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

by winhp120 winhp120

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

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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. The results showed that the use of liquid organic fertilizers from lamtoro leves 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% liquid organic fertilizer 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% liquid organic fertilizer 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, cultivar, liquid organic fertilizers, stomata, urea,

I. INTRODUCTION

The green bean plant (*Phaseolus vulgaris* L.) is one of the legume group 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 and environmental management for plant growth. One of the efforts that can be done is applying the balanced fertilization that meet with the nutritional needs for growth. The productivity of green beans can be increased by using improved cultivar There are many of cultivar of green beans availibale 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 N derived from inorganic and organic fertilizers. Urea is a source of 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), 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 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 N 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 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 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}, 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%.

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 30 days after planting (DAP). 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 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* $= 11{,}24 \times A_{662} - 2{,}04 \times A_{645}$

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

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

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

III RESULTS AND DISCUSSION

The results of LOF analysis 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 (Watson et al., 2002)

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 combination of 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). Application of 20% N LOF source resulted in heavier dry stover weight than control, while the application of urea, 10% LOF, and 20% LOF was not different. Dry weight were not different among treatmens of urea, LOF 10%, and LOF 30% (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 (/mm²)
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 application of N sources and cultivar affected 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 at the control was lower than urea treatment, while the chlorophyll content was not different between control and the LOF 30%. Chlorophyll content treated with urea did not differ compared to LOF 10% and LOF 20% (Table 2). The application of 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 application of different nitrogen source produced the highest number of stomata compared to the control, while the application 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: Perkasa	Cultivar: Lebat-3	$HSD_{0,05}$
Greeness 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 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 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 30% LOF treatment at Perkasa cultivar and urea at 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 N sources. There is a significant difference between number of pods of 2 cultivars on the treatment of 20% LOF The results showed that the combination between Perkasa cultivar and 20% LOF resulted in the highest number of bean pods per plant but 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. There is a significant difference between yield of 2 cultivars on the treatment of 20% LOF. On the Perkasa cultivar, the plants treated with urea and LOF 20% had a higher yield while on Lebat-3 cultivar, urea and 10% LOF treatment had a higher yield 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.

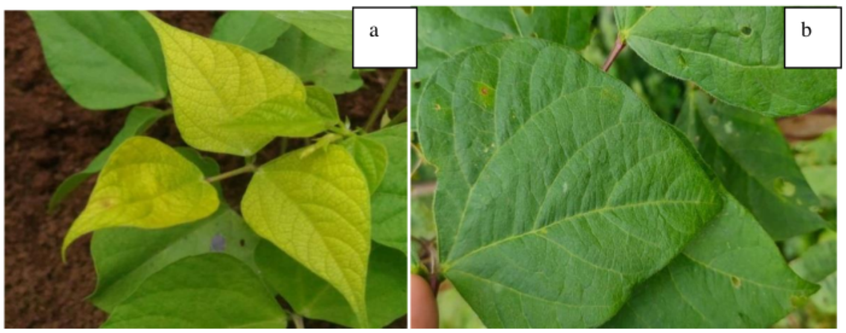


Figure 1. *Comparison of deficiency N (a) The color of the leaf deficient N (b) The color of the normal leaf*

Discussion

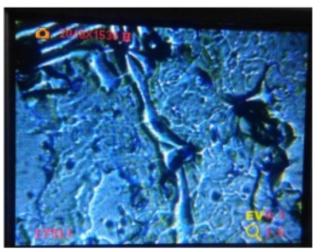
The application of N fertilizers affected plant height (Table 2). This is supported by the research of Pamungkas and Supijatno (2017) which states that nitrogen fertilizer has a significant effect and results in the growth of tea plants. Nitrogen can increase plant height due to increased leaf area and 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.

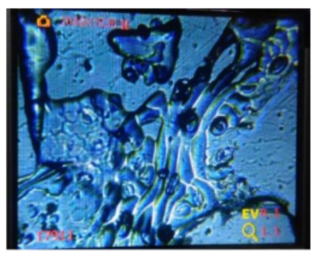
The results showed that the provision of N sources affected the dry weight of the plants. LOF 20% produced the highest dry weight of green beans and was not significantly different from Urea and LOF 10%. It is assumed that the availability of sufficient nutrients in an appropriate amount in the treatment 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 increase leaf size and increase the percentage of protein. The more leaves and this protein will increase the dry stover weight in plants. Madusari (2019) said that 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.

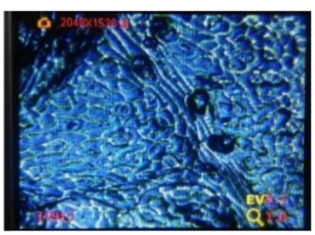
The results of observing the number of stomata in the two cultivars of green beans showed that nitrogen fertilizer affected the number of stomata (Table 1). The two cultivars of green beans gave the same response, and the application of inorganic fertilizers produced more stomata than the other treatments. 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.



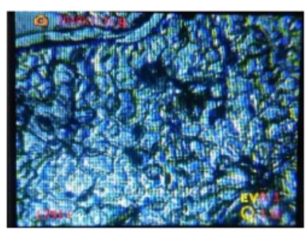
Perkasa Cultivar (control)



Lebat-3 Cultivar (control)



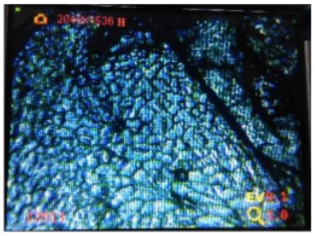
Perkasa Cultivar (Urea)



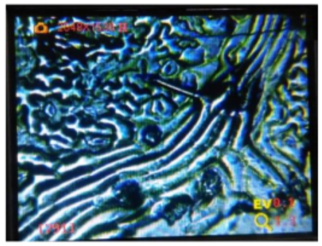
Lebat-3 Cultivar (Urea)

Perkasa Cultivar LOF 10%

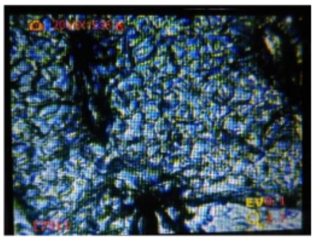
Lebat-3 Cultivar LOF 10%



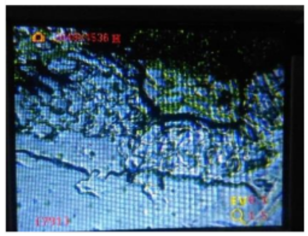
Perkasa Cultivar LOF 20%



Lebat-3 Cultivar LOF 20%



Perkasa Cultivar LOF 30%



Lebat-3 Cultivar LOF 30%

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 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

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. 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 increased the growth variable of 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/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

The research fund was obtained from Faculty of Agriculture, Universitas Lampung year 2020. We thank Dr Paul Benyamin Timotiwu (Head of The Integrated Laboratory and Innovation Center of Technology, Universitas Lampung) for discussion and helping with pigment measurement. We give appreciation to Setyo Widagdo and Fitri Yelli for scientific discussions.

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