in the control were lesser compared to 10, 20, and 30% LOF, while the number of trifoliate leaves treated with urea, and the different LOF concentrations showed no significant differences (Table 1). Application of 20% LOF produced heavier dry weight compared to control, while the application of urea, and the different LOF concentrations were not different (Table 1).

Table 2. Effects of treatment with different nitrogen sources and cultivar on chlorophyll, carotenoid, and numbers of stomata.

Treatment	Chlorophyll (mg g^{-1} FW)	Carotenoid (mg g^{-1} FW)	The number of stomata (mm^{-2})
Perkasa Cultivar	12.92 a	1.59 a	14.40 a
Lebat-3 Cultivar	13.24 a	1.88 a	14.67 a
$HSD_{0,05}$	1.16	0.29	3.50
Control	9.68 b	1.38 b	8.50 c
Urea	15.93 a	2.35 a	22.00 a
10% LOF	15.56 a	1.69 ab	11.50 bc
20% LOF	13.77 a	1.76 ab	17.83 ab
30% LOF	10.46 b	1.47 b	12.83 bc
$HSD_{0,05}$	2.64	0.67	8.05

In a column, common values letter(s) do not differ significantly at $p \leq 0,05$ as per HSD

Based on the results, the application of N sources and cultivars affected chlorophyll, carotenoids, and the number of stomata in green beans. Meanwhile, the parameters of chlorophyll, carotenoids, and the number of stomata in the Perkasa cultivar did not differ significantly compared to Lebat-3. The chlorophyll content in the control was lower than the urea treatment, and was not different between the control and 30% LOF. Furthermore, the chlorophyll content for the urea treatment did not differ compared to 10 and 20% LOF (Table 2). The application of urea produced a higher carotenoid content compared to the control, but was not different compared to 10, and 20% LOF treatments (Table 2). Also, the application of 10, 20, and 30% LOF showed no differences in the carotenoid content compared to the control. The application of urea produced a higher number of stomata compared to the control, while the application of urea and 20% LOF showed no differences in the number of stomata. Similarly, LOF applications of 10, and 30% also produced no difference in the numbers of stomata (Table 2).

Table 3. Effects of treatment nitrogen source and cultivar on dry weight, plant,number of pods, greeness leaves and yield two cultivar bean.

Parameter	Source N	Cultivar		$HSD_{0,05}$
		Perkasa	Lebat-3	
Greeness of the leaves	Control	18.31 Ab	17.54 Ab	
	Urea	27.79 Aa	28.91 Aa	9.34
	10% LOF	20.13 Aab	28.11 Aa	
	20% LOF	24.06 Aab	24.19 Aa	
	30% LOF	28.96 Aa	21.81 Aab	
Number of pods	Control	5.46 Ac	2.50 Ab	
	Urea	9.13 Aab	9.05 Aa	4.40
	10% LOF	9.96 Aab	12.13 Aa	
	20% LOF	13.38 Aa	4.67 Bab	
	30% LOF	6.92 Abc	3.75 Ab	
Yield of green bean (kg ha^{-1})	Control	231.11 Ac	113.33 Ab	
	Urea	720.89 Aab	429.78 Aa	220.24
	10% LOF	565.33 Ab	515.56 Aa	
	20% LOF	846.67 Aa	181.33 Bb	
	30% LOF	333.78 Ac	148.00 Ab	

Mean followed by the same letter (capital horizontal and small letter read vertically) do not differ significantly at $p \leq 0,05$ as per HSD

The results showed that the level of leaf greenness, number of pods, and bean production were significantly affected by the interaction of N sources and bean cultivar (Table 3). The 30% LOF treatment with Perkasa cultivar and urea with Lebat-3 produced the highest level of leaf greenness compared to the others but were still significantly the same as the other treatments with different N sources. Moreover, the data indicated that the average value of leaf greenness of plants treated with organic and inorganic fertilizers was higher than the control plants without nitrogen fertilizers. The treatment without N fertilizer had low greenness. Perkasa cultivar with 20% LOF produced a statistically higher number of bean pods compared to the Lebat-3. Similarly, Perkasa cultivar with 20% LOF produced the highest number of bean pods per plant but was not significantly different from the 10% LOF and urea treatments. Furthermore, Lebat-3 cultivar with LOF 10% produced the highest number of bean pods but was not significantly different from the urea and 20% LOF treatment. There was a significant difference between the yield of the two cultivars with 20% LOF treatment. The Perkasa cultivar treated with urea and LOF 20% produced a higher yield, while Lebat-3 with urea and 10% LOF treatment produced a higher yield compared to other treatments (Table 3).

Symptoms of N Deficiency (Figure 1.)

Symptoms of nitrogen nutrient deficiency were found in the green bean leaves. This deficiency occurs in the leaves of plants without treatment (control), characterized by a yellowish appearance compared to the leaves treated with nitrogen fertilizer. Normal leaves have fresh green leaf color (Figure 1). Santosa et al. (2017) stated that the use of chemical fertilizers not only increases production costs but also decreases productivity and gradually leads to higher risks. Furthermore, nitrogen requirement by plants is needs to be in accordance with the demand of the plant. Zainal et al. (2014) stated that the lack of this nutrient leads to leaf chlorosis indicated by yellowing of the leaves. In contrast, excess nitrogen accelerates plant growth, especially on the stems, the leaves turn dark green.

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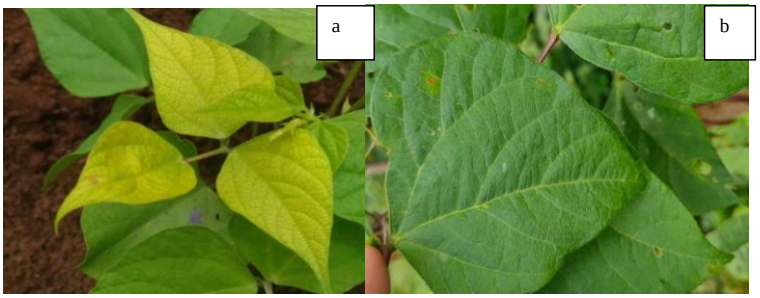

Figure 1. *Comparison of deficiency N (a) The color of the leaf deficient N (b) The color of the normal leaf*

Discussion

The results showed that the Perkasa and Lebat-3 cultivar had no significantly different effect on vegetative growth, while the application of inorganic-and-organic-sources-based nitrogen affected vegetative growth parameters namely plant height, numbers of leaves, and dry weight (Table 1). This is supported by Pamungkas and Supijatno (2017) which reported that nitrogen fertilizer significantly affect the growth of tea plants. In addition, Amin (2011), reported that nitrogen increased plant growth and height to produce numerous internodes which resultantly produce more leaves.

The number of trifoliate leaves in green beans is influenced by the availability of N nutrients. This parameter increased significantly after the application of organic nitrogen sources. Based on the results, the 10% LOF treatment produced the highest number of trifoliate leaves but was not different from the 20, and 30% LOF, as well as urea treatment. Pramitasari et al. (2016), stated that higher N absorption by plant leads to larger growth of the leaves. Furthermore, the application of LOF from lamtoro leaves showed significant growth in plant height, numbers of leaves, and fresh weight of mustard greens (Pary, 2015) highest yield on the number of pakcoy leaves (Hidayat and Suharyana, 2019), and increased the growth and number of fruit in tomato plants (Septirosya et al., 2019). The number of trifoliate leaves is a plant characteristic that affects the speed of photosynthesis to capture sunlight. Meanwhile, liquid organic fertilizers are rich in nitrogen and increases the number of plant leaves.

The application of nitrogen sources affected the dry weight of the plant. LOF 20% produced the highest dry weight but was not significantly different from urea and 10% LOF. Furthermore, it was assumed that the availability of sufficient nutrients in the treatment affects plant growth and yield. The high dry weight was influenced by the initial vegetative growth as this parameter is related to the number of leaves and fresh weight. Arista et al. (2015) stated that nitrogen is an element that functions to increase leaf size and the percentage of protein. Meanwhile, Madusari (2019) reported that liquid organic fertilizers affect plant growth and nutrient absorption by increasing plant stem diameter and dry weight.

Based on the results, the application of inorganic-and-organic-sources-based nitrogen affected physiological characters namely chlorophyll, carotenoids, number of stomata and greenness of leaves. However, chlorophyll and leaf carotenoids were not affected by the bean cultivar. Bojovic et al. (2005), stated that the leaf color of certain cultivars did not directly correlate with chlorophyll content. Meanwhile, the chlorophyll and carotenoid contents are affected by the availability of N nutrients. Wijiyanti (2019) reported that nitrogen is the main nutrient needed for the formation of chlorophyll and carotenoids. This is also in line with Razaq et al. (2017) which found that chlorophyll and carotenoids synthesis depends on optimal N availability, therefore, nitrogen plays an important role in the formation of photosynthetic pigments. Furthermore, Hendriyani et al., (2018) reported that carotenoids and chlorophyll are complementary pigments, but carotenoids are fewer in number because it play a role in the absorption of light by chlorophyll.

The number of stomata in the two cultivars of green beans was affected by the application of nitrogen fertilizers (Table 2). The two cultivars showed similar responses, while the application of inorganic fertilizers produced more stomata compared to other treatments. Nitrogen fertilizer treatment on green beans had a significant effect on the number of stomata (Figure 1). Furthermore, urea and 20% LOF produced a higher number of stomata compared to the control. Meanwhile, the number of stomata in plants affects metabolic processes in plants such as photosynthesis. The rate of photosynthesis increases as the number of stomata rises; hence, plant productivity also increases. This is supported by Proklapmasiningsih et al. (2012), which stated that the rate of photosynthesis in plants is closely related to the yield. Moreover, Putri et al. (2017), reported that stomata play an important role in photosynthesis by acting as a surface for CO_2 exchange in the leaves.

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You should decide whether you present separately Results and separately Discussion or you present the joint section Results and Discussion here.

Many of the points indicated in this section now do repeat the information represented in the section Results and Discussion above. Please, select one of the ways listed above by me, and then re-write two sections ("Discussion" and "Results and Discussion) either as two sections ("Results" and then "Discussion") or one section ("Results and Discussion"). Once you perform this correction, it will be possible to evaluate the discussion of the obtained results. But now I would be forced to read twice the same results and discussion. Finally, please, note that each cited reference should be discussed closely in relation to the results obtained in your study. This is not enough to present a set of statements related to this research topic. These studies should be in accordance with your results or contradict to your results. Why? Your explanation will improve this paper.

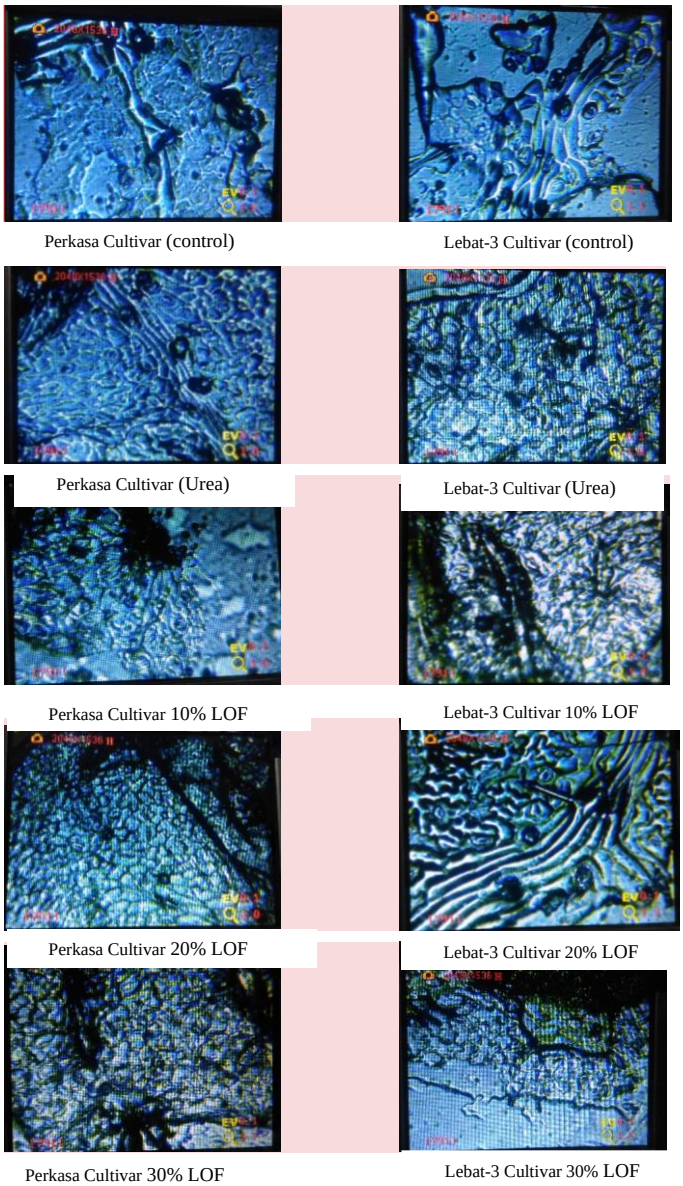

Figure 2. The number of stomata on Perkasa (left) and Lebat-3 (right)

The application of nitrogen fertilizers also affects the greenness of the leaves. Nitrogen is an important element which increases leaf greenness in plants (Faustina et al., 2015). Pramitasari et al. (2016) also stated that the N nutrient affects plant growth, appearance, and color hence, the plant organs turn green due to the chlorophyll content. Furthermore, Pamungkas and Supijatno (2017), reported that the level of leaf greenness indicates that the plant has sufficient nitrogen levels and good health conditions.

Commented [A10]: At first, Fig.2 should be present as the single illustration instead of the set of pictures embedded into the text. AT second, it is not a discussion! This is the presentation of the obtained results, and this should be placed to the results with the appropriate subsection name, because previously in the text there were no data on the stomata research.

Based on the results, the application of inorganic-and-organic-sources-based nitrogen affected vegetative growth, namely number of pods and yield. In this study, the application of 10 and 20% LOF was sufficient for the growth of green beans but was not significantly different from urea. Meanwhile, Permanasari et al. (2014) stated that chlorophyll formation plays an important role in the process of photosynthesis. In addition, nitrogen is known to increase the chlorophyll content of leaves, which is important for photosynthesis and affects the numbers of bean pods. The plant genetic traits in the two cultivars influenced the different responses to N fertilization. Beshir et al., (2015) stated that different cultivars increase the photosynthetic area (or leaf area index), thereby, producing more pods.

The results showed that there was a symptom of N deficiency in green bean leaves without nitrogen fertilizer. The symptoms include yellowish-green coloration of leaves compared to normal leaves which are fresh green. Erythrina et al. (2016) stated that nitrogen is the main nutrient in the formation of leaf color due to its important role in increasing leaf green matter and protein. Therefore, the application of nitrogen increases the green color of the leaves but when deficient, the formation of chlorophyll is reduced thereby causing the leaves to appear yellowish-green. Furthermore, Bojovic et al. (2009) stated that nitrogen deficiency causes a reduction in leaf greenish color and area, as well as photosynthesis due to the linear correlation between leaf chlorophyll formation and nitrogen.

Lebat-3 cultivar requires a lower LOF concentration compared with Perkasa to produce significant yield. Table 3 shows that Perkasa cultivar with 20% LOF produced a higher yield compared to other treatments but was not significantly different from the 100% recommended urea treatment. This is attributed to the effect of liquid organic fertilizer which does not uniformly dissolve for easy absorption by plants (Ginandjar et al., 2019). The Lebat-3 cultivar with 10% LOF produced a higher yield compared to other treatments but was not significantly different from the recommended 100% urea treatment. Chaturdevi (2005), reported that nitrogen fertilization with the right dose affects grain yield in rice and other parameters in each cultivar. Furthermore, the use of N sources for plants affects the results of photosynthesis. This is supported by Rathke (2005), which stated that plant yield is improved by increasing the source of N. In addition, nitrogen improves yield by increasing leaf area and the rate of photosynthesis, hence, high carbohydrates are produced by the plants (Chaturdevi, 2005). The yield of Lebat-3 cultivar was lower compared to Perkasa but was not significantly different from the recommended 100% urea treatment and 20% LOF. Ratnasari et al. (2015), stated that the differences in the characters possessed by cultivar are caused by the varying genetic composition, hence, each cultivar responds differently to environmental and production factors. The positive effect of liquid organic fertilizers from lamtoro leaves in increasing crop yields was also found by Duaja et al. (2013) on chickpeas, Palimbungan et al. (2006) on mustard plants, Septirosya et al. (2019) on tomato plants, and Ainiya et al. (2019) on sweet corn plants. The experiment showed that the liquid organic fertilizers derived from lamtoro leaves are applicable as an alternative nitrogen source in bean cultivation. This low-cost technology is easy to use by farmers and also supports organic bean production.

In conclusion, the use of plant-based nitrogen fertilization from lamtoro leaves is applicable as an alternative to N fertilization in bean plants. The 20% LOF is recommended as an adequate concentration to increase the growth and yield of green beans. Furthermore, each cultivar shows different responses to environmental and production factors. Treatment of Perkasa (with 20% LOF) and Lebat-3 cultivar (with 10% LOF) produced the highest bean yield, respectively.

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REFERENCES

Ainiya M, Fadli M, Despita R. 2019. Peningkatan pertumbuhan dan hasil jagung manis dengan pemanfaatan trichokompos dan POC daun lamtoro. Agrotech. Res. J. 3(2): 69-74.

Amin, MEH. 2011. Effect of different nitrogen sources on growth, yield and quality of fodder maize (Zea mays L.). J. Saudi Soc.Agric. Sci.. 10: 17-23.

Arista, D., Suryono, Sudadi. 2015. Efek dari kombinasi pupuk N, P dan K terhadap pertumbuhan dan hasil kacang tanah pada lahan kering Alfisol. J. Agrosains. 17(2): 49-52.

Beshir, HM, Tesfaye B, Bueckert R, Tar'an B. 2015. Pod quality of snap bean as affected by nitrogen fixation, cultivar and climate zone under dryland agriculture. Afr. J. Agric. Res.. 10(32): 3157-3169.

Bojovic, B, Markovic A. 2009. Correlation between nitrogen and chlorophyll content in wheat (Triticum aestivum L.). Kragujevac J. Sci.. 31: 69-74.

Bojovic, B, Stojanovic J. 2005. Chlorophyll and carotenoid content in wheat cultivars as a function of mineral nutrition. Arch. Biol. Sci. Belgade. 57(4): 283-290.

Camara, CRS, Urrea CA, Schlegel V. 2013. Pinto beans (Phaseolus vulgaris L.) as a functional food: Implications of human health. Agriculture. 3: 90-111.
Chaturvedi, I. 2005. Effect of nitrogen fertilizers on growth, yield and quality of hybrid rice (Oryza sativa). J. Central Eur. Agric.. 6(4): 611-618.
Chaudhary MM, Bhanvadia AS, Parmar PN. 2015. Effect of integrated nutrient management on growth, yield attributes and yield of cabbage (Brassica oleracea Var. Capitata L.) under middle Gujarat conditions. Trends Biosci. 8(8): 2164-2168.
Duaja, MD, Mukhsin, Sijabat R. 2013. Analisis pertumbuhan dan hasil dua varietas buncis (Phaseolus vulgaris L.) pada perbedaan jenis pupuk organik cair. Bioplantae, 2(1): 47-54.
Duaja, MD. 2013. Pengaruh jenis bahan dasar dan dosis pupuk organik cair terhadap pertumbuhan dan hasil buncis (Phaseolus vulgaris L.). Bioplantae. 2(4): 192-200
Erythrina. 2016. Bagan warna daun: Alat untuk meningkatkan efisiensi pemupukan nitrogen pada tanaman padi. J. Litbang Pert.. 35(1): 1-10.
Fahmi A, Syamsudin, Utami SNH, Radjagukguk B. 2010. Pengaruh interaksi hara nitrogen dan fosfor terhadap pertumbuhan tanaman jagung (Zea mays L.) pada tanah Regosol dan Latosol. Berita Biologi. 10(3): 297-304.
Faustina, E., Sudradjat, Supijatno. 2015. Optimization of nitrogen and phosphorus fertilizer on two years old of oil palm (Elaeis guineensis Jacq.). Asian J. Appl. Sci. 3(3): 421-428.
Ginandjar, S, Frasetya B, Nugraha W, Subandi M. 2019. The effect of liquid organic fertilizer of vegetable waste and planting media on growth and yield of strawberry (Fragaria spp.) Earlibrite Cultivar. IOP Conf. Series: Earth and Environ. Sci. 334, 012033
Hendriyani, IK, Nurchayati Y, Setiari N. 2018. Kandungan klorofil dan karotenoid kacang tunggak (Vigna unguiculata (L.) Walp.) pada umur tanaman yang berbeda. J. Biol. Trop. 1(2): 38-43.
Hidayat, O, Suharyana, A. 2019. Pengaruh dosis pupuk organik cair daun lamtoro terhadap pertumbuhan dan hasil tanaman pakcoy (Brassica rapa L.) varietas Nauli-F1. Paspalum J. Ilm. Pertanian 7(2): 57-63.
Jeksen, J, Mutiara, C. 2017. Analisis kualitas pupuk organik cair dari beberapa jenis tanaman Leguminosa. J. Pendidikan MIPA. 7(2): 124-130.
Madusari, S. 2019. Processing of fibre and its application as liquid organic fertilizer in oil palm (Elaeis guineensis Jacq.) seedling for sustainable agriculture. J. Appl. Sci. Adv. Technol. 1(3): 81-90.
Maghfoer, M.D., Koesriharti, Islami T, Kanwal NDS. 2018. A study of the efficacy of various nutrient sources on the growth and yield of cabbage. Agrivita Journal of Agricultural Science. 40(1): 168-176.
Pahlevi, RW, Guritno B, Suminarti NE. 2016. Pengaruh kombinasi proporsi pemupukan nitrogen dan kalium pada pertumbuhan, hasil dan kualitas tanaman ubi jalar (Ipomoea batatas (L.) Lamb) varietas Cilembu pada dataran rendah. J. Produksi Tanaman. 4(1): 16-22.
Palimbungan, N., Labatar R, Hamzah F. 2006. Pengaruh ekstrak daun lamtoro sebagai pupuk organik cair terhadap pertumbuhan dan hasil produksi tanaman sawi. J. Agrisitem. 2(2): 96-101.
Pamungkas, MA, Supijatno. 2017. Pengaruh pemupukan nitrogen terhadap percabangan tanaman teh (Camelia sinensis (L.) O. Kuntze) untuk pembentukan bidang petik. Bul. Agronomi. 5(2): 234-41.
Pary, C. 2015. Pengaruh pupuk organik (daun lamtoro) dalam berbagai konsentrasi terhadap pertumbuhan tanaman sawi. J. Fikratuna. 7(2): 247-255.
Paul, V, L. Sharma, R. Pandey, R.C. Meena. 2017. Measurements of stomatal density and stomatal index on leaf/plant surfaces. Manual of ICAR sponsored traning programme on “physiological techniques to analyze the impact of climate change on crop plants. Division of Plant Physiology, IARI, New Delhi.
Permanasari I, Irfan M, Abizar. 2014. Pertumbuhan dan hasil kedelai (Glycine max (L.) Merill) dengan pemberian Rhizobium dan pupuk urea pada media gambut. J. Agroteknologi. 5(1) ; 29-34.
Pramitasari HE, Wardiyati T, Nawawi M. 2016. Pengaruh dosis pupuk nitrogen dan tingkat kepadatan tanaman terhadap pertumbuhan dan hasil tanaman kailan (Brassica oleraceae L.). J. Produksi Tanaman. 4(1): 49-56.
Proklamasiningsih E, Prijambada ID, Rachmawati D, Sancaningsih RP. 2012. Laju fotosintesi dan kandungan klorofil kedelai pada media tanam masam dengan pemberian garam aluminium. Agrotorp 2(1): 17-24.
Putri FM, Suedy SWA, Darmanti S. 2017. Pengaruh pupuk nanosilika terhadap jumlah stomata, kandungan klorofil dan pertumbuhan padi hitam (Oryza sativa L. cv. japonica). Bul. Anatomi Fisiologi. 2(1): 72-79.
Rahimi, A., Moghaddam SS, Ghiyasi M, Heydarzadeh S, Ghazizadeh K, Popovic-Djordjevic J. 2019. The influence of chemical, organic and biological fertilizers on agrobiological and antioxidant properties of syrian cephalaria (Cephalaria Syriaca L.). Agriculture. 9 (122): 1-13.
Rathke, GW, Christen O, Diepenbrock W. 2005. Effects of nitrogen source and rate on productivity and quality of winter oilseed rape (Brassica napus L.) grown in different crop rotations. Field Crops Res.. 94, 103–113.
Ratnasari D, Bangun MK, Damanik RIM. 2015. Respon dua varietas kedelai (Glycine max (L.) Merrill.) pada pemberian pupuk hayati dan NPK majemuk. J. Online Agroteknologi 3(1): 276-82.
Razaq M, Zhang P, Shen H, Salahuddin. 2017. Influence of nitrogen and phosphorous on the growth and root morphology of Acer mono. Journal PLoS One. 12(2): e0171321

Rihana S, Heddy YBS, Maghfoer MD. 2013. Pertumbuhan dan hasil tanaman buncis (Phaseolus viulgaris L.) pada berbagai dosis pupuk kotoran kambing dan konsentrasi zat pengatur tumbuh Dekamon. J. Produksi Tanaman. 1(4): 369-377.

Rizqiani NF, Ambarwati E, Yuwono NW. 2006. Pengaruh dosis dan frekuensi pemberian pupuk organik cair terhadap pertumbuhan dan hasil buncis (Phaseolus vulgaris L.) dataran rendah. Ilmu Pertanian 13(2): 163-178

Santosa M, Magfoer MD, Tarno H. 2017. The influence of organic and inorganic fertilizers on the growth and yield of green bean, Phaseolus vulgaris L. grown in dry and rainy season. Agrivita J. Agric. Sci. 39(3): 296-302.

Septirosya, T, Putri RH, Aulawi T. 2019. Aplikasi pupuk organik cair lamtoro pada pertumbuhan hasil tanaman tomat. Agroscript. 1(1): 1-8.

Sinaga, AS, Guritno B, Sudiarso. 2017. Pengaruh dosis kompos sampah rumah tangga terhadap pertumbuhan dan hasil tiga varietas buncis tipe tegak (Phaseolus vulgaris L.). J. Produksi Tanaman. 5(6):947-956.

Watson, CA, Atkinson, D, Gosling, P, Jackson, LR, Rayns, FW. 2002. Managing soil fertility in organic farming systems. Soil Use Manag. 18:239-247

Wijiyanti, P, Hastuti ED, Haryanti S. 2019. Pengaruh masa inkubasi pupuk dari air cucian beras terhadap pertumbuhan tanaman sawi hijau (Brassica juncea L.). Bul. Anatomi Fisiol.. 4(1): 41-28.

Zainal, M, A. Nugroho, NE, Suminarti. 2014. Respon pertumbuhan dan hasil tanaman kedelai (Glycine max (L.) Merill) pada berbagai tingkat pemupukan N dan pupuk kandang ayam. J. Produksi Tanaman. 2(6): 484-490.

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THE GROWTH AND YIELD RESPONSES OF TWO BEAN CULTIVARS TO ORGANIC AND INORGANIC NITROGEN SOURCES

Abstract. The productivity of ~~beans can be~~ beans is increased by selecting ~~cultivars~~ the best cultivar and applying fertilizers ~~in accordance with~~ according to the needs of the ~~bean plants~~plant. ~~The use~~ In addition, the application of ~~high~~ high-yielding cultivar and ~~the application of~~ N fertilizers with the right dosage ~~can overcome the~~ is used to improve low production. ~~The purpose of this~~ Therefore, this study ~~was~~ aims to determine the effect of ~~N~~ nitrogen sources on the growth and yield of two ~~cultivar of beans~~beans cultivars. ~~The study used a~~ A 5x2 factorial treatment ~~design~~ was used in a randomized block design with three replications. The first factor is the Perkasa ~~cultivar~~ and ~~the~~ Lebat-3 cultivar~~. The~~ , while the second ~~factor~~ is organic and inorganic nitrogen fertilizer, namely control, urea ~~100~~ 100 kg ha^{-1}, ~~concentration~~ as well as 10~~%~~, 20~~%~~, and 30% concentrations of liquid organic fertilizer from lamtoro leaves. The results showed that the use of liquid organic fertilizers with the right dose ~~can be used~~ is applicable as an alternative to ~~N~~ nitrogen fertilization. ~~The effect of~~ Furthermore, the 20% ~~liquid organic fertilizer~~concentration produced the highest number of trifoliate leaves (8.81 leaves) and ~~plant~~ dry weight (4.52 g), while urea produced the highest plant height (171.48 cm), chlorophyll (15.93 mg g^{-1} FW), carotenoids (2.35 mg g^{-1} FW) and the number of stomata (22/mm^2). ~~The~~ Based on the results, the use of ~~a combination of~~ 20% liquid organic fertilizer ~~and~~ with Perkasa cultivar showed the best effect on the number of pods per plant (5.67~~)~~), and ~~the highest bean~~ yield (846.67 kg ha^{-1}).

Keywords: chlorophyll, cultivar, liquid organic fertilizers, stomata, urea,

~~**Key words:** chlorophyll, cultivar, liquid organic fertilizers, stomata, urea,~~

~~I. INTRODUCTION~~

~~The green bean plant (*Phaseolus vulgaris* L.) is one of the legume plants which is a source of vegetable protein. The plant is widely consumed by the Indonesian people as it has an important role in fulfilling health needs as a nutritious food ingredient. According to Rihana et al. (2013), beans are a vegetable source of vegetable protein and are rich in vitamins A, B, C and could overcome several diseases such as oxidative stress, cardiovascular, cancer and diabetes (Camara et al., 2013). As the population increases, the need for fresh food and vegetables also continues to increase. To increase the production of green beans, it is necessary to apply good cultivation techniques for plant growth. One of the efforts is applying the balanced fertilization that meet with the nutritional needs for growth. In addition, the productivity of green beans can be increased by using improved cultivar. There are many of cultivar of green beans available in the market. According to Ratnasari et al. (2015), each cultivar has different genetic characteristics, which cause differences in appearance and character as well as different responses to production factors.~~

~~Fertilization is one way to meet the nutrient needs of nitrogen in green beans. Fertilization of nitrogen (N) can be derived from organic and inorganic fertilizers. Urea is a source of inorganic nitrogen fertilization. Nitrogen is a major nutrient needed by green beans, which plays an important role in the formation of chlorophyll, protoplasm, protein, and nucleic acids (Fahmi et al., 2010). The plant's need for N is higher than other nutrients. Pahlevi et al. (2016) said that the nutrient N affects the photosynthetic process of plants and the resulting photosynthate. According to Maghfoer et al. (2018), application of inorganic fertilizers produced large growth and yields for plants. However, the continuous use of inorganic fertilizers can interfere with low soil fertility and low productivity.~~

Therefore an alternative way is needed to reduce the use of inorganic fertilizers, namely using organic fertilizers.

Availability of nitrogen could be supplied with liquid organic fertilizers (LOF). Liquid organic fertilizer is an organic fertilizer that is available in liquid form, which contains nutrients in the form of a solution so that it is very easily absorbed by plants. Liquid organic fertilizer can be utilized by sprinkling it on plants or spraying on the leaves or stems of plants. Organic fertilizers can be made from plant waste available in the surrounding environment. The advantage of using liquid organic fertilizers is that their distribution can be adjusted to the needs of plants (Ginandjar et al., 2019). One example of organic matter that can be used as liquid organic fertilizer source of nitrogen is lamtoro leves (*Leucaena leucocephala*). Liquid organic fertilizer derived from lamtoro leaves contains nitrogen nutrients needed for plants (Jeksen and Mutiara, 2017). The N content in lamtoro leaves is quite high, namely 3.84% so it can be a source of organic N to increase the growth and yield of green beans (Palimbungan et al., 2006). Research results by Rizqiani et al. (2007) stated that the application of liquid organic fertilizers increased the fresh weight of pods in green beans and in Duaja's (2013) research, liquid organic fertilizer of kirinyuh (*Chromolaena odorata* L.) provided the highest yield of pods and bean yields per plant.

Plant cultivar is a factor that greatly determines the quality of agricultural products. The use of high-yielding cultivar of beans is expected to increase productivity and yield quality of beans. Each cultivar has different genetic characteristics and traits. Based on genetic characteristics, there will be differences in the character and appearance of each cultivar. Examples of high yielding cultivar of beans are Lebat-3 and Perkasa. The advantages of Perkasa cultivar according to the description are having resistance to leaf rust disease, early maturity and having large and long pods. The superiority of Lebat-3 cultivar based on its description is that it is well adapted to the low-highlands, has early maturity and has high yield potential. The results by Sinaga et al. (2017) showed that the use of cultivar had a significant effect on the growth and yield of beans. According to Duaja (2013), there is an interaction between the use of bean cultivar and liquid organic fertilizers on the number of pods and the yield of beans.

The fertilizer requirement by each cultivar is different. This is due to the genetic characteristics of these cultivar, so that the selection of fertilizer types and fertilizer requirements need to be considered. The proper doses of liquid organic fertilizers as needed is also a factor that affects plant growth. According to Ratnasari et al. (2015), differences in genetic traits of cultivar may show different responses to the environment and production factors. Little information exists on source of different organic and inorganic nitrogen sources. It is hypothesized that there will be a different response of two beans cultivar to the treatment of different types and doses of inorganic-and-organic-sources-based nitrogen. This study aims to determine the effect of inorganic and organic nitrogen sources on the growth and yield of two cultivar of beans.

II. MATERIALS AND METHODS

This research was conducted on the experimental research area Pemanggilan, Natar, Lampung province, Indonesia from January to March 2020. The research began with soil cultivation using hoes. The land is loosened with a depth of 20-30 cm and evenly processed and an experimental plot is made with a size of 3 x 2.5 m. The planting of the Perkasa and Lebat-3 cultivar was carried out by drilling the planting holes. The seeds given to each planting hole are 2 seeds with a spacing of 40 cm x 40 cm.

~~The treatment design used was factorial (2 x 5) in a randomized block design (RBD) with three replications in order to obtain 30 experimental units. The first factor is the bean cultivars, namely Perkasa and Lebat 3. The second factor is the source of nitrogen, namely control, urea 100 kg ha^{-1}, 10% LOF, 20% LOF, and 30% LOF. Data were subjected to analysis of variance procedures. Means were compared using the Honestly Significant Difference (HSD) 5%.~~

~~Preparation of liquid fertilizer is done by mixing the chopped lamtoro leaves (1 kg of lamtoro leaves: 2 liters of water), with 200 ml of molasses and 200 ml of EM4 in a drum then fermenting for 15 days. The liquid is filtered and ready to be applied to plants. Inorganic fertilizers given were urea 100 kg ha^{-1} (75 g plot^{-1}) given at the beginning of planting and 4 weeks after planting (WAP). While SP-36 200 kg ha^{-1} (150 g plot^{-1}) and KCL 100 kg ha^{-1} (75 g plot^{-1}) were given at the initial planting time. Fertilization is applied in a strip with a distance of 5 cm from the plant.~~

~~The application~~

I. INTRODUCTION

Green bean (*Phaseolus vulgaris* L.) constitute one of ~~**LIQUID ORGANIC FERTILIZER**~~ the legume plants and serve as a source of vegetable protein. The plant is ~~**CONDUCTED**~~ widely consumed by ~~**SPRAYING IT ON**~~ the ~~**TOP**~~ Indonesians due to its important role in fulfilling health needs as a nutritious food ingredient. Rihana et al. (2013), stated that beans are source of ~~**THE PLANT**~~ vegetable protein, rich in vitamins A, B, C and has great potential for the ~~**BOTTOM**~~ treatment of ~~**THE PLANT (60:40**~~several diseases such as oxidative stress, cardiovascular disease, cancer, and diabetes (Camara et al., 2013). ~~**THIS LOF SPRAYING**~~ Furthermore, as the population grows, the need for fresh food and vegetables continue to also increases. Therefore, to increase the production of green beans, it is ~~**CARRIED OUT ONCE**~~ necessary to apply good cultivation techniques such as applying a ~~**WEEK**~~ balanced fertilization that fulfills the nutritional needs for growth. The productivity of green beans are also increased by using ~~**A CONCENTRATION**~~ improved cultivars. Meanwhile, there are numerous green beans cultivar available in the market. Ratnasari et al. (2015), stated that each cultivar has different genetic characteristics, which lead to differences in appearance, character, as well as responses to production factors.

Fertilization is one way to meet the nutritional needs of nitrogen in green beans. Meanwhile, nitrogen is an important nutrient required by green beans for the formation of ~~10% (100 ml LOF solution + 900 ml water)~~chlorophyll, protoplasm, protein, and nucleic acids (Fahmi et al., 2010). Fertilization with nitrogen (N) is derived from organic and inorganic fertilizers such as Urea. Furthermore, ~~20% (200 ml LOF solution + 800 ml water~~green bean nutritional need for N is higher than any other nutrient. Pahlevi et al. (2016) reported that nitrogen affects the photosynthetic process in plants as well as the photosynthate produced. Maghfoer et al. (2018), also stated that the application of inorganic fertilizers produced large growth and ~~30% (300 ml LOF solution + 700 ml water).~~

~~**PLANT MAINTENANCE INCLUDES WEEDING MANUALLY AND THINNING. HARVESTING**~~ plant yield. However, the continueous use of inorganic fertilizers leads to low soil fertility and productivity. Therefore, an alternative approach is needed to reduce the use of inorganic fertilizers, via organic fertilization.

Nitrogen is commonly supplied alternatively to plants using Liquid Organic Fertilizers (LOF). It is ~~**CARRIED OUT**~~ an organic fertilizer available in ~~**STAGES ACCORDING**~~ liquid form and contains nutrients in the form of a solution, therefore, it is easily absorbed by plants. Furthermore, it is applied via sprinkling or spraying on the leaves or stems of plants. Organic fertilizers are made from plant waste available in the environment. In particular, liquid organic fertilizers are more beneficial because its distribution is adjustable to the ~~**HARVEST AGE**~~ needs of ~~**EACH CULTIVAR**~~plants

(Ginandjar et al., 2019). One example of organic matter widely used as a liquid organic fertilizer source of nitrogen is lamtoro leaves (*Leucaena leucocephala*). Liquid organic fertilizer derived from this plant contains nitrogen nutrients needed by plants (Jeksen and Mutiara, 2017). The ~~CHARACTERISTICS~~ N content in lamtoro leaves is quite high, namely 3.84%, therefore, it is a source of organic nutrient to increase the growth and yield of green beans ~~THAT ARE READY TO BE HARVESTED~~(Palimbungan et al., 2006). Furthermore, the ~~COLOR~~ application of liquid organic fertilizers increased the fresh weight of pods in green beans (Rizqiani et al., 2007), and provided the highest yield of pods and bean per plant in kirinyuh (*Chromolaena odorata* L.)(Duaja, 2013).

Plant cultivar is ~~RATHER YOUNG~~ a factor that greatly determines the quality of agricultural products. The use of high-yielding beans cultivar increases productivity and yield quality. Each cultivar has different genetic characteristics and traits which leads to differences in the respective character and appearance. Examples of high-yielding beans cultivar include Lebat-3 and Perkasa. The advantages of Perkasa cultivar include resistance to leaf rust disease, early maturity as well as the large and ~~GLOOMY~~long pods. In contrast, the ~~SKIN SURFACE IS~~ advantage of Lebat-3 cultivar include well adapted to the low-highlands, early maturity and has high yield potential. Sinaga et al. (2017) showed that the use of cultivars had a ~~BIT ROUGH~~significant effect on the growth and yield of beans. Furthermore, Duaja (2013) stated that there is an interaction between the ~~SEEDS IN~~ use of bean cultivar with liquid organic fertilizers on the number of pods ~~ARE NOT YET PROMINENT~~and productivity.

The fertilizer requirement by each cultivar is usually different, this is due to the individual genetic characteristics hence, the selection of fertilizer types and ~~WHEN~~ requirements need to be considered. Besides, the ~~PODS ARE BROKEN~~appropriate doses of liquid organic fertilizers also influences plant growth. Ratnasari et al. (2015), ~~THEY WILL USUALLY MAKE A POPPING SOUND~~ stated that ~~USUALLY OCCURS 2-3 WEEKS AFTER~~ variations in genetic traits of cultivar lead to different responses to environmental and production factors. There are only few studies on the different organic and inorganic nitrogen sources. In this study, two beans cultivar were hypothesized to produce different responses to treatment with various types and doses of inorganic-and-organic-sources-based nitrogen. Therefore, this study aims to determine the effect of inorganic and organic nitrogen sources on the ~~FLOWERS BLOOM.~~growth and yield of two beans cultivars.

~~I.~~II. MATERIALS AND METHODS

This study was conducted at the experimental research area Pemanggilan, Natar, Lampung province, Indonesia from January to March 2020. The soil was first cultivated using hoes, loosened to a depth of 20-30 cm, evenly processed and an experimental plot was made with a size of 3 x 2.5 m. Furthermore, the Perkasa and Lebat-3 cultivar were planted by drilling the planting holes, while two seeds each were planted with a spacing of 40 cm x 40 cm.

The (2 x 5) factorial treatment was used in a randomized block design (RBD) with three replications totaling 30 experimental units. The first factor was the bean cultivars, namely Perkasa and Lebat-3, while the second was the source of nitrogen, namely control, urea 100 kg ha^{-1}, as well as 10, 20**,** and 30% LOF. Furthermore, the data were analyzed using analysis of variance procedures, while the means were compared using the Honestly Significant Difference (HSD) of 5%.

The liquid fertilizer was prepared by mixing chopped lamtoro leaves (1 kg of lamtoro leaves: 2 liters of water), with 200 ml of molasses and 200 ml of EM4 in a drum, the mixture was then fermented for 15 days and the liquid was filtered. The inorganic fertilizers given include urea 100 kg ha^{-1} (75 g $plot^{-1}$) at the beginning and 4 weeks after planting (WAP), while SP-36 200 kg ha^{-1} (150 g $plot^{-1}$) and KCL 100 kg ha^{-1} (75 g $plot^{-1}$) were given at the beginning of planting. Fertilization was applied in a strip with a distance of 5 cm from the plant.

The liquid organic fertilizer was applied by spraying on the top and bottom of the plant (60:40). This was carried out once a week using a concentration of 10% (100 ml LOF solution + 900 ml water), 20% (200 ml LOF solution + 800 ml water), and 30% (300 ml LOF solution + 700 ml water).

Plant maintenance includes weeding manually and thinning, while the harvest was carried out in stages according to the age of each cultivar. The characteristics of beans ready for harvest include young and gloomy pod color, rough skin surface, less prominent seeds in the pods which usually make a popping sound when the pods are broken especially between 2-3 weeks after flowering.

The parameters observed ~~were~~ include plant height (6 WAP), number of trifoliate leaves (6 WAP), chlorophyll, carotenoids (5 WAP), number of stomata (5 WAP), greenness of leaves (5 WAP), symptoms of N deficiency, number of pods per plant, dry weight, and yield. ~~The~~ Furthermore, the replica method ~~used~~ modified from Paul, 2017 was used to observe the stomata on the leaf ~~surface is the replica method (modified from Paul, 2017), in which the~~ surface. The leaves ~~are~~ were first cleaned with a tissue to remove dust or dirt~~,~~ and then rubbed with a transparent nail polish~~. The nail polish is allowed~~ , and allowed to dry for a few minutes~~, after which the nail polish is applied dry with a~~ . A transparent strip ~~of~~ tape measuring 1 cm x 1 cm in size ~~and~~ was applied, smoothed, and then peeled off slowly. The ~~result of the peel is~~ sample produced was then attached to the slide and observed under a microscope.

~~Measurement of~~ The chlorophyll and carotenoid ~~content was carried out~~ contents were measured using the ~~spectophotometric~~ spectrophotometric method. The green beans ~~are~~ were crushed using a mortar and 100 ml of 70% alcohol solution ~~is~~ was added. ~~Then~~ Furthermore, the extract was filtered and the filtrate was placed in a cuvet to measure the total chlorophyll and carotenoid ~~content~~ contents using a ~~spectophotometer. According to Rahimi et al~~spectrophotometer. ~~(2019) the~~ The chlorophyll and carotenoid ~~content was~~ contents were calculated using the ~~formula~~formula (Rahimi et al., 2019):

Chlorophyll *a* = 11,24 x A_{662} - 2,04 x A_{645}
Chlorophyll *b* = 20,13 x A_{645} - 4,19 x A_{662}
Chlorophyll total = 7,05 x A_{662} + 18,09 x A_{645}

$$\text{Carotenoid} = \frac{(1000 \times A470 - 1{,}90 \times \text{klorofil a} - 63{,}14 \times \text{klorofil b})}{214}$$

$$\frac{(1000 \times A470 - 1{,}90 \times \text{klorofil a} - 63{,}14 \times \text{klorofil b})}{214}$$

III RESULTS AND DISCUSSION

The ~~results of~~ LOF analysis results showed that the N content in the ~~LOF of~~ lamtoro leaves was 0.16%, ~~had a~~ C-Organic ~~content of~~ 3.08%, N-total ~~was~~ 0.16%, P-total ~~was~~ 0.18% and K ~~was~~ 0.56% with a pH of 3.64. ~~The results of~~ Furthermore, the ~~analysis showed that the~~ C/N ~~of the lamtoro LOF~~ ratio was 19.25~~. C/N ratio has met~~ , which fulfills the standard of organic fertilizer. A good C/N ratio ~~is~~ ranges between 15-20%~~. A~~ , meanwhile, a high ~~C/N~~ ratio ~~causes~~ decreases the biological activity of ~~microorganisms to decrease~~microorganisms, ~~while~~ and a ~~C/N ratio that is too~~ very low ~~will cause~~ ratio causes denitrification (Watson et al., 2002)

Table 1. Effects of treatment with different nitrogen ~~source~~ sources and cultivar on plant height, number of trifoliate leaves, and dry ~~weight plant~~weight.

Treatment	Plant height (cm)	Number of trifoliate leaves	Dry ~~weight plant~~weight (g)
Perkasa Cultivar	133.60 a	7.20 a	3.21 a
Lebat-3 Cultivar	137.63 a	8.11 a	3.17 a
$HSD_{0,05}$	18.47	1.43	0.92
Control	94.71 c	5.57 b	1.95 b
Urea	171.48 a	8.50 ab	3.78 ab
10% LOF	150.60 ab	9.11 a	3.13 ab
20% LOF	148.02 ab	8.81 ab	4.52 a

30% LOF	113.29 bc	6.30 ab	2.58 ab
$HSD_{0,05}$	42.11	3.25	2.09

In a ~~colum~~column, common values letter(s) do not differ significantly at $p \leq 0,05$ as per HSD

~~The results showed that the combination of N sources and cultivar did not affect plant height, number of trifoliate leaves, and dry weight. In plant height, the plant height in the control was shorter than the treatment of urea, 10% LOF, 20% LOF; while the application of N sources from urea, 10% LOF, 20% LOF, and 30% LOF did not differ (Table 1). The number of trifoliate leaves on control was less than on 10% LOF, 20% LOF, and 30% LOF, while the number of trifoliate leaves treated with Urea, 20% LOF, and 30% LOF had statistically the same results (Table 1). Application of 20% N LOF source resulted in heavier dry weight than control, while the application of urea, 10% LOF, 20% LOF and 30% LOF were not different (Table 1).~~

The results showed that the combination of N sources and cultivar did not affect plant height, numbers of trifoliate leaves, and dry weight. Plant height in the control was shorter than the treatment with urea, as well as 10, and 20% LOF, meanwhile, the application of N sources from urea, as well as 10, 20, and 30% LOF showed no significant differences (Table 1). Moreover, the numbers of trifoliate leaves in the control was lesser compared to 10, 20, and 30% LOF, while the number of trifoliate leaves treated with Urea, and the different LOF concentrations showed no significant differences (Table 1). Application of 20% LOF produced heavier dry weight compared to control, while the application of urea, and the different LOF concentrations were not different (Table 1).

Table 2. Effects of treatment with different nitrogen sources and cultivar on chlorophyll, carotenoid, and numbers of stomata.

~~**Table 2.** Effects of treatment nitrogen source and cultivar on, chlorophyll, carotenoid of leaves, and number of stomata.~~

Treatment	Chlorophyll (mg g^{-1} FW)	Carotenoid (mg g^{-1} FW)	The number of stomata (/mm^2)
Perkasa Cultivar	12.92 a	1.59 a	14.40 a
Lebat-3 Cultivar	13.24 a	1.88 a	14.67 a
$HSD_{0,05}$	1.16	0.29	3.50
Control	9.68 b	1.38 b	8.50 c
Urea	15.93 a	2.35 a	22.00 a
LOF 10%	15.56 a	1.69 ab	11.50 bc
LOF 20%	13.77 a	1.76 ab	17.83 ab
LOF 30%	10.46 b	1.47 b	12.83 bc
$HSD_{0,05}$	2.64	0.67	8.05

In a column, common values letter(s) do not differ significantly at $p \leq 0,05$ as per HSD

~~The results showed that~~ Based on the results, the application of N sources and ~~cultivar~~ cultivars affected chlorophyll, carotenoids, and the number of stomata in green beans. ~~Parameters~~ Meanwhile,

the parameters of chlorophyll, carotenoids, and the number of ~~leaf~~ stomata ~~of~~ in the Perkasa cultivar did not differ significantly compared to ~~cultivar~~ Lebat-3. The chlorophyll content ~~at~~ in the control was lower than the urea treatment, ~~while the chlorophyll content~~ and was not different between the control and ~~the~~ 30% LOF. ~~Chlorophyll~~ Furthermore, the chlorophyll content ~~treated with~~ for the urea treatment did not differ compared to ~~10% LOF~~ 10 and 20% LOF (Table 2). The application of urea ~~resulted in~~ produced a higher carotenoid content ~~than~~ compared to the control, ~~while the application of urea,~~ but was not different compared to 10~~% LOF~~, and 20% LOF ~~were not different~~ treatments (Table 2). ~~The~~ Also, the application of ~~N source 1 0% LOF~~10, 20~~% LOF 20%~~, and 30% LOF ~~resulted~~ showed no differences in ~~no different~~ the carotenoid content ~~between~~ compared to the control. The application of urea produced a higher number of stomata compared to the control, ~~The~~ while the application of urea and 20% LOF ~~were not different on~~ showed no differences in the number of stomata. Similarly, ~~while~~ LOF ~~application~~ applications of 10~~%~~, and 30% also produced no ~~different~~ difference in the numbers of stomata (Table 2).

Table 3. Effects of treatment with different nitrogen ~~source~~ sources and ~~cultivar~~ cultivars on dry ~~weight~~ ~~plant,~~weight, number of pods, ~~greeness~~ greenness of leaves and yield of two ~~cultivar bean~~beans cultivar.

Parameter	Source N	Cultivar		$HSD_{0,05}$
		Perkasa	Lebat-3	
~~Greeness~~ Greenness of the leaves (unit)	Control	18.31 Ab	17.54 Ab	9.34
	Urea	27.79 Aa	28.91 Aa	
	LOF 10%	20.13 Aab	28.11 Aa	
	LOF 20%	24.06 Aab	24.19 Aa	
	LOF 30%	28.96 Aa	21.81 Aab	
Number of pods	Control	5.46 Ac	2.50 Ab	4.40
	Urea	9.13 Aab	9.05 Aa	
	LOF 10%	9.96 Aab	12.13 Aa	
	LOF 20%	13.38 Aa	4.67 Bab	
	LOF 30%	6.92 Abc	3.75 Ab	
Yield (kg ha^{-1})	Control	231.11 Ac	113.33 Ab	220.24
	Urea	720.89 Aab	515.56 Aa	
	LOF 10%	565.33 Ab	429.78 Aa	
	LOF 20%	846.67 Aa	148.00 Bb	
	LOF 30%	333.78 Ac	181.33 Ab	

Mean followed by the same letter (capital read horizontally and small letter read vertically) do not differ significantly at $p \leq 0,05$ as per HSD

The results showed that the level of leaf greenness, number of pods, and bean production were significantly affected by the interaction of N sources and bean cultivar (Table 3). ~~For the greeness level of the leaves, the~~ The 30% LOF treatment ~~at~~ with Perkasa cultivar and urea ~~at~~ with Lebat-3 ~~cultivar~~ produced the highest level of leaf greenness compared to the others but were still significantly the same as the other treatments ~~of~~ with different N sources~~. The~~. Moreover, the data indicated that the average value of leaf greenness of plants treated with ~~nitrogen fertilizers with~~ organic and inorganic fertilizers

was ~~much~~ higher than the control plants without nitrogen fertilizers. The treatment without N fertilizer had low greenness. ~~-~~Perkasa cultivar with 20% LOF produced a statistically ~~more~~ higher number of bean pods compared to the Lebat-~~3 cultivar treatment.~~3. Similarly, Perkasa cultivar with 20% LOF produced the highest number of bean pods per plant ~~and~~ but was not significantly different from the ~~treatment of~~ 10% LOF and ~~urea. Cultivar~~ urea treatments. Furthermore, Lebat-3 cultivar with LOF 10% produced the highest number of bean pods ~~and~~ but was not significantly different from the urea ~~fertilizer treatment~~ and 20% ~~LOF.~~ LOF treatment. There ~~is~~ was a significant difference between the yield of ~~2 cultivars on~~ the ~~treatment of~~ two cultivars with 20% ~~LOF~~LOF treatment. ~~On the~~ The Perkasa ~~cultivar, the plants~~ cultivar treated with urea and LOF 20% ~~had~~ produced a higher ~~yield~~ yield, while ~~on~~ Lebat-3 ~~cultivar,~~ with urea and 10% LOF treatment ~~had~~ produced a higher yield compared to other treatments (Table 3).

Symptoms of N Deficiency (Figure 1.)

Symptoms of nitrogen nutrient deficiency ~~occur~~ were found in the green bean leaves. ~~Symptoms of~~ This deficiency ~~of nitrogen nutrients occur~~ occurs in the leaves of plants without treatment (control), ~~with the characteristic that the green bean leaves appear~~ characterized by a yellowish appearance compared to the leaves treated with nitrogen fertilizer. Normal leaves have ~~a~~ fresh green leaf color (Figure 1). Santosa et al. (2017) stated that the use of chemical fertilizers not only increases production costs but also decreases productivity and gradually leads to ~~gradually~~ higher risks. ~~Nitrogen for~~ Furthermore, nitrogen requirement by plants ~~must~~ is needs to be in accordance with the ~~needs~~ demand of the plant. ~~According to~~ Zainal et al. (2014)~~. Lack~~ stated that the lack of this nutrient ~~will cause the leaves~~ leads to ~~experience~~ leaf chlorosis ~~which is~~ indicated by yellowing of the leaves. In contrast, ~~whereas if~~ excess nitrogen ~~will accelerate~~ accelerates plant growth, especially on the stems, the leaves ~~will~~ turn dark ~~green and the plants become secondary.~~ green.

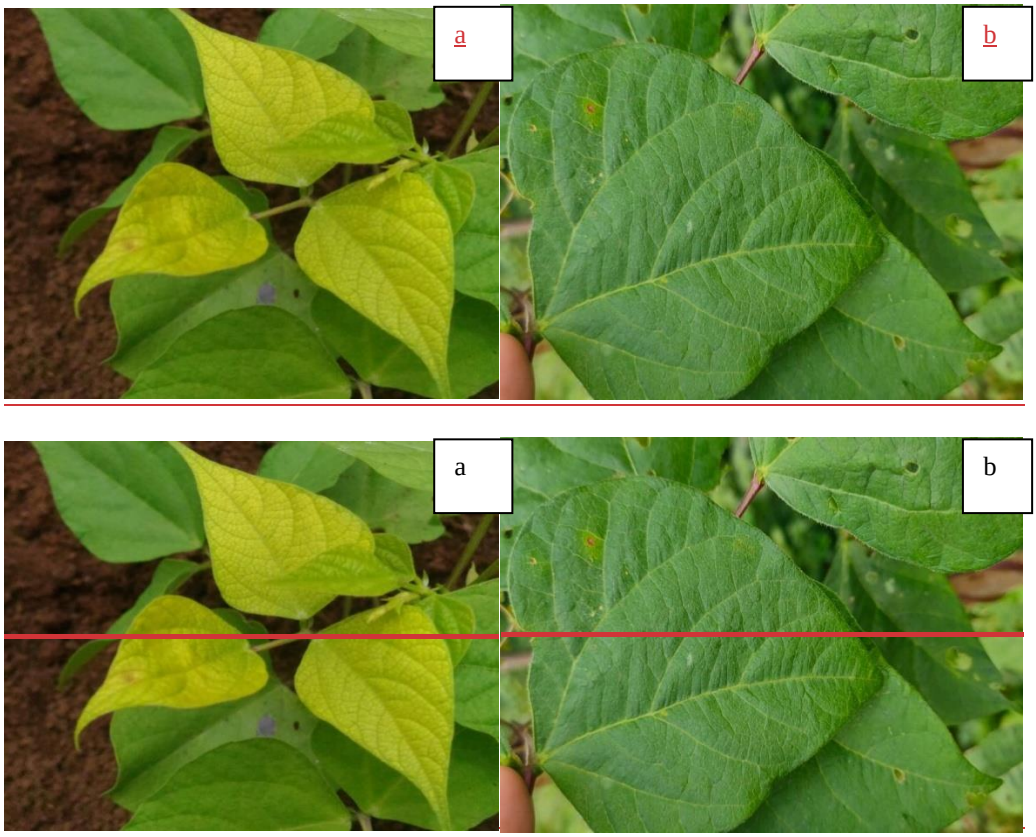

Figure 1. *Comparison of deficiency N (a) The color of the leaf deficient N (b) The color of the normal leaf*

Discussion

The results showed that the Perkasa and Lebat-3 cultivar had no ~~different~~ significantly different effect on ~~the~~ vegetative growth~~. The~~ , while the application of inorganic-and-organic-sources-based nitrogen affected vegetative growth parameters namely plant height, ~~number~~ numbers of ~~leaves~~ leaves, and dry weight (Table 1). This is supported by ~~the research of~~ Pamungkas and Supijatno (2017) which ~~states~~ reported that nitrogen fertilizer ~~has a significant effect in~~ significantly affect the growth of tea plants. ~~According to~~ In addition, Amin (2011), reported that nitrogen ~~will increase~~ increased plant growth and height ~~so that it will~~ to produce ~~a lot of~~ numerous internodes ~~and these will~~ which resultantly produce more leaves.

The number of trifoliate leaves in green beans is influenced by the availability of N nutrients. ~~The number of leaves~~ This parameter increased significantly ~~when fertilized with~~ after the application of organic nitrogen sources. ~~At~~ Based on the results, the 10% LOF treatment produced the highest number of trifoliate leaves ~~and~~ but was not different ~~from~~ from the 20~~% LOF,~~ , and 30% LOF, ~~and urea~~as well as urea treatment. ~~According to~~ Pramitasari et al. (2016), ~~the more N is absorbed by the plant, the leaves will grow larger. The effect of LOF lamtoro leaves in increasing plant growth was also stated~~ stated that higher N absorption by ~~Pary (2015) which found that application of~~ plant leads to larger growth of the leaves. Furthermore, the application of LOF ~~of~~ from lamtoro ~~leaves~~ leaves showed significant ~~plant~~ growth ~~in the parameters of~~ in plant height, ~~number~~ numbers of leaves, and fresh weight of mustard ~~greens; by Hidayat and Suharyana (2019) who stated that application of LOF leaves lamtoro showed the~~ greens (Pary, 2015) highest yield on the number of pakcoy ~~leaves; by Septirosya et al. (~~leaves (Hidayat and Suharyana, 2019), and ~~who stated that application of LOF lamtoro~~ increased the growth and number of fruit in tomato ~~plants~~plants (Septirosya et al., 2019). The number of trifoliate leaves is a plant characteristic that affects the speed of photosynthesis to capture sunlight. ~~Liquid~~ Meanwhile, liquid organic fertilizers ~~contained a~~ are rich ~~of~~ in nitrogen ~~that affect an increased~~ and increases the number of plant leaves.

The ~~results showed that the~~ application of nitrogen sources affected the dry weight of the ~~plants~~plant. LOF 20% produced the highest dry weight ~~of green beans and~~ but was not significantly different from urea and LOF 10%. ~~It is~~ Furthermore, it was assumed that the availability of sufficient ~~nutrients~~ nutrients in ~~an appropriate amount in~~ the treatment affects plant growth and yield. The high dry weight was influenced by the initial vegetative growth ~~of green beans because the dry weight was~~ as this parameter is related to the number of leaves and ~~plant~~ fresh weight. ~~According to~~ Arista et al. (2015) stated that nitrogen is an element that functions to increase leaf size and ~~increase~~ the percentage of protein. ~~The more leaves and this protein will increase the dry stover weight in plants.~~ Meanwhile, Madusari (2019) ~~said~~ reported that liquid organic fertilizers ~~tend to determine~~ affect plant growth and ~~good~~ nutrient absorption ~~which can increase~~ by increasing plant stem diameter~~, so that liquid organic fertilizers could increase plant~~ and dry weight.

~~The~~ Based on the results, the application of inorganic-and-organic-sources-based nitrogen affected physiological characters namely chlorophyll, carotenoids, number of stomata and greenness of leaves~~. Chlorophyll~~ . However, chlorophyll and leaf carotenoids ~~did~~ were not affected by the bean cultivar. ~~According to~~ Bojovic et al. (2005),~~ the~~ stated that the leaf color of ~~each cultivar and~~ certain ~~cultivar~~ cultivars did not directly correlate with ~~leaf~~ chlorophyll content. ~~The content of~~ Meanwhile, the chlorophyll and ~~carotenoids can be~~ carotenoid contents are affected by the availability of N nutrients. ~~According to~~ Wijiyanti (2019) reported that nitrogen is the main nutrient needed for the formation of chlorophyll and carotenoids. This is also in line with ~~the result of research of~~ Razaq et al. (2017) ~~who~~ which found ~~synthesis of~~ that chlorophyll and carotenoids synthesis depends on optimal N ~~availability so that N play~~ availability, therefore, nitrogen plays an important role in the formation of photosynthetic pigments. ~~According to~~ Furthermore, Hendriyani et al., (2018) reported that carotenoids and chlorophyll

are complementary pigments, but carotenoids ~~have less numbers than chlorophyll~~ are fewer in number because ~~carotenoids~~ it play a role in ~~helping~~ the absorption of light by chlorophyll.

The ~~results of observing the~~ number of stomata in the two cultivars of green beans ~~showed that nitrogen fertilizer~~ was affected by the ~~number~~ application of ~~stomata~~ nitrogen fertilizers (Table 2). The two cultivars ~~of green beans gave the same response~~showed similar responses, ~~and~~ while the application of inorganic fertilizers produced more stomata ~~than the~~ compared to other treatments. Nitrogen fertilizer treatment on green beans had a significant effect on the number of stomata (Figure 1). ~~It can be seen that~~ Furthermore, urea and 20% LOF ~~had~~ produced a higher number of stomata ~~than those without N source (~~compared to the control~~)~~. ~~The~~ Meanwhile, the number of stomata in plants affects ~~the~~ metabolic ~~process~~ processes in ~~plants, namely~~ plants such as photosynthesis. The rate of photosynthesis increases as the number of stomata ~~increases so that~~ rises, hence, plant ~~production~~ productivity also increases. This is supported by Proklapmasiningsih et al. (2012), which ~~states~~ stated that the rate of photosynthesis in plants is closely related to the ~~plant production~~yield. ~~According to~~ Moreover, Putri et al. (2017), reported that stomata play an important role in ~~the~~ photosynthesis ~~process because they function~~ by acting as a ~~place to~~ surface for CO_2 exchange ~~CO_2~~ in the leaves~~.~~

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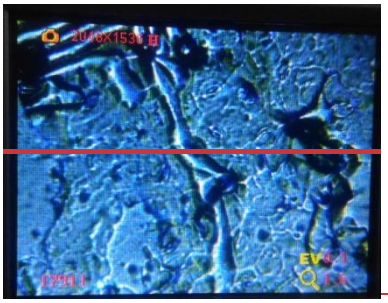
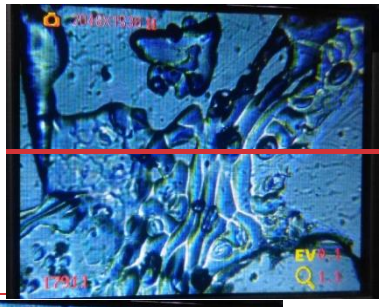
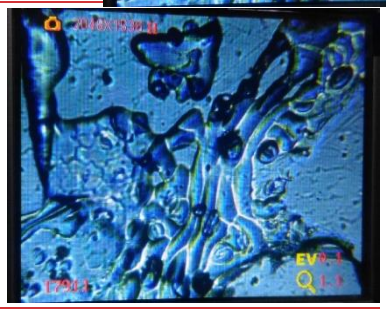
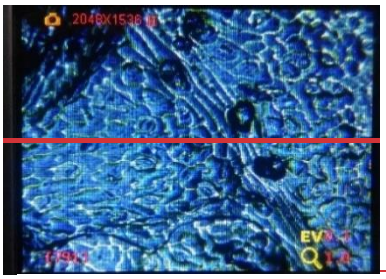


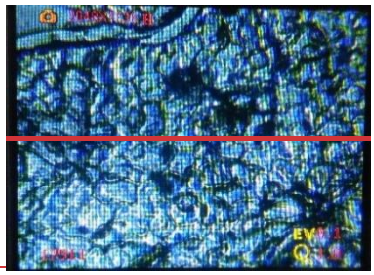


Perkasa Cultivar (control)



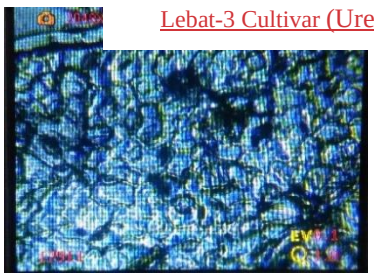
Lebat-3 Cultivar (control)

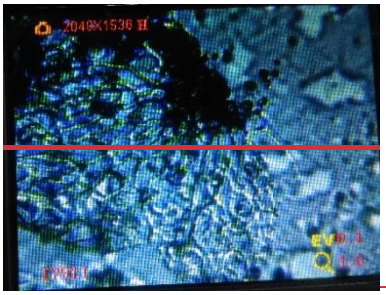


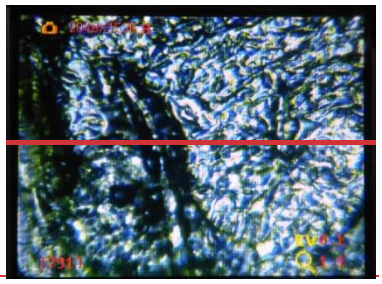


Perkasa Cultivar (Urea)

Lebat-3 Cultivar (Urea)

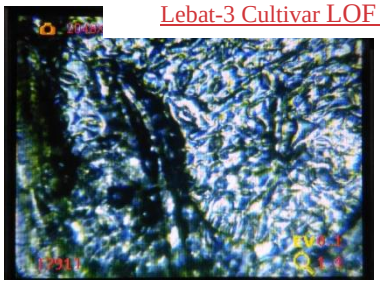


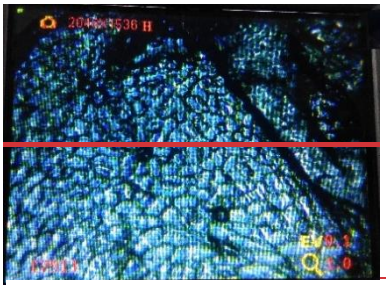


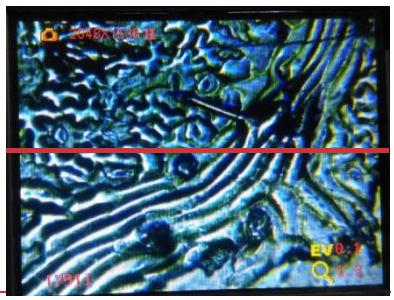


Perkasa Cultivar LOF 10%

Lebat-3 Cultivar LOF 10%

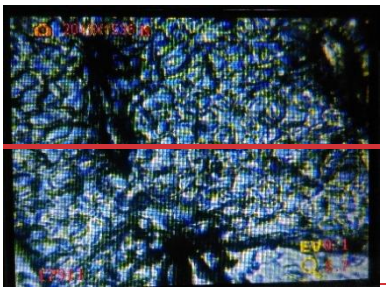






Perkasa Cultivar LOF 20%

Lebat-3 Cultivar LOF 20%



Perkasa Cultivar LOF 30%

Lebat-3 Cultivar LOF 30%

Has

Figure 2. The number of stomata on Perkasa (left) and Lebat-3 (right)

The application of nitrogen fertilizers ~~contained nitrogen~~ also affects the greenness of the leaves. Nitrogen is an important ~~part of increasing~~ element which increases leaf greenness in plants (Faustina et al., 2015). ~~According to~~ Pramitasari et al. (2016) also stated that the N nutrient affects plant growth, appearance, and color ~~so that~~ hence, the plant organs turn green ~~because they contain chlorophyll.. According~~ due to the chlorophyll content. Furthermore, Pamungkas and Supijatno (2017), reported that the level of leaf greenness ~~of the leaves~~ indicates that the plant has sufficient nitrogen levels and ~~indicates healthy planting~~ good health conditions.

~~The~~ Based on the results, the application of inorganic-and-organic-sources-based nitrogen affected ~~generative growth~~ vegetative growth, namely number of pods and yield. ~~The results showed that the application of nitrogen sources and cultivar affected the number of bean pods per plant.~~ In this study, the application of 10 and 20% LOF ~~and 10% LOF was~~ was sufficient for the growth of green beans ~~and~~ but was ~~no~~ not significantly different from urea. ~~According to~~ Meanwhile, Permanasari et al. (2014~~) in generative plant growth,~~) stated that chlorophyll formation ~~will play a very~~ plays an important role in the process of ~~plant photosynthate formation~~photosynthesis. In addition~~, it~~ , nitrogen is ~~expected that that nitrogen~~ known to increase the chlorophyll content of leaves, which is important for photosynthesis and ~~has a role in~~ affects the ~~number~~ numbers of bean pods. ~~In addition,~~ The plant genetic traits in the two ~~cultivar~~ cultivars influenced the different responses to N fertilization. ~~According to~~ Beshir et al~~.~~., (2015) stated that different cultivars ~~have an effect in increasing~~ increase the photosynthetic area (or leaf area index), ~~so that~~ thereby, producing more ~~pods are formed~~pods.

The results showed that there was a symptom of N deficiency in green bean leaves without nitrogen fertilizer. ~~Symptoms that arise are the color of old leaves that are yellowish~~ The symptoms include yellowish-green coloration of leaves compared to normal leaves which are fresh green. ~~According to~~ Erythrina et al. (2016) stated that nitrogen is the main nutrient in the formation of leaf color ~~because nitrogen will play a~~ due to its important role in increasing leaf green matter and protein. ~~Applying~~Therefore, the application of nitrogen ~~will increase~~ increases the green color of the leaves ~~and if it is deficient in nitrogen~~but when deficient, ~~it reduces~~ the formation of ~~chlorophyll,~~ chlorophyll is reduced thereby causing the leaves to appear yellowish-green. ~~According to~~ Furthermore, Bojovic et al. (2009) stated that nitrogen deficiency causes a reduction in leaf greenish ~~color, decreases leaf~~ color and area, ~~and reduces~~ as well as photosynthesis ~~because nitrogen has a~~ due to the linear correlation ~~with~~ between leaf chlorophyll ~~formation~~formation and nitrogen.

Lebat-3 cultivar requires a lower LOF concentration compared ~~to Perkasa cultivar~~with Perkasa to produce ~~the~~ significant yield. Table 3 ~~showed~~ shows that Perkasa cultivar with 20% LOF ~~treatment resulted in higher production~~ produced a higher yield compared to other treatments ~~and~~ but was not significantly different from the 100% recommended urea treatment. This is attributed to the effect of liquid organic fertilizer which does not ~~undergo a dissolving process so that it can be easily absorbed~~ uniformly dissolve for easy absorption by plants (Ginandjar et al., 2019). ~~In~~ The Lebat-3 ~~cultivar,~~ cultivar with 10% LOF ~~treatment resulted in higher production~~ produced a higher yield compared to other treatments ~~and~~ but was not significantly different from the recommended 100% urea treatment. ~~According to~~ Chaturdevi (2005), ~~nitrogen~~ reported that nitrogen fertilization with the right dose ~~affect~~ affects grain yield in rice and other parameters in each cultivar. ~~The~~ Furthermore, the use of N sources for plants affects the results of ~~the photosynthesis process~~photosynthesis. This is supported by Rathke (2005), ~~who~~ which stated that plant yield is improved by increasing the source of ~~N increase the yield~~N. ~~Nitrogen increases~~In addition, nitrogen improves yield ~~due to increased~~ by increasing leaf area and the rate of photosynthesis ~~so that the production of assimilation and dry matter also increases and consequently produces~~ hence, high carbohydrates ~~for~~ are produced by the plants (Chaturdevi, 2005). The yield of Lebat-3 cultivar was lower ~~than that of~~ compared to Perkasa ~~cultivar in the~~ but was not significantly different from the recommended 100% urea treatment and 20% LOF. Ratnasari et al.

(2015), stated that the differences in the characters possessed by cultivar are caused by ~~differences in~~ the varying genetic ~~composition in~~ composition, hence, each cultivar ~~so that they show different responses~~ responds differently to ~~the environment~~ environmental and production factors. The positive effect of ~~using~~ liquid organic fertilizers from lamtoro leaves in increasing crop yields was also found by Duaja et al. (2013) on chickpeas, Palimbungan et al. (2006) ~~-~~on mustard plants, Septirosya et al. (2019) on tomato plants, and Ainiya et al. (2019) on sweet corn plants. The experiment showed that the liquid organic fertilizers derived from lamtoro leaves ~~could be~~ are applicable as an alternative nitrogen ~~sources~~ source in bean cultivation~~. -~~. This low-cost technology ~~could be easily adopted~~ is easy to use by farmers and also ~~support the~~ supports organic ~~bena~~ bean production.

CONCLUSION

~~The~~ Based on the results, the use of plant-based nitrogen fertilization from lamtoro leaves ~~could be used~~ is applicable as an alternative to N fertilization in bean plants. The 20% LOF is recommended ~~concentration~~ as ~~could~~ an adequate concentration to increase the growth and yield of green beans. ~~Different cultivars showed~~ Furthermore, each cultivar shows different ~~responses~~responses to environmental and production factors. Treatment of Perkasa ~~cultivar at~~ (with 20% ~~LOF resulted in the highest bean yield of, while treatment of~~ LOF) and Lebat-3 cultivar ~~at~~ (with 10% ~~LOF resulted in~~ LOF) produced the highest bean yield, respectively.

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REFERENCES

Ainiya, M., M. Fadli, R. Despita. 2019. Peningkatan pertumbuhan dan hasil jagung manis dengan pemanfaatan trichokompos dan LOF daun lamtoro. *Agrotech. Res. J.* 3(2): 69-74.

Amin, MEH. 2011. Effect of different nitrogen sources on growth, yield and quality of fodder maize (*Zea mays* L.). *J. Saudi Soc.Agric. Sci.*. 10 (1): 17-23.

Arista, D., Suryono, Sudadi. 2015. Efek dari kombinasi pupuk N, P dan K terhadap pertumbuhan dan hasil kacang tanah pada lahan kering Alfisol. *Jurnal Agrosains*. 17(2): 49-52.

Beshir, HM., B. Tesfaye, R. Bueckert, B. Tar'an. 2015. Pod quality of snap bean as affected by nitrogen fixation, cultivar and climate zone under dryland agriculture. *African Journal of Agricultural Research*. 10(32): 3157-3169.

Bojovic, B., A. Markovic. 2009. Correlation between nitrogen and chlorophyll content in wheat (*Triticum aestivum* L.). *Kragujevac Journal Science*. 31(1): 69-74.

Bojovic, B., J. Stojanovic. 2005. Chlorophyll and carotenoid content in wheat cultivars as a function of mineral nutrition. *Archives of Biological Science Belrgade*. 57 (4): 283-290.

Camara, CRS., CA. Urrea, V. Sichlegel. 2013. Pinto beans (*Phaseolus vulgaris* L.) as a functional food: Implications of human health. *Agriculture.* 3(1): 90-110.

Chaturdevi, I. 2005. Effect of nitrogen fertilizers on growth, yield and quality of hybrid rice (Oryza Sativa). *Journal Central European Agriculture.* 6(4): 611-618.

Chaudhary, MM., AS. Bhanvadia, PN Parmar. 2015. Effect of integrated nutrient management on growth, yield attributes and yield of cabbage (*Brassica oleracea* Var. Capitata L.) under middle Gujarat conditions. *Trends in Bioscience.* 8(8): 2164-2168.

Duaja, MD. 2013. Pengaruh jenis bahan dasar dan dosis pupuk organik cair terhadap pertumbuhan dan hasil buncis (*Phaseolus vulgaris* L.). *Bioplantae.* 2(1): 47-54.

Duaja, MD., Mukhsin, R. Sijabat. 2013. Analisis pertumbuhan dan hasil dua varietas buncis (*Phaseolus vulgaris* L.) pada perbedaan jenis pupuk organik cair. *Program Studi Agroekoteknologi, Fakultas Pertanian Universitas Jambi.* 2(1): 47-54.

Erythrina. 2016. Bagan warna daun: Alat untuk meningkatkan efisiensi pemupukan nitrogen pada tanaman padi. *Jurnal Litbang Pertanian*. 35(1): 1-10.

Fahmi, A., Syamsudin, SNH. Utami., B. Radjagukguk. 2010. Pengaruh interaksi hara nitrogen dan fosfor terhadap pertumbuhan tanaman jagung (*Zea mays* L.) pada tanah Regosol dan Latosol. *Berita Biologi.* 10(3): 297-304.

Faustina, E., Sudradjat, Supijatno. 2015. Optimization of nitrogen and phosphorus fertilizer on two years old of oil palm (*Elaeis guineensis* jacq.). *Asian Journal of Applied Sciences*. 3(3): 421-428.

Ginandjar, S, B. Prasetya, W. Nugraha, M. Subandi. 2019. The effect of liquid organic fertilizer of vegetable waste and planting media on growth and yield of strawberry (*Fragaria* spp.) Earlibrite Cultivar. IOP Conf. Series: Earth and Enviromental Science 334, 012033

Hendriyani, IK, Y. Nurchayati, N. Setiari. 2018. Kandungan klorofil dan karotenoid kacang tunggak (*Vigna unguiculata* (L.) Walp.) pada umur tanaman yang berbeda. *Jurnal Biologi Tropika.* 1(2): 38-43.

Hidayat, O, Suharyana, A. 2019. Pengaruh dosis pupuk organik cair daun lamtoro terhadap pertumbuhan dan hasil tanaman pakcoy (*Brassica rapa* L.) varietas Nauli-F1. *Jurnal Ilmiah Pertanian.* 7(2): 57-63.

Jeksen, J., C. Mutiara. 2017. Analisis kualitas pupuk organik cair dari beberapa jenis tanaman Leguminosa. Jurnal Pendidikan MIPA. 7(2): 124-130.

Madusari, S. 2019. Processing of fibre and its application as liuid organic fertilizer in oil palm (*Elaeis guineensis* Jacq.) seedling for sustainable agriculture. *Joulnal of Applied Science and Advanced Technology*. 1 (3): 81-90.

Maghfoer, M.D., Koesriharti, T. Islami, NDS, Kanwal. 2018. A study of the efficacy of various nutrient sources on the growth and yield of cabbage. *AGRIVITA Journal of Agricultural Science.* 40(1): 168-176.

Pahlevi, RW, B. Guritno, NE, Suminarti. 2016. Pengaruh kombinasi proporsi pemupukan nitrogen dan kalium pada pertumbuhan, hasil dan kualitas tanaman ubi jalar (*Ipomoea batatas* (L.) Lamb) varietas Cilembu pada dataran rendah. *Jurnal Produksi Tanaman*. 4(1): 16-22.

Palimbungan, N., R. Labatar, F. Hamzah. 2006. Pengaruh ekstrak daun lamtoro sebagai pupuk organik cair terhadap pertumbuhan dan hasil produksi tanaman sawi. *Jurnal Agrisitem*. 2(2): 96-101.

Pamungkas, MA, Supijatno. 2017. Pengaruh pemupukan nitrogen terhadap percabangan tanaman teh (*Camelia sinensis* (L.) O. Kuntze) untuk pembentukan bidang petik. *Buletin Agronomi*. 5(2): 234-41.

Pary, C. 2015. Pengaruh pupuk organik (daun lamtoro) dalam berbagai konsentrasi terhadap pertumbuhan tanaman sawi. *Jurnal Fikratuna*. 7(2): 247-255.

Paul, V, L. Sharma, R. Pandey, R.C. Meena. 2017. Measurements of stomatal density and stomatal index on leaf/plant surfaces. Manual of ICAR sponsored traning programme on "physiological techniques to analyze the impact of climate change on crop plants. Division of Plant Physiology, IARI, Nrw Delhi.

Permanasari, I., M. Irfan, Abizar. 2014. Pertumbuhan dan hasil kedelai (*Glycine max (*L.) Merill) dengan pemberian *Rhizobium* dan pupuk urea pada media gambut. *Jurnal Agroteknologi.* 5(1) ; 29-34.

Pramitasari, HE, T. Wardiyanti, M. Nawawi. 2016. Pengaruh dosis pupuk nitrogen dan tingkat kepadatan tanaman terhadap pertumbuhan dan hasil tanaman kailan (*Brassica oleraceae* L.). *Jurnal Produksi Tanaman.* 4(1): 49-56.

Proklalmasiningsih, E., ID. Prijambada, D. Rachmawati, dan RP. Sancaningsih. 2012. Laju fotosintesi dan kandungan klorofil kedelai pada media tanam masam dengan pemberian garam aluminium. *AGROTROP*. 2(1): 17-24.

Putri, FM, SWA. Suedy., S. Darmanti. 2017. Pengaruh pupuk nanosilika terhadap jumlah stomata, kandungan klorofil dan pertumbuhan padi hitam (*Oryza sativa* L. cv. japonica). *Buletin Anatomi dan Fisiologi*. 2(1): 72-79.

Rahimi, A., SS, Moghaddam, M. Ghiyasi, S. Heydarzadeh, K. Ghazizadeh, J. Popovi´c-Djordjevi´c. 2019. The influence of chemical, organic and biological fertilizers on agrobiological and antioxidant properties of syrian cephalaria (*Cephalaria Syriaca* L.). *Journal Agriculture.* 9 (122): 1-13.

Rathke, GW, O. Christen, W. Diepenbrock. 2005. Effects of nitrogen source and rate on productivity and quality of winter oilseed rape (*Brassica napus* L.) grown in different crop rotations. *Field Crops Research*. 94 (1) 103–113.

Ratnasari, D., MK, Bangun, RIM, Damanik. 2015. Respon dua varietas kedelai (*Glycine max* (L.) Merrill.) pada pemberian pupuk hayati dan NPK majemuk. *Jurnal Oline Agroteknologi*. 3(1): 276-82.

Razaq, M., P. Zhang, H, Shen, Salahuddin. 2017. Influence of nitrogen and phosphorous on the growth and root morphology of *Acer mono*. *Journal PLoS ONE*. 12(2): 1-13.

Rihana, S., YBS. Heddy, MD, Maghfoer. 2013. Pertumbuhan dan hasil tanaman buncis (*Phaseolus viulgaris* L.) pada berbagai dosis pupuk kotoran kambing dan konsentrasi zat pengatur tumbuh Dekamon. *Jurnal Produksi Tanaman*. 1(4): 369-377.

Rizqiani, NF, E. Ambarwati, NW, Yuwono. 2007. Pengaruh dosis dan frekuensi pemberian pupuk organik cair terhadap pertumbuhan dan hasil buncis (*Phaseolus vulgaris* L.) dataran rendah. *Jurnal Ilmu Tanah dan Lingkungan*. 7(1): 43-53.

Santosa, M., MD, Magfoer, H, Tarno. 2017. The influence of organic and inorganic fertilizers on the growth and yield of green bean, *Phaseolus vulgaris* L. Gron in dry and rainy season. *AGRIVITA Journal of Agricultural Science*. 39(3): 296-302.

Septirosya, T, R, Hartono, T, Aulawi. 2019. Aplikasi pupuk organik cair daun lamtoro pada pertumbuhan hasil tanaman tomat. *Agroscript*. 1(1): 1-8.

Sinaga, AS, B. Guritno, Sudiarso. 2017. Pengaruh dosis kompos sampah rumah tangga terhadap pertumbuhan dan hasil tiga varietas buncis tipe tegak (*Phaseolus vulgaris* L.). *Jurnal Produksi Tanaman*. 5(6):947-956.

Watson, CA, Atkinson, D, Gosling, P, Jackson, LR, Rayns, FW. 2002. Managing soil fertility in organic farming systems. *Soil Use and Management* 18:239-247

Wijiyanti, P, ED. Hastuti, S. Haryanti. 2019. Pengaruh masa inkubasi pupuk dari air cucian beras terhadap pertumbuhan tanaman sawi hijau (*Brassica juncea* L.). *Buletin Anatomi dan Fisiologi.* 4(1): 41-28.

Zainal, M, A. Nugroho, NE, Suminarti. 2014. Respon pertumbuhan dan hasil tanman kedelai (*Glycine max* (L.) Merill) pada berbagai tingkat pemupukan N dan pupuk kandang ayam. *Jurnal Produksi Tanaman.* 2(6): 484-490.

Ainiya M, Fadil M, Despita R. 2019. Increase Growth and Yield of Sweet Corn with The Benefit Tricokompos and Liquid Organic Fertlizers Lamtoro Leaves (In indonesian: Peningkatan Pertumbuhan dan Hasil Jagung Manis dengan Pemanfaatan Trichokompos dan POC Daun Lamtoro). *Agrotechnology Research Journal* 3: 69-74

Amin ME-MH. 2011. Effect of Different Nitrogen Sources on Growth, Yield and Quality of Fodder Maize (Zea mays L.). *Journal of the Saudi Society of Agricultural Sciences* 10: 17-23

Arista D, Suryono, Sudadi. 2015. Effect of N, P and K Fertilizer Combinations to Growth and Yield of Peanut on Alfisols Dry Land (in indonesian: Efek dari Kombinasi Pupuk N, P dan K terhadap Pertumbuhan dan Hasil Kacang Tanah pada Lahan Kering Alfisol. *Agrosains* 17: 49-52

Bojović B, Marković A. 2009. Correlation Between Nitrogen and Chlorophyll Content in Wheat (*Triticum aestivum* L.). *Kragujevac Journal Science* 31: 69-74

Bojovic B, Stojanovic J. 2005. Chlorophyll and Carotenoid Content in Wheat Cultivars as A Function of Mineral Nutrition. *Archives of Biological Science Belrgade* 57: 283-90

Chaturvedi I. 2005. Effect of Nitrogen Fertilizers on Growth, Yield and Quality of Hybrid Rice *(Oryza Sativa)*. *Journal Central European Agriculture* 6: 611-18

Chaudhary MM, Bhanvadia AS, Parmar PN. 2015. Effect of Integrated Nutrient Management on Growth, Yield Attributes and Yield of Cabbage (Brassica oleracea Var. Capitata L.) Under Middle Gujarat Conditions. *Trends in Biosciences* 8: 2164-68

Duaja MD, Mukhsin, Sijabat R. 2013. Analisis pertumbuhan dan hasil dua varietas buncis (Phaseolus vulgaris L.) pada beberapa jenis pupuk organik cair. *Bioplantae* 2: 47-54

Erythrina. 2016. Leaf Color Chart: a Tool to Increase Nitrogen Fertilizer Efficiency in Rice (in indonesian: Bagan Warna Daun: Alat Untuk Meningkatkan Efisiensi Pemupukan Nitrogen pada Tanaman Padi). *Jurnal Litbang Pertanian* 35: 1-10

Faustina E, Sudradjat, Supijatno. 2015. Optimization of Nitrogen and Phosphorus Fertilizer on Two Years Old of Oil Palm *(Elaeis guineensis* Jacq.). *Asian Journal of Applied Sciences* 3: 421-28

Ginandjar S, Frasetya B, Nugraha W, Subandi M. 2019. The Effect of Liquid Organic Fertilizer of Vegetable Waste and Planting Media on Growth and Yield of Strawberry *(Fragaria* spp.) Earlibrite Cultivar. *IOP Conf. Series: Earth and Environmental Science* 334: 1-8

Hendriyani IS, Nurchayati Y, Setiari3 N. 2018. Contents of Chlorofil and Carotenoid of Beans (*Vigna Unguiculata* (L.) Walp.) In The Different Age of Plants (In Indonesian: Kandungan Klorofil dan Karotenoid Kacang Tunggak (*Vigna Unguiculata* (L.) Walp.) pada Umur Tanaman Yang Berbeda). *Jurnal Biologi Tropika* 1: 38-43

Hidayat O, Suharyana A. 2019. The Effect of Dosage of Lamtoro Leaf Organic Fertilizer to Growth and Yield of Pakcoy (*Brassica rapa* L.) Plant Varieties Nauli-F1. (in Indonesian: Pengaruh Dosis Pupuk Organik Cair Daun Lamtoro terhadap Pertumbuhan dan Hasil Tanaman Pakcoy (Brassica rapa l.) Varietas Nauli-F1. *Jurnal Ilmiah Pertanian* 7: 57-63

Madusari S. 2019. Processing of Fibre and Its Application as Liquid Organic fertilizer in Oil Palm (*Elaeis guineensis* Jacq.) Seedling for Sustainable Agriculture. *Journal of Applied Science and Advanced Technology* 1: 81-90

Palimbungan N, Labatar R, Hamzah F. 2006. Pengaruh ekstrak daun lamtoro sebagai pupuk organik cair terhadap pertumbuhan dan produksi tanaman sawi. *Jurnal Agrisistem* 2: 96-101

Pamungkas MA, Supijatno. 2017. The Effect of Nitrogen Fertilization on High and Branching Tea Plant (Camelia sinensis (L.) O. Kuntze) Frame Formation (In indonesian: Pengaruh Pemupukan Nitrogen Terhadap Tinggi dan Percabangan Tanaman Teh (Camelia Sinensis (L.) O. Kuntze) untuk Pembentukan Bidang Petik). *Buletin Agronomi* 5: 234-41

Pary C. 2015. The influence of organic fertilizer (lamtoro leaves) in various concentration to the growth mustard plant (in indonesian: Pengaruh Pupuk Organik (Daun Lamtoro) dalam berbagai konsentrasi terhadap Pertumbuhan Tanaman Sawi). *Jurnal Fikratuna* 7: 247-55

Permanasari I, Irfan M, Abizar. 2014. Growth and Yield of Soybean (*Glycine max* (L.) Merill) with Application of Rhizobium and Nitrogen Fertilizer on Peat Media (in indonesian:Pertumbuhan dan Hasil Kedelai (*Glycine max* (L.) Merill) dengan Pemberian Rhizobium dan Pupuk Urea pada Media Gambut. *Jurnal Agroteknologi* 5: 29-34

Pramitasari HE, Wardiyati T, Nawawi M. 2016. Pengaruh Dosis Pupuk Nitrogen dan tingkat kepadatan tanaman terhadap pertumbuhan dan hasil tanaman kailan (Brassica oleraceae L.). *Jurnal Produksi Tanaman* 4: 49-56

Proklamasiningsih E, Rachmawati, Prijambada ID, Sancayaningsih RP. 2012. Rate of Photosynthesis and Chlorophyll Content of Soybean on Acidic Growth Medium Exposure with Aluminum Salts (In indonesian: Laju Fotosintesis dan Kandungan Klorofil Kedelai pada Media Tanam Masam dengan Pemberian Garam Aluminium). *Agrotrop* 2: 17-24

Putri FM, Suedy SWA, Darmanti S. 2017. The Effect Nanosilica Fertilizer on Numbers of Stomata, Chlorophyll Content, and Growth of Black Rice (Oryza sativa L. cv. Japonica) (In indonesian: Pengaruh Pupuk Nanosilika Terhadap Jumlah Stomata, Kandungan Klorofil dan Pertumbuhan Padi Hitam (Oryza sativa L. cv. japonica). *Buletin Anatomi dan Fisiologi* 2: 72-79

Rathke G-W, Christen O, Diepenbrock W. 2005. Effects of nitrogen source and rate on productivity and quality of winter oilseed rape (Brassica napus L.) grown in different crop rotations. *Field Crops Research* 94: 103-13

Ratnasari D, Bangun MK, Damanik RIM. 2015. Response of Two Soybean (*Glycine max* (L.) Merrill.) Varieties on the Biofertilizer and NPK Compound Fertilizer application (In Indonesian: Respons Dua Varietas Kedelai (*Glycine max* (L.) Merrill.) pada Pemberian Pupuk Hayati dan NPK Majemuk *Jurnal Online Agroekoteknologi* 3: 276-82

Razaq M, Zhang P, Shen H-l, Salahuddin. 2017. Influence of Nitrogen and Phosphorous on The Growth and Root Morphology of Acer Mono. *PLOS ONE* 12: 1-13

Santosa M, Maghfoer MD, Tarno H. 2017. The Influence of Organic and Inorganic Fertilizers on the Growth and Yield of Green Bean, Phaseolus vulgaris L. Grown in Dry and Rainy Season *Agrivita* 39(3): 296-302

Septirosya T, Putri RH, Aulawi T. 2019a. Aplikasi pupuk organik cair lamtoro pada pertumbuhan dan hasil tanaman tomaT (In English: The application of lamtoro organic liquid fertilizer on tomato's growth and yield). *Agroscript* 1: 1-8

Septirosya T, Putri RH, Aulawi T. 2019b. The Application of Lamtoro Organic Liquid Fertilizer on Tomato's Growth and Yield (in Indonesian: Aplikasi Pupuk Organik Cair Lamtoro pada Pertumbuhan dan Hasil Tanaman Tomat). *AGROSCRIPT* 1: 1-8

Wijiyanti P, Hastuti ED, Haryanti2 S. 2019. Effect of Fertilizer Incubation Period of Rice Wash Water on Green Mustard Plant Growth (Brassica Juncea L.) (in indonesian: Pengaruh Masa Inkubasi Pupuk dari Air Cucian Beras terhadap Pertumbuhan Tanaman Sawi Hijau (Brassica Juncea L.)). *Buletin Anatomi dan Fisiologi* 4: 21-28

Zainal M, Nugroho A, Suminarti NE. 2014. Response Of Nitrogen Fertilization And Chicken Fertilezer At Various Levels On Growth And Yield Of Soybean (*Glycine max* (L.) Merrill) (In Indonesian: Respon Pertumbuhan dan Hasil Tanaman Kedelai

(Glycine max (L.) Merill) pada Berbagai Tingkat Pemupukan N dan Pupuk Kandang Ayam). *Jurnal Produksi Tanaman* 2: 484-90

THE GROWTH AND YIELD RESPONSES OF TWO BEAN CULTIVARS TO ORGANIC AND INORGANIC NITROGEN SOURCES

Abstract. The productivity of beans is increased by selecting the best cultivar and applying fertilizers according to the needs of the plant. In addition, the application of high-yielding cultivar and N fertilizers with the right dosage is used to improve low production. Therefore, this study aims to determine the effect of nitrogen sources on the growth and yield of two beans cultivars. A 5x2 factorial treatment was used in a randomized block design with three replications. The first factor is the Perkasa and Lebat-3 cultivar, while the second is organic and inorganic nitrogen fertilizer, namely control, urea 100 kg ha^{-1}, as well as 10, 20, and 30% concentrations of liquid organic fertilizer from lamtoro leaves. The results showed that the use of liquid organic fertilizers with the right dose is applicable as an alternative to nitrogen fertilization. Furthermore, the 20% concentration produced the highest number of trifoliate leaves (8.81 leaves) and dry weight (4.52 g), while urea produced the highest plant height (171.48 cm), chlorophyll (15.93 mg g^{-1} FW), carotenoids (2.35 mg g^{-1} FW) and the number of stomata (22 mm^{-2}). Based on the results, the use of 20% liquid organic fertilizer with Perkasa cultivar showed the best effect on the number of pods per plant (5.67), and yield (846.67 kg ha^{-1}).
Keywords: chlorophyll, cultivar, liquid organic fertilizers, stomata, urea,

I. INTRODUCTION

Green bean (*Phaseolus vulgaris* L.) constitutes one of the legume plants and serve as a source of vegetable protein. The plant is widely consumed by the Indonesians due to its important role in fulfilling health needs as a nutritious food ingredient. Rihana et al. (2013), stated that beans are source of vegetable protein, rich in vitamins A, B, C and has great potential for the treatment of several diseases such as oxidative stress, cardiovascular disease, cancer, and diabetes (Camara et al., 2013). Furthermore, as the population grows, the need for fresh food and vegetables continue to also increases. Therefore, to increase the production of green beans, it is necessary to apply good cultivation techniques such as applying a balanced fertilization that fulfills the nutritional needs for growth. The productivity of green beans is also increased by using improved cultivars. Meanwhile, there are numerous green beans cultivar available in the market. Ratnasari et al. (2015), stated that each cultivar has different genetic characteristics, which lead to differences in appearance, character, as well as responses to production factors.

Fertilization is one way to meet the nutritional needs of nitrogen in green beans. Meanwhile, nitrogen is an important nutrient required by green beans for the formation of chlorophyll, protoplasm, protein, and nucleic acids (Fahmi et al., 2010). Fertilization with nitrogen (N) is derived from organic and inorganic fertilizers such as Urea. Furthermore, green bean nutritional need for N is higher than any other nutrient. Pahlevi et al. (2016) reported that nitrogen affects the photosynthetic process in plants as well as the photosynthate produced. Maghfoer et al. (2018), also stated that the application of inorganic fertilizers produced large growth and plant yield. However, the continueous use of inorganic fertilizers leads to low soil fertility and productivity. Therefore, an alternative approach is needed to reduce the use of inorganic fertilizers, via organic fertilization.

Nitrogen is commonly supplied alternatively to plants using Liquid Organic Fertilizers (LOF). It is an organic fertilizer available in liquid form and contains nutrients in the form of a solution, therefore, it is easily absorbed by plants. Furthermore, it is applied via sprinkling or spraying on the leaves or stems of plants. Organic fertilizers are made from plant waste available in the environment. In particular, liquid organic fertilizers are more beneficial because its distribution is adjustable to the needs of plants (Ginandjar et al., 2019). One example of organic matter widely used as a liquid organic fertilizer source of nitrogen is lamtoro leaves (*Leucaena leucocephala*). Liquid organic fertilizer derived from this plant contains nitrogen nutrients needed by plants (Jeksen and Mutiara, 2017). The N content in lamtoro leaves is quite high, namely 3.84%, therefore, it is a source of organic nutrient to increase the growth and yield of green beans (Palimbungan et al., 2006). Furthermore, the application of liquid organic fertilizers increased the fresh weight of pods in green beans (Rizqiani et al., 2007), and provided the highest yield of pods and bean per plant in kirinyuh (*Chromolaena odorata* L.) (Duaja, 2013).

Plant cultivar is a factor that greatly determines the quality of agricultural products. The use of high-yielding beans cultivar increases productivity and yield quality. Each cultivar has different genetic characteristics and traits which leads to differences in the respective character and appearance. Examples of high-yielding beans cultivar include Perkasa and Lebat-3. The advantages of Perkasa cultivar include resistance to leaf rust disease, early maturity as well as the large and long pods. In contrast, the advantages of Lebat-3 cultivar include well adapted to the low-highlands, early maturity and has high yield potential. Sinaga et al. (2017) showed that the use of cultivars had a significant effect on the growth and yield of beans. Furthermore, Duaja (2013) stated that there is an interaction between the use of bean cultivar with liquid organic fertilizers doses on the number of pods and productivity.

The fertilizer requirement by each cultivar is usually different, this is due to the individual genetic characteristics hence, the selection of fertilizer types and requirements need to be considered. Besides, the appropriate doses of liquid organic fertilizers also influence plant growth. Ratnasari et al. (2015), stated that variations in genetic traits of cultivar lead to different responses to environmental and production factors. There are only few studies on the different organic and inorganic nitrogen

sources. In this study, two beans cultivar were hypothesized to produce different responses to treatment with various types and doses of inorganic-and-organic-sources-based nitrogen. Therefore, this study aims to determine the effect of inorganic and organic nitrogen sources on the growth and yield of two beans cultivars.

II. MATERIALS AND METHODS

This study was conducted at the experimental research area Pemanggilan, Natar, Lampung province, Indonesia from January to March 2020. The soil was first cultivated using hoes, loosened to a depth of 20-30 cm, evenly processed and an experimental plot was made with a size of 3 x 2.5 m. Furthermore, the Perkasa and Lebat-3 cultivar were planted by drilling the planting holes, while two seeds each were planted with a spacing of 40 cm x 40 cm.

The (2 x 5) factorial treatment was used in a randomized block design (RBD) with three replications totaling 30 experimental units. The first factor was the bean cultivars, namely Perkasa and Lebat-3, while the second was the source of nitrogen, namely control, urea 100 kg ha^{-1}, as well as 10, 20**,** and 30% LOF. Furthermore, the data were analyzed using analysis of variance procedures, while the means were compared using the Honestly Significant Difference (HSD) of 5%.

The liquid fertilizer was prepared by mixing chopped lamtoro leaves (1 kg of lamtoro leaves: 2 liters of water), with 200 ml of molasses and 200 ml of EM4 in a drum, the mixture was then fermented for 15 days and the liquid was filtered. The inorganic fertilizers given include urea 100 kg ha^{-1} (75 g $plot^{-1}$) at the beginning and 4 weeks after planting (WAP), while SP-36 200 kg ha^{-1} (150 g $plot^{-1}$) and KCL 100 kg ha^{-1} (75 g $plot^{-1}$) were given at the beginning of planting. Fertilization was applied in a strip with a distance of 5 cm from the plant.

The liquid organic fertilizer was applied by spraying on the top and bottom of the plant (60:40). This was carried out once a week using a concentration of 10% (100 ml LOF solution + 900 ml water), 20% (200 ml LOF solution + 800 ml water), and 30% (300 ml LOF solution + 700 ml water).

Plant maintenance includes weeding manually and thinning, while the harvest was carried out in stages according to the age of each cultivar. The characteristics of beans ready for harvest include young and gloomy pod color, rough skin surface, less prominent seeds in the pods which usually make a popping sound when the pods are broken especially between 2-3 weeks after flowering.

The parameters observed include plant height (6 WAP), number of trifoliate leaves (6 WAP), chlorophyll, carotenoids (5 WAP), number of stomata (5 WAP), greenness of leaves (5 WAP), symptoms of N deficiency, number of pods per plant, dry weight, and yield. Furthermore, the replica method modified from Paul, 2017 was used to observe the stomata on the leaf surface. The leaves were first cleaned with a tissue to remove dust or dirt and then rubbed with a transparent nail polish, and allowed to dry for a few minutes. A transparent strip tape measuring 1 cm x 1 cm in size was applied, smoothed, and then peeled off slowly. The sample produced was then attached to the slide and observed under a microscope.

The chlorophyll and carotenoid contents were measured using the spectrophotometric method. The green beans were crushed using a mortar and 100 ml of 70% alcohol solution was added. Furthermore, the extract was filtered and the filtrate was placed in a cuvet to measure the total chlorophyll and carotenoid contents using a spectrophotometer. The chlorophyll and carotenoid contents were calculated using the formula (Rahimi et al., 2019):

Chlorophyll *a* = $11{,}24 \times A_{662} - 2{,}04 \times A_{645}$

Chlorophyll *b* = $20{,}13 \times A_{645} - 4{,}19 \times A_{662}$

Chlorophyll total = $7{,}05 \times A_{662} + 18{,}09 \times A_{645}$

Carotenoid = $\frac{(1000 \times A470 - 1{,}90 \times \text{clorofil a} - 63{,}14 \times \text{clorofil b})}{214}$

III RESULTS AND DISCUSSION

The LOF analysis results showed that the N content in the lamtoro leaves was 0.16%, C-organic 3.08%, N-total 0.16%, P-total 0.18% and K 0.56% with a pH of 3.64. Furthermore, the C/N ratio was 19.25, which fulfills the standard of organic fertilizer. A good C/N ratio ranges between 15-20%, meanwhile, a high ratio decreases the biological activity of microorganisms, and a very low ratio causes denitrification (Watson et al., 2002)

Table 1. Effects of treatment with different nitrogen sources and cultivar on plant height, number of trifoliate leaves, and dry weight.

Treatment	Plant height (cm)	Number of trifoliate leaves	Dry weight (g)
Perkasa Cultivar	133.60 a	7.20 a	3.21 a
Lebat-3 Cultivar	137.63 a	8.11 a	3.17 a
$HSD_{0,05}$	18.47	1.43	0.92
Control	94.71 c	5.57 b	1.95 b
Urea	171.48 a	8.50 ab	3.78 ab
10% LOF	150.60 ab	9.11 a	3.13 ab
20% LOF	148.02 ab	8.81 ab	4.52 a
30% LOF	113.29 bc	6.30 ab	2.58 ab
$HSD_{0,05}$	42.11	3.25	2.09

In a column, common values letter(s) do not differ significantly at $p \leq 0,05$ as per HSD

The results showed that the combination of N sources and cultivar did not affect plant height, numbers of trifoliate leaves, and dry weight. Plant height in the control was shorter than the treatment with urea, as well as 10, and 20% LOF, meanwhile, the application of N sources from urea, as well as 10, 20, and 30% LOF showed no significant differences (Table 1). Moreover, the numbers of trifoliate leaves in the control were lesser compared to 10, 20, and 30% LOF, while the number of trifoliate leaves treated with urea, and the different LOF concentrations showed no significant differences (Table 1). Application of 20% LOF produced heavier dry weight compared to control, while the application of urea, and the different LOF concentrations were not different (Table 1).

Table 2. Effects of treatment with different nitrogen sources and cultivar on chlorophyll, carotenoid, and numbers of stomata.

Treatment	Chlorophyll (mg g^{-1} FW)	Carotenoid (mg g^{-1} FW)	The number of stomata (mm^{-2})
Perkasa Cultivar	12.92 a	1.59 a	14.40 a
Lebat-3 Cultivar	13.24 a	1.88 a	14.67 a
$HSD_{0,05}$	1.16	0.29	3.50
Control	9.68 b	1.38 b	8.50 c
Urea	15.93 a	2.35 a	22.00 a
10% LOF	15.56 a	1.69 ab	11.50 bc
20% LOF	13.77 a	1.76 ab	17.83 ab
30% LOF	10.46 b	1.47 b	12.83 bc
$HSD_{0,05}$	2.64	0.67	8.05

In a column, common values letter(s) do not differ significantly at $p \leq 0,05$ as per HSD

Based on the results, the application of N sources and cultivars affected chlorophyll, carotenoids, and the number of stomata in green beans. Meanwhile, the parameters of chlorophyll, carotenoids, and the number of stomata in the Perkasa cultivar did not differ significantly compared to Lebat-3. The chlorophyll content in the control was lower than the urea treatment, and was not different between the control and 30% LOF. Furthermore, the chlorophyll content for the urea treatment did not differ compared to 10 and 20% LOF (Table 2). The application of urea produced a higher carotenoid content compared to the control, but was not different compared to 10, and 20% LOF treatments (Table 2). Also, the application of 10, 20, and 30% LOF showed no differences in the carotenoid content compared to the control. The application of urea produced a higher number of stomata compared to the control, while the application of urea and 20% LOF showed no differences in the number of stomata. Similarly, LOF applications of 10, and 30% also produced no difference in the numbers of stomata (Table 2).

Table 3. Effects of treatment nitrogen source and cultivar on dry weight, plant,number of pods, greeness leaves and yield two cultivar bean.

Parameter	Source N	Cultivar		$HSD_{0,05}$
		Perkasa	Lebat-3	
Greeness of the leaves	Control	18.31 Ab	17.54 Ab	9.34
	Urea	27.79 Aa	28.91 Aa	
	10% LOF	20.13 Aab	28.11 Aa	
	20% LOF	24.06 Aab	24.19 Aa	
	30% LOF	28.96 Aa	21.81 Aab	
Number of pods	Control	5.46 Ac	2.50 Ab	4.40
	Urea	9.13 Aab	9.05 Aa	
	10% LOF	9.96 Aab	12.13 Aa	
	20% LOF	13.38 Aa	4.67 Bab	
	30% LOF	6.92 Abc	3.75 Ab	
Yield of green bean (kg ha^{-1})	Control	231.11 Ac	113.33 Ab	220.24
	Urea	720.89 Aab	429.78 Aa	
	10% LOF	565.33 Ab	515.56 Aa	
	20% LOF	846.67 Aa	181.33 Bb	
	30% LOF	333.78 Ac	148.00 Ab	

Mean followed by the same letter (capital horizontal and small letter read vertically) do not differ significantly at $p \leq 0,05$ as per HSD

The results showed that the level of leaf greenness, number of pods, and bean production were significantly affected by the interaction of N sources and bean cultivar (Table 3). The 30% LOF treatment with Perkasa cultivar and urea with Lebat-3 produced the highest level of leaf greenness compared to the others but were still significantly the same as the other treatments with different N sources. Moreover, the data indicated that the average value of leaf greenness of plants treated with organic and inorganic fertilizers was higher than the control plants without nitrogen fertilizers. The treatment without N fertilizer had low greenness. Perkasa cultivar with 20% LOF produced a statistically higher number of bean pods compared to the Lebat-3. Similarly, Perkasa cultivar with 20% LOF produced the highest number of bean pods per plant but was not significantly different from the 10% LOF and urea treatments. Furthermore, Lebat-3 cultivar with LOF 10% produced the highest number of bean pods but was not significantly different from the urea and 20% LOF treatment. There was a significant difference between the yield of the two cultivars with 20% LOF treatment. The

Perkasa cultivar treated with urea and LOF 20% produced a higher yield, while Lebat-3 with urea and 10% LOF treatment produced a higher yield compared to other treatments (Table 3).

Symptoms of N Deficiency (Figure 1.)

Symptoms of nitrogen nutrient deficiency were found in the green bean leaves. This deficiency occurs in the leaves of plants without treatment (control), characterized by a yellowish appearance compared to the leaves treated with nitrogen fertilizer. Normal leaves have fresh green leaf color (Figure 1). Santosa et al. (2017) stated that the use of chemical fertilizers not only increases production costs but also decreases productivity and gradually leads to higher risks. Furthermore, nitrogen requirement by plants is needs to be in accordance with the demand of the plant. Zainal et al. (2014) stated that the lack of this nutrient leads to leaf chlorosis indicated by yellowing of the leaves. In contrast, excess nitrogen accelerates plant growth, especially on the stems, the leaves turn dark green.

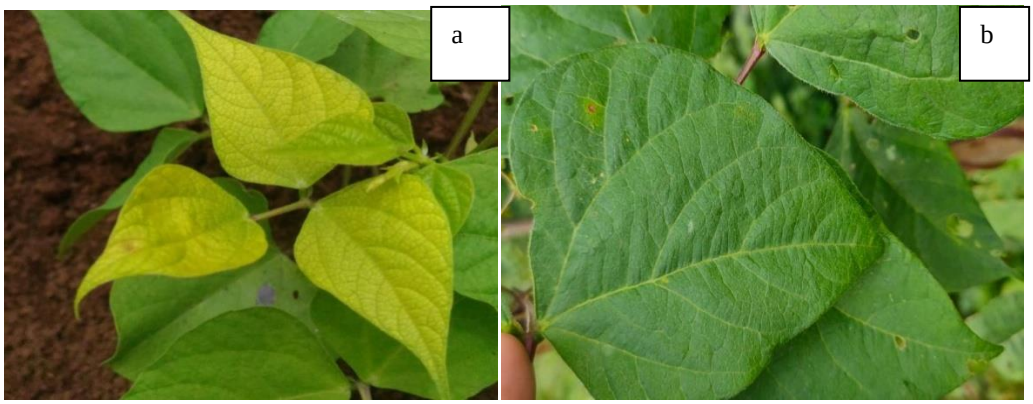


Figure 1. *Comparison of deficiency N (a) The color of the leaf deficient N (b) The color of the normal leaf*

Discussion

The results showed that the Perkasa and Lebat-3 cultivar had no significantly different effect on vegetative growth, while the application of inorganic-and-organic-sources-based nitrogen affected vegetative growth parameters namely plant height, numbers of leaves, and dry weight (Table 1). This is supported by Pamungkas and Supijatno (2017) which reported that nitrogen fertilizer significantly affect the growth of tea plants. In addition, Amin (2011), reported that nitrogen increased plant growth and height to produce numerous internodes which resultantly produce more leaves.

The number of trifoliate leaves in green beans is influenced by the availability of N nutrients. This parameter increased significantly after the application of organic nitrogen sources. Based on the results, the 10% LOF treatment produced the highest number of trifoliate leaves but was not different from the 20, and 30% LOF, as well as urea treatment. Pramitasari et al. (2016), stated that higher N absorption by plant leads to larger growth of the leaves. Furthermore, the application of LOF from lamtoro leaves showed significant growth in plant height, numbers of leaves, and fresh weight of mustard greens (Pary, 2015) highest yield on the number of pakcoy leaves (Hidayat and Suharyana, 2019), and increased the growth and number of fruit in tomato plants (Septirosya et al., 2019). The number of trifoliate leaves is a plant characteristic that affects the speed of photosynthesis to capture sunlight. Meanwhile, liquid organic fertilizers are rich in nitrogen and increases the number of plant leaves.

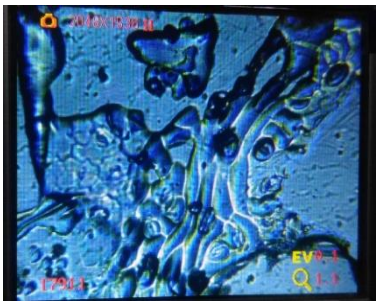
The application of nitrogen sources affected the dry weight of the plant. LOF 20% produced the highest dry weight but was not significantly different from urea and 10% LOF. Furthermore, it was assumed that the availability of sufficient nutrients in the treatment affects plant growth and yield. The high dry weight was influenced by the initial vegetative growth as this parameter is related to the

number of leaves and fresh weight. Arista et al. (2015) stated that nitrogen is an element that functions to increase leaf size and the percentage of protein. Meanwhile, Madusari (2019) reported that liquid organic fertilizers affect plant growth and nutrient absorption by increasing plant stem diameter and dry weight.

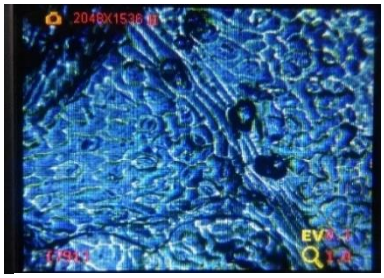
Based on the results, the application of inorganic-and-organic-sources-based nitrogen affected physiological characters namely chlorophyll, carotenoids, number of stomata and greenness of leaves. However, chlorophyll and leaf carotenoids were not affected by the bean cultivar. Bojovic et al. (2005), stated that the leaf color of certain cultivars did not directly correlate with chlorophyll content. Meanwhile, the chlorophyll and carotenoid contents are affected by the availability of N nutrients. Wijiyanti (2019) reported that nitrogen is the main nutrient needed for the formation of chlorophyll and carotenoids. This is also in line with Razaq et al. (2017) which found that chlorophyll and carotenoids synthesis depends on optimal N availability, therefore, nitrogen plays an important role in the formation of photosynthetic pigments. Furthermore, Hendriyani et al., (2018) reported that carotenoids and chlorophyll are complementary pigments, but carotenoids are fewer in number because it play a role in the absorption of light by chlorophyll.

The number of stomata in the two cultivars of green beans was affected by the application of nitrogen fertilizers (Table 2). The two cultivars showed similar responses, while the application of inorganic fertilizers produced more stomata compared to other treatments. Nitrogen fertilizer treatment on green beans had a significant effect on the number of stomata (Figure 1). Furthermore, urea and 20% LOF produced a higher number of stomata compared to the control. Meanwhile, the number of stomata in plants affects metabolic processes in plants such as photosynthesis. The rate of photosynthesis increases as the number of stomata rises; hence, plant productivity also increases. This is supported by Proklapmasiningsih et al. (2012), which stated that the rate of photosynthesis in plants is closely related to the yield. Moreover, Putri et al. (2017), reported that stomata play an important role in photosynthesis by acting as a surface for CO_2 exchange in the leaves.

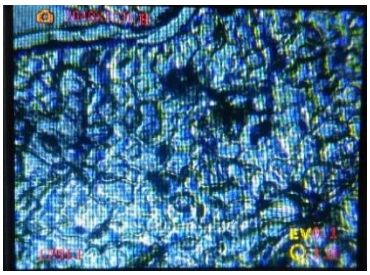
Perkasa Cultivar (control)



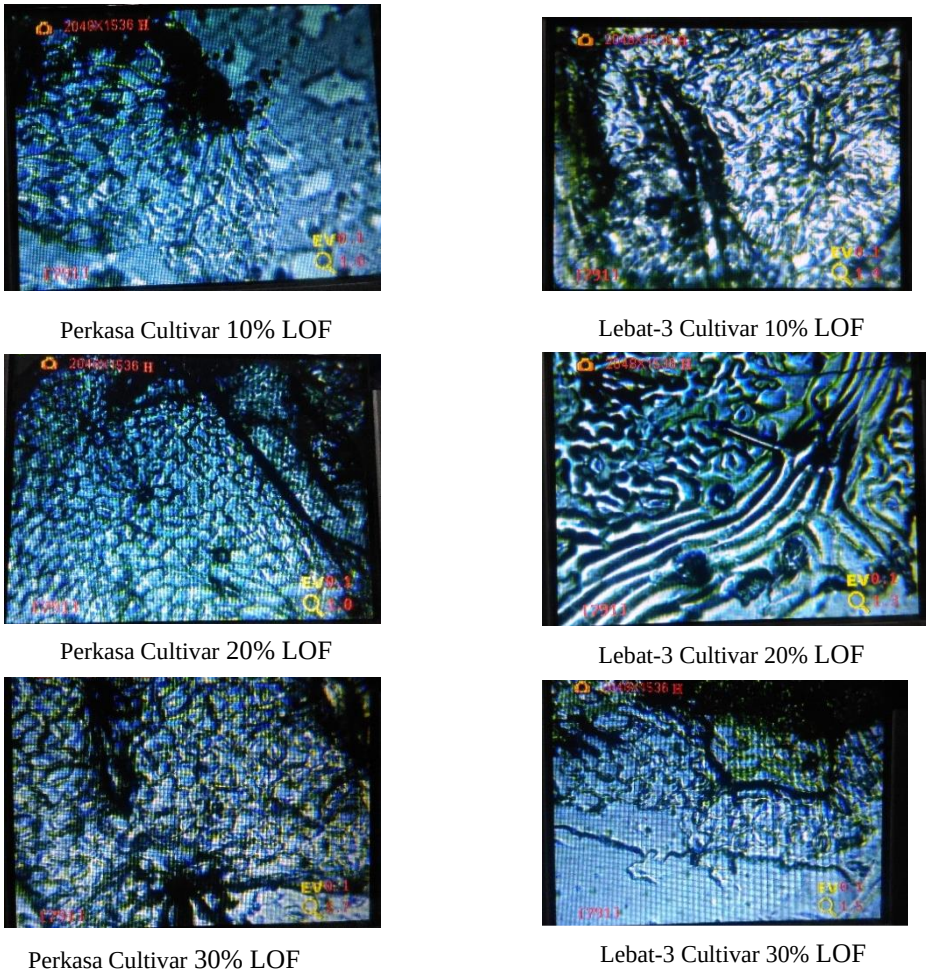
Lebat-3 Cultivar (control)



Perkasa Cultivar (Urea)



Lebat-3 Cultivar (Urea)



Perkasa Cultivar 10% LOF

Lebat-3 Cultivar 10% LOF

Perkasa Cultivar 20% LOF

Lebat-3 Cultivar 20% LOF

Perkasa Cultivar 30% LOF

Lebat-3 Cultivar 30% LOF

Figure 2. The number of stomata on Perkasa (left) and Lebat-3 (right)

The application of nitrogen fertilizers also affects the greenness of the leaves. Nitrogen is an important element which increases leaf greenness in plants (Faustina et al., 2015). Pramitasari et al. (2016) also stated that the N nutrient affects plant growth, appearance, and color hence, the plant organs turn green due to the chlorophyll content. Furthermore, Pamungkas and Supijatno (2017), reported that the level of leaf greenness indicates that the plant has sufficient nitrogen levels and good health conditions.

Based on the results, the application of inorganic-and-organic-sources-based nitrogen affected vegetative growth, namely number of pods and yield. In this study, the application of 10 and 20% LOF was sufficient for the growth of green beans but was not significantly different from urea. Meanwhile, Permanasari et al. (2014) stated that chlorophyll formation plays an important role in the process of photosynthesis. In addition, nitrogen is known to increase the chlorophyll content of leaves, which is important for photosynthesis and affects the numbers of bean pods. The plant genetic traits in the two cultivars influenced the different responses to N fertilization. Beshir et al., (2015) stated that different cultivars increase the photosynthetic area (or leaf area index), thereby, producing more pods.

The results showed that there was a symptom of N deficiency in green bean leaves without nitrogen fertilizer. The symptoms include yellowish-green coloration of leaves compared to normal leaves which are fresh green. Erythrina et al. (2016) stated that nitrogen is the main nutrient in the formation of leaf color due to its important role in increasing leaf green matter and protein. Therefore, the application of nitrogen increases the green color of the leaves but when deficient, the formation of chlorophyll is reduced thereby causing the leaves to appear yellowish-green. Furthermore, Bojovic et

al. (2009) stated that nitrogen deficiency causes a reduction in leaf greenish color and area, as well as photosynthesis due to the linear correlation between leaf chlorophyll formation and nitrogen.

Lebat-3 cultivar requires a lower LOF concentration compared with Perkasa to produce significant yield. Table 3 shows that Perkasa cultivar with 20% LOF produced a higher yield compared to other treatments but was not significantly different from the 100% recommended urea treatment. This is attributed to the effect of liquid organic fertilizer which does not uniformly dissolve for easy absorption by plants (Ginandjar et al., 2019). The Lebat-3 cultivar with 10% LOF produced a higher yield compared to other treatments but was not significantly different from the recommended 100% urea treatment. Chaturdevi (2005), reported that nitrogen fertilization with the right dose affects grain yield in rice and other parameters in each cultivar. Furthermore, the use of N sources for plants affects the results of photosynthesis. This is supported by Rathke (2005), which stated that plant yield is improved by increasing the source of N. In addition, nitrogen improves yield by increasing leaf area and the rate of photosynthesis, hence, high carbohydrates are produced by the plants (Chaturdevi, 2005). The yield of Lebat-3 cultivar was lower compared to Perkasa but was not significantly different from the recommended 100% urea treatment and 20% LOF. Ratnasari et al. (2015), stated that the differences in the characters possessed by cultivar are caused by the varying genetic composition, hence, each cultivar responds differently to environmental and production factors. The positive effect of liquid organic fertilizers from lamtoro leaves in increasing crop yields was also found by Duaja et al. (2013) on chickpeas, Palimbungan et al. (2006) on mustard plants, Septirosya et al. (2019) on tomato plants, and Ainiya et al. (2019) on sweet corn plants. The experiment showed that the liquid organic fertilizers derived from lamtoro leaves are applicable as an alternative nitrogen source in bean cultivation. This low-cost technology is easy to use by farmers and also supports organic bean production.

CONCLUSION

The use of plant-based nitrogen fertilization from lamtoro leaves is applicable as an alternative to N fertilization in bean plants. The 20% LOF is recommended as an adequate concentration to increase the growth and yield of green beans. Furthermore, each cultivar shows different responses to environmental and production factors. Treatment of Perkasa (with 20% LOF) and Lebat-3 cultivar (with 10% LOF) produced the highest bean yield, respectively.

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REFERENCES

Ainiya, M., M. Fadli, R. Despita. 2019. Peningkatan pertumbuhan dan hasil jagung manis dengan pemanfaatan trichokompos dan LOF daun lamtoro. *Agrotech. Res. J.* 3(2): 69-74.

Amin, MEH. 2011. Effect of different nitrogen sources on growth, yield and quality of fodder maize (*Zea mays* L.). *J. Saudi Soc.Agric. Sci.*. 10 (1): 17-23.

Arista, D., Suryono, Sudadi. 2015. Efek dari kombinasi pupuk N, P dan K terhadap pertumbuhan dan hasil kacang tanah pada lahan kering Alfisol. *Jurnal Agrosains*. 17(2): 49-52.

Beshir, HM., B. Tesfaye, R. Bueckert, B. Tar'an. 2015. Pod quality of snap bean as affected by nitrogen fixation, cultivar and climate zone under dryland agriculture. *African Journal of Agricultural Research*. 10(32): 3157-3169.

Bojovic, B., A. Markovic. 2009. Correlation between nitrogen and chlorophyll content in wheat (*Triticum aestivum* L.). *Kragujevac Journal Science.* 31(1): 69-74.

Bojovic, B., J. Stojanovic. 2005. Chlorophyll and carotenoid content in wheat cultivars as a function of mineral nutrition. *Archives of Biological Science Belrgade*. 57 (4): 283-290.

Camara, CRS., CA. Urrea, V. Sichlegel. 2013. Pinto beans (*Phaseolus vulgaris* L.) as a functional food: Implications of human health. *Agriculture.* 3(1): 90-110.

Chaturdevi, I. 2005. Effect of nitrogen fertilizers on growth, yield and quality of hybrid rice (Oryza Sativa). *Journal Central European Agriculture.* 6(4): 611-618.

Chaudhary, MM., AS. Bhanvadia, PN Parmar. 2015. Effect of integrated nutrient management on growth, yield attributes and yield of cabbage (*Brassica oleracea* Var. Capitata L.) under middle Gujarat conditions. *Trends in Bioscience.* 8(8): 2164-2168.

Duaja, MD. 2013. Pengaruh jenis bahan dasar dan dosis pupuk organik cair terhadap pertumbuhan dan hasil buncis (*Phaseolus vulgaris* L.*)*. *Bioplantae.* 2(1): 47-54.

Duaja, MD., Mukhsin, R. Sijabat. 2013. Analisis pertumbuhan dan hasil dua varietas buncis (*Phaseolus vulgaris* L.) pada perbedaan jenis pupuk organik cair. *Program Studi Agroekoteknologi, Fakultas Pertanian Universitas Jambi.* 2(1): 47-54.

Erythrina. 2016. Bagan warna daun: Alat untuk meningkatkan efisiensi pemupukan nitrogen pada tanaman padi. *Jurnal Litbang Pertanian*. 35(1): 1-10.

Fahmi, A., Syamsudin, SNH. Utami., B. Radjagukguk. 2010. Pengaruh interaksi hara nitrogen dan fosfor terhadap pertumbuhan tanaman jagung (*Zea mays* L.) pada tanah Regosol dan Latosol. *Berita Biologi.* 10(3): 297-304.

Faustina, E., Sudradjat, Supijatno. 2015. Optimization of nitrogen and phosphorus fertilizer on two years old of oil palm (*Elaeis guineensis* jacq.). *Asian Journal of Applied Sciences*. 3(3): 421-428.

Ginandjar, S, B. Prasetya, W. Nugraha, M. Subandi. 2019. The effect of liquid organic fertilizer of vegetable waste and planting media on growth and yield of strawberry (*Fragaria* spp.) Earlibrite Cultivar. IOP Conf. Series: Earth and Enviromental Science 334, 012033

Hendriyani, IK, Y. Nurchayati, N. Setiari. 2018. Kandungan klorofil dan karotenoid kacang tunggak (*Vigna unguiculata* (L.) Walp.) pada umur tanaman yang berbeda. *Jurnal Biologi Tropika.* 1(2): 38-43.

Hidayat, O, Suharyana, A. 2019. Pengaruh dosis pupuk organik cair daun lamtoro terhadap pertumbuhan dan hasil tanaman pakcoy (*Brassica rapa* L.) varietas Nauli-F1. *Jurnal Ilmiah Pertanian.* 7(2): 57-63.

Jeksen, J., C. Mutiara. 2017. Analisis kualitas pupuk organik cair dari beberapa jenis tanaman Leguminosa. Jurnal Pendidikan MIPA. 7(2): 124-130.

Madusari, S. 2019. Processing of fibre and its application as liquid organic fertilizer in oil palm (*Elaeis guineensis* Jacq.) seedling for sustainable agriculture. *Journal of Applied Science and Advanced Technology*. 1 (3): 81-90.

Maghfoer, M.D., Koesriharti, T. Islami, NDS, Kanwal. 2018. A study of the efficacy of various nutrient sources on the growth and yield of cabbage. *AGRIVITA Journal of Agricultural Science.* 40(1): 168-176.

Pahlevi, RW, B. Guritno, NE, Suminarti. 2016. Pengaruh kombinasi proporsi pemupukan nitrogen dan kalium pada pertumbuhan, hasil dan kualitas tanaman ubi jalar (*Ipomoea batatas* (L.) Lamb) varietas Cilembu pada dataran rendah. *Jurnal Produksi Tanaman*. 4(1): 16-22.

Palimbungan, N., R. Labatar, F. Hamzah. 2006. Pengaruh ekstrak daun lamtoro sebagai pupuk organik cair terhadap pertumbuhan dan hasil produksi tanaman sawi. *Jurnal Agrisitem*. 2(2): 96-101.

Pamungkas, MA, Supijatno. 2017. Pengaruh pemupukan nitrogen terhadap percabangan tanaman teh (*Camelia sinensis* (L.) O. Kuntze) untuk pembentukan bidang petik. *Buletin Agronomi*. 5(2): 234-41.

Pary, C. 2015. Pengaruh pupuk organik (daun lamtoro) dalam berbagai konsentrasi terhadap pertumbuhan tanaman sawi. *Jurnal Fikratuna*. 7(2): 247-255.

Paul, V, L. Sharma, R. Pandey, R.C. Meena. 2017. Measurements of stomatal density and stomatal index on leaf/plant surfaces. Manual of ICAR sponsored traning programme on "physiological techniques to analyze the impact of climate change on crop plants. Division of Plant Physiology, IARI, Nrw Delhi.

Permanasari, I., M. Irfan, Abizar. 2014. Pertumbuhan dan hasil kedelai (*Glycine max (*L.) Merill) dengan pemberian *Rhizobium* dan pupuk urea pada media gambut. *Jurnal Agroteknologi.* 5(1) ; 29-34.

Pramitasari, HE, T. Wardiyanti, M. Nawawi. 2016. Pengaruh dosis pupuk nitrogen dan tingkat kepadatan tanaman terhadap pertumbuhan dan hasil tanaman kailan (*Brassica oleraceae* L.). *Jurnal Produksi Tanaman.* 4(1): 49-56.

Proklalmasiningsih, E., ID. Prijambada, D. Rachmawati, dan RP. Sancaningsih. 2012. Laju fotosintesi dan kandungan klorofil kedelai pada media tanam masam dengan pemberian garam aluminium. *AGROTROP*. 2(1): 17-24.

Putri, FM, SWA. Suedy., S. Darmanti. 2017. Pengaruh pupuk nanosilika terhadap jumlah stomata, kandungan klorofil dan pertumbuhan padi hitam (*Oryza sativa* L. cv. japonica). *Buletin Anatomi dan Fisiologi*. 2(1): 72-79.

Rahimi, A., SS, Moghaddam, M. Ghiyasi, S. Heydarzadeh, K. Ghazizadeh, J. Popovi´c-Djordjevi´c. 2019. The influence of chemical, organic and biological fertilizers on agrobiological and antioxidant properties of syrian cephalaria (*Cephalaria Syriaca* L.). *Journal Agriculture.* 9 (122): 1-13.

Rathke, GW, O. Christen, W. Diepenbrock. 2005. Effects of nitrogen source and rate on productivity and quality of winter oilseed rape (*Brassica napus* L.) grown in different crop rotations. *Field Crops Research*. 94 (1) 103–113.

Ratnasari, D., MK, Bangun, RIM, Damanik. 2015. Respon dua varietas kedelai (*Glycine max* (L.) Merrill.) pada pemberian pupuk hayati dan NPK majemuk. *Jurnal Oline Agroteknologi*. 3(1): 276-82.

Razaq, M., P. Zhang, H, Shen, Salahuddin. 2017. Influence of nitrogen and phosphorous on the growth and root morphology of *Acer mono*. *Journal PLoS ONE*. 12(2): 1-13.

Rihana, S., YBS. Heddy, MD, Maghfoer. 2013. Pertumbuhan dan hasil tanaman buncis (*Phaseolus viulgaris* L.) pada berbagai dosis pupuk kotoran kambing dan konsentrasi zat pengatur tumbuh Dekamon. *Jurnal Produksi Tanaman*. 1(4): 369-377.

Rizqiani, NF, E. Ambarwati, NW, Yuwono. 2007. Pengaruh dosis dan frekuensi pemberian pupuk organik cair terhadap pertumbuhan dan hasil buncis (*Phaseolus vulgaris* L.) dataran rendah. *Jurnal Ilmu Tanah dan Lingkungan*. 7(1): 43-53.

Santosa, M., MD, Magfoer, H, Tarno. 2017. The influence of organic and inorganic fertilizers on the growth and yield of green bean, *Phaseolus vulgaris* L. Gron in dry and rainy season. *AGRIVITA Journal of Agricultural Science*. 39(3): 296-302.

Septirosya, T, R, Hartono, T, Aulawi. 2019. Aplikasi pupuk organik cair daun lamtoro pada pertumbuhan hasil tanaman tomat. *Agroscript*. 1(1): 1-8.

Sinaga, AS, B. Guritno, Sudiarso. 2017. Pengaruh dosis kompos sampah rumah tangga terhadap pertumbuhan dan hasil tiga varietas buncis tipe tegak (*Phaseolus vulgaris* L.). *Jurnal Produksi Tanaman*. 5(6):947-956.

Watson, CA, Atkinson, D, Gosling, P, Jackson, LR, Rayns, FW. 2002. Managing soil fertility in organic farming systems. *Soil Use and Management* 18:239-247

Wijiyanti, P, ED. Hastuti, S. Haryanti. 2019. Pengaruh masa inkubasi pupuk dari air cucian beras terhadap pertumbuhan tanaman sawi hijau (*Brassica juncea* L.). *Buletin Anatomi dan Fisiologi.* 4(1): 41-28.

Zainal, M, A. Nugroho, NE, Suminarti. 2014. Respon pertumbuhan dan hasil tanman kedelai (*Glycine max* (L.) Merill) pada berbagai tingkat pemupukan N dan pupuk kandang ayam. *Jurnal Produksi Tanaman.* 2(6): 484-490.

Ainiya M, Fadil M, Despita R. 2019. Increase Growth and Yield of Sweet Corn with The Benefit Tricokompos and Liquid Organic Fertlizers Lamtoro Leaves (In indonesian: Peningkatan Pertumbuhan dan Hasil Jagung Manis dengan Pemanfaatan Trichokompos dan POC Daun Lamtoro). *Agrotechnology Research Journal* 3: 69-74

Amin ME-MH. 2011. Effect of Different Nitrogen Sources on Growth, Yield and Quality of Fodder Maize (Zea mays L.). *Journal of the Saudi Society of Agricultural Sciences* 10: 17-23

Arista D, Suryono, Sudadi. 2015. Effect of N, P and K Fertilizer Combinations to Growth and Yield of Peanut on Alfisols Dry Land (in indonesian: Efek dari Kombinasi Pupuk N, P dan K terhadap Pertumbuhan dan Hasil Kacang Tanah pada Lahan Kering Alfisol. *Agrosains* 17: 49-52

Bojović B, Marković A. 2009. Correlation Between Nitrogen and Chlorophyll Content in Wheat (*Triticum aestivum* L.). *Kragujevac Journal Science* 31: 69-74

Bojovic B, Stojanovic J. 2005. Chlorophyll and Carotenoid Content in Wheat Cultivars as A Function of Mineral Nutrition. *Archives of Biological Science Belrgade* 57: 283-90

Chaturvedi I. 2005. Effect of Nitrogen Fertilizers on Growth, Yield and Quality of Hybrid Rice *(Oryza Sativa)*. *Journal Central European Agriculture* 6: 611-18

Chaudhary MM, Bhanvadia AS, Parmar PN. 2015. Effect of Integrated Nutrient Management on Growth, Yield Attributes and Yield of Cabbage (Brassica oleracea Var. Capitata L.) Under Middle Gujarat Conditions. *Trends in Biosciences* 8: 2164-68

Duaja MD, Mukhsin, Sijabat R. 2013. Analisis pertumbuhan dan hasil dua varietas buncis (Phaseolus vulgaris L.) pada beberapa jenis pupuk organik cair. *Bioplantae* 2: 47-54

Erythrina. 2016. Leaf Color Chart: a Tool to Increase Nitrogen Fertilizer Efficiency in Rice (in indonesian: Bagan Warna Daun: Alat Untuk Meningkatkan Efisiensi Pemupukan Nitrogen pada Tanaman Padi). *Jurnal Litbang Pertanian* 35: 1-10

Faustina E, Sudradjat, Supijatno. 2015. Optimization of Nitrogen and Phosphorus Fertilizer on Two Years Old of Oil Palm *(Elaeis guineensis* Jacq.). *Asian Journal of Applied Sciences* 3: 421-28

Ginandjar S, Frasetya B, Nugraha W, Subandi M. 2019. The Effect of Liquid Organic Fertilizer of Vegetable Waste and Planting Media on Growth and Yield of Strawberry *(Fragaria* spp.) Earlibrite Cultivar. *IOP Conf. Series: Earth and Environmental Science* 334: 1-8

Hendriyani IS, Nurchayati Y, Setiari3 N. 2018. Contents of Chlorofil and Carotenoid of Beans (*Vigna Unguiculata* (L.) Walp.) In The Different Age of Plants (In Indonesian: Kandungan Klorofil dan Karotenoid Kacang Tunggak (*Vigna Unguiculata* (L.) Walp.) pada Umur Tanaman Yang Berbeda). *Jurnal Biologi Tropika* 1: 38-43

Hidayat O, Suharyana A. 2019. The Effect of Dosage of Lamtoro Leaf Organic Fertilizer to Growth and Yield of Pakcoy (*Brassica rapa* L.) Plant Varieties Nauli-F1. (in Indonesian: Pengaruh Dosis Pupuk Organik Cair Daun Lamtoro terhadap Pertumbuhan dan Hasil Tanaman Pakcoy (Brassica rapa l.) Varietas Nauli-F1. *Jurnal Ilmiah Pertanian* 7: 57-63

Madusari S. 2019. Processing of Fibre and Its Application as Liquid Organic fertilizer in Oil Palm (*Elaeis guineensis* Jacq.) Seedling for Sustainable Agriculture. *Journal of Applied Science and Advanced Technology* 1: 81-90

Palimbungan N, Labatar R, Hamzah F. 2006. Pengaruh ekstrak daun lamtoro sebagai pupuk organik cair terhadap pertumbuhan dan produksi tanaman sawi. *Jurnal Agrisistem* 2: 96-101

Pamungkas MA, Supijatno. 2017. The Effect of Nitrogen Fertilization on High and Branching Tea Plant (Camelia sinensis (L.) O. Kuntze) Frame Formation (In indonesian: Pengaruh Pemupukan Nitrogen Terhadap Tinggi dan Percabangan Tanaman Teh (Camelia Sinensis (L.) O. Kuntze) untuk Pembentukan Bidang Petik). *Buletin Agronomi* 5: 234-41

Pary C. 2015. The influence of organic fertilizer (lamtoro leaves) in various concentration to the growth mustard plant (in indonesian: Pengaruh Pupuk Organik (Daun Lamtoro) dalam berbagai konsentrasi terhadap Pertumbuhan Tanaman Sawi). *Jurnal Fikratuna* 7: 247-55

Permanasari I, Irfan M, Abizar. 2014. Growth and Yield of Soybean (*Glycine max* (L.) Merill) with Application of Rhizobium and Nitrogen Fertilizer on Peat Media (in indonesian:Pertumbuhan dan Hasil Kedelai (*Glycine max* (L.) Merill) dengan Pemberian Rhizobium dan Pupuk Urea pada Media Gambut. *Jurnal Agroteknologi* 5: 29-34

Pramitasari HE, Wardiyati T, Nawawi M. 2016. Pengaruh Dosis Pupuk Nitrogen dan tingkat kepadatan tanaman terhadap pertumbuhan dan hasil tanaman kailan (Brassica oleraceae L.). *Jurnal Produksi Tanaman* 4: 49-56

Proklamasiningsih E, Rachmawati, Prijambada ID, Sancayaningsih RP. 2012. Rate of Photosynthesis and Chlorophyll Content of Soybean on Acidic Growth Medium Exposure with Aluminum Salts (In indonesian: Laju Fotosintesis dan Kandungan Klorofil Kedelai pada Media Tanam Masam dengan Pemberian Garam Aluminium). *Agrotrop* 2: 17-24

Putri FM, Suedy SWA, Darmanti S. 2017. The Effect Nanosilica Fertilizer on Numbers of Stomata, Chlorophyll Content, and Growth of Black Rice (Oryza sativa L. cv. Japonica) (In indonesian: Pengaruh Pupuk Nanosilika Terhadap Jumlah Stomata, Kandungan Klorofil dan Pertumbuhan Padi Hitam (Oryza sativa L. cv. japonica). *Buletin Anatomi dan Fisiologi* 2: 72-79

Rathke G-W, Christen O, Diepenbrock W. 2005. Effects of nitrogen source and rate on productivity and quality of winter oilseed rape (Brassica napus L.) grown in different crop rotations. *Field Crops Research* 94: 103-13

Ratnasari D, Bangun MK, Damanik RIM. 2015. Response of Two Soybean (*Glycine max* (L.) Merrill.) Varieties on the Biofertilizer and NPK Compound Fertilizer application (In Indonesian: Respons Dua Varietas Kedelai (*Glycine max* (L.) Merrill.) pada Pemberian Pupuk Hayati dan NPK Majemuk *Jurnal Online Agroekoteknologi* 3: 276-82

Razaq M, Zhang P, Shen H-l, Salahuddin. 2017. Influence of Nitrogen and Phosphorous on The Growth and Root Morphology of Acer Mono. *PLOS ONE* 12: 1-13

Santosa M, Maghfoer MD, Tarno H. 2017. The Influence of Organic and Inorganic Fertilizers on the Growth and Yield of Green Bean, Phaseolus vulgaris L. Grown in Dry and Rainy Season *Agrivita* 39(3): 296-302

Septirosya T, Putri RH, Aulawi T. 2019a. Aplikasi pupuk organik cair lamtoro pada pertumbuhan dan hasil tanaman tomaT (In English: The application of lamtoro organic liquid fertilizer on tomato's growth and yield). *Agroscript* 1: 1-8

Septirosya T, Putri RH, Aulawi T. 2019b. The Application of Lamtoro Organic Liquid Fertilizer on Tomato's Growth and Yield (in Indonesian: Aplikasi Pupuk Organik Cair Lamtoro pada Pertumbuhan dan Hasil Tanaman Tomat). *AGROSCRIPT* 1: 1-8

Wijiyanti P, Hastuti ED, Haryanti2 S. 2019. Effect of Fertilizer Incubation Period of Rice Wash Water on Green Mustard Plant Growth (Brassica Juncea L.) (in indonesian: Pengaruh Masa Inkubasi Pupuk dari Air Cucian Beras terhadap Pertumbuhan Tanaman Sawi Hijau (Brassica Juncea L.)). *Buletin Anatomi dan Fisiologi* 4: 21-28

Zainal M, Nugroho A, Suminarti NE. 2014. Response Of Nitrogen Fertilization And Chicken Fertilezer At Various Levels On Growth And Yield Of Soybean (*Glycine max* (L.) Merrill) (In Indonesian: Respon Pertumbuhan dan Hasil Tanaman Kedelai

(Glycine max (L.) Merill) pada Berbagai Tingkat Pemupukan N dan Pupuk Kandang Ayam). *Jurnal Produksi Tanaman* 2: 484-90

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