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RESEARCH ARTICLE

Response of Bean Plant Resistance to Bacterial Leaf Blight Disease by Application of Liquid Organic Fertilizer and Trichocompost

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A B S T R A C T

Increasing crop production still has challenges in the form of disease-causing pathogen attacks. Thus, improving crop production should go hand in hand with enhancing plant resistance to diseases. This study aimed to determine the response of growth and yield of bean plants and their resistance to bacterial leaf blight on the application of doses of liquid organic fertilizer (LOF) and trichocompost. The research was conducted from March to July 2024 at UGTechnoPark, Cianjur, West Java, Indonesia, with coordinates -6.761864, 107.210279 at 392 meters above sea level. The research design used was a Factorial Randomized Complete Group Design. The first factor was the dose of banana waste LOF, consisting of 4 treatment levels: 0 mL/plant, 150 mL/plant, 200 mL/plant, and 250 mL/plant. The second factor was the dose of trichocompost, consisting of 3 treatment levels: 0 g/plant, 100 g/plant, and 200 g/plant. The parameters observed were plant height (cm), number of compound leaves (strands), root length (cm), root wet weight (g), root dry weight (g), pod length (cm), pod fresh weight (g), pod dry weight (g), number of pods per plant, disease incidence, disease severity, AUDPC, and plant resistance response to bacterial leaf blight. The results showed that the provision of trichocompost can increase the resistance of bean plants to bacterial leaf blight disease, which was previously susceptible to moderate resistance. This finding can be a recommendation for bean farmers to apply organic materials enriched with beneficial microbes to be one component in integrated disease control and support sustainable agriculture.

Keywords: Bacterial leaf blight, organic fertilizer, plant resistance, sustainable agriculture, *Xathomonas axonopodis* pv. *phaseoli*

INTRODUCTION

Bean (*Phaseolus vulgaris* L.) is a legume plant originating from America. Then, it is widely planted in various regions in Indonesia, such as Sumatra, Java, Bali, West Nusa Tenggara, East Nusa Tenggara, Kalimantan, Sulawesi, Maluku, and Papua (Nababan *et al.,* 2021). Beans are one of the legume groups favoured by the public, with an average per capita consumption of Beans in Indonesia in 2023 of 0,986 Kg/capita/year (Center for Agricultural Data and Information Systems, 2023). However, bean production in Indonesia decreased in 2023 to 305,049 tons, compared to 2022 (325,602 tons) and 2021 (320,774 tons) (Directorate General of Horticulture, Ministry of Agriculture, 2024). One of the efforts that can be made to achieve optimal production or optimal results and sound quality is the availability of adequate nutrients through fertilization (Farida, 2022). Fertilization activities in bean cultivation still depend on synthetic chemical fertilizers. Meanwhile, synthetic chemical fertilizers have a high price, have the potential to damage the soil, and are not safe for agricultural products consumed by humans (Mulyanti *et al.,* 2022). One of the alternatives is using organic fertilizers.

Liquid organic fertilizer (LOF) is a type of organic fertilizer that can be used to increase bean plant production (Purnamasari and Zulfarosda, 2019). LOF is a type of organic fertilizer that comes from plant or animal material that has undergone a decomposition process that contains substances that support plant growth (Harahap and Nasution, 2023). The nutrient content of LOF is macronutrients in the form of N, P, and K, so it can provide more nutrients and encourage plant growth and yield (Farida and Daryono, 2017).

Besides LOF, compost can also provide the nutrients needed by plants organically. Trichocompost is a form of composted organic fertilizer containing macro and micronutrients and the fungus *Trichoderma* sp. *Trichoderma in* compost can act as a decomposer and antagonistic agent for soil-borne pathogens such as *Sclerotium* sp., *Pythium* sp., *Fusarium* sp., *Phytophthora* sp., and *Rhizoctonia* sp. In contrast, organic matter from compost increases the soil's pH and microbial activity (Isnaini *et al.,* 2022).

Increasing crop production often faces challenges such as disease-causing pathogen attacks. A critical disease in Beans is leaf blight caused by the bacterium *Xanthomonas axonopodis* pv. *phaseoli*. This disease generally occurs in areas experiencing warm weather conditions, causing a reduction in yield of up to 45% (Belete and Bastas, 2017). The attack of the pathogen *Xanthomonas axonopodis* pv. *glycines* have initial symptoms in small pale green spots accompanied by a yellowish colour and pustules under the leaf surface; over time, the spots turn light brown and dark brown (Amaniyah *et al.,* 2017). The size of the spots varies, ranging from small to large and irregular, and they are formed due to the merging of many small spots. The spots dry out and make the leaves susceptible to tearing in the wind, resulting in irregular shapes. Heavy pathogen attacks can cause leaves to fall prematurely, resulting in incomplete pod filling (Sari, 2016). Therefore, efforts to increase crop production need to be followed by increased plant resistance. This study aimed to determine the response of growth and yield of Bean plants and their resistance to stem base rot disease through the application of LOF and trichocompost.

METHODOLOGY

Place and Time: The research was conducted in the experimental garden, UG Technopark, Cianjur, West Java, Indonesia. in March-July 2024 with coordinates 6.761541,107.211232 at 392 meters above sea level. Meanwhile, the research began in March 2024 and ended in July 2024. The research location is at coordinates 6.761541,107.211232 at 392 meters above sea level.

Experiment Design: The design used in this research is a Factorial Randomized Complete Group Design (RKLT) consisting of 2 factors, namely LOF dose (P) and Trichocompost dose (T). The liquid organic fertilizer (P) dose factor consists of 4 levels, namely P0 = 0 mL/plant, P1 = 150 mL/plant, P2 = 200 mL/plant, and P3 = 250 mL/plant. The LOF dose was determined based on previous research conducted by Siregar & Khairina (2022), which found that the POC dose of 200 mL/plant gave the best results on all parameters, then a difference of 50 mL higher and 50 mL lower was made to determine the more efficient use of LOF. Trichocompost dosing factor (T) consisted of 3 levels, namely T0 = 0 g/plant, T1 = 100 g/plant, and T2 = 200 g/plant. The dosage of trichocompost is determined based on the recommended dosage of the trichocompost manufacturer and 2 recommended dosage. There were 12 treatment combinations with four replications, so there were 48 experimental units; each treatment consisted of 3 samples, with 144 experimental units.

Experiment Procedure: Land Preparation: A land area of 7.5´7.5 m was manually cleared of weeds and other waste using a hoe, and then the land was covered with black silver mulch. Black silver mulch is used to cover the entire surface of the soil so that weed germination is inhibited due to obstruction of sunlight (Basuki *et al.,* 2022). Plastic mulch minimizes pest and disease attacks by inhibiting the growth of host plants in the form of weeds (Basuki *et al.,* 2009).

Planting Media Preparation: The soil was obtained from the UG TechnoPark experimental garden with a low pH of 3.7. Chicken manure fertilizer can increase soil pH, N-total P-available and C-organic (Safitri *et al.,* 2022). Chicken manure contains higher nitrogen than cow and goat manure, with a total N value of 1.27% (Wijayanti *et al.,* 2013). The soil and chicken manure ratio used is 1:1 (Sitawati *et al.,* 2021). The soil and chicken manure media were mixed and put into 35´35 cm polybags. The planting medium was left for seven days to decompose all the materials used (Nurainun *et al.,*2022). Each polybag is arranged 40´40 cm apart (Marpaung *et al.,*2021).

Trichocompost Treatment: Trichocompost was applied seven days before planting (Trosian *et al.,* 2023) by mixing it into the planting medium according to the dose of each treatment (0 g/plant, 100 g/plant, and 200 g/plant).

Bean Planting: Seeds were treated with matriconditioning by mixing seeds (g), sawdust (g), and distilled water (mL) in a ratio of 1:0.5:0.7. After 9 hours, the seeds were dried for 15-20 minutes and sieved to separate the media. Then, the seeds were washed with sterile water and air-dried for 1-2 hours before planting (Aris, 2019). Planting is done directly in the planting hole with a depth of about 4 cm. Each planting hole is filled with three seeds and again covered with planting media. After the plants were two weeks after planting (MST), the plants were nested, and only one plant was left per polybag.

LOF application: LOF application refers to the method of (Santosa *et al.,* 2023) by sprinkling on the soil surface after watering, starting when the plants were two weeks after planting (MST), lasting 7 days until seven days before the last harvest. LOF application used a concentration of 20 mL/1 L of water with doses according to the treatment (0 mL/plant, 150 mL/plant, 200 mL/plant, and 250 mL/plant).

Harvesting: Bean plants were harvested at the age of 8 weeks after planting. The criteria for harvested Beans are that the pod colour is still relatively young and gloomy, the skin surface is somewhat rough, the seeds in the pods have not protruded, and the pods are not fibrous. Harvesting is done gradually every three days, as many as ten times (Nurmayulis*et al.,* 2014).

Observation Variables: Plant height (cm): Plant height was measured from the soil surface to the plant growth point (Siregar and Khairina, 2022) using a measuring tape at 3, 4, 5, 6, and 7 weeks after planting (MST).

Number of compound leaves (strands)

The number of leaves was observed at the age of 3, 4, 5, 6, and 7 weeks after planting. The criteria for the observed leaves are compound leaves of three strands (trifoliate) on beans that have grown completely (Safitri, 2022).

Root length (cm): Root length is measured using a measuring tape, starting from the base to the tip of the root, carried out after the plant is removed from the growing medium (Noviana, 2017).

Root wet weight (g): The roots were cleaned from the remaining soil, washed with water, and dried. The wet weight of the roots was calculated after entering harvest time; the roots were separated from the plant stem and then weighed (Sakina, 2023) using a digital scale.

Root dry weight (g): Roots were oven-dried at 80 0C for 48 hours (Mbeke *et al.,* 2014). The maximum temperature in the oven can only reach 70 0C. Therefore, the drying time was adjusted to 54 hours and 52 minutes. The dried roots were weighed using an analytical balance.

Pod length (cm): Pod length observations were made after harvest by measuring the length of all pods sampled (Senja, 2018) using a measuring tape.

Pod fresh weight per plant (g): Wet pod weights were observed after harvest by weighing each pod on each plant (Senja, 2018). Weighing was done using a digital scale.

Pod dry weight per plant (g): Pods were dried in an oven at 80 0C for 48 hours (Mbeke *et al.,* 2014). The maximum temperature in the oven can only reach 70 ^{o}C. Hence, the drying time was adjusted to 54 h 52 min. The dried pods were weighed using an analytical balance.

Number of pods per plant: The number of pods per plant is counted after harvest by counting all pods on each sample plant (Aiman *et al.,* 2015). The pods taken were filled (Trosian *et al.,* 2023).

Disease incidence: The percentage of disease incidence is the percentage of the number of affected plants out of the total number of plants observed (Herliyana *et al.,* 2020). Disease incidence is calculated using the following formula (Maryono *et al.,* 2020): with

DI = disease incidence, n = number of diseased clumps, and N = total number of clumps observed

Disease severity: The percentage of disease severity is the percentage of plant tissue area attacked by pathogens from the total area (Herliyana *et al.,* 2020). The intensity of the disease attack was calculated using the formula (Sinaga, 2003): Description: n = number of affected plants in the score category (v), with

DS = disease severity, v = score in each attack category, N = total number of plants observed, V = score for the heaviest attack

The score for each category of leaf blight attack can be seen in Table 1 below.

Area Under the Disease Progress Curve (AUDPC)

AUDPC calculation is done with the following formula (Apriyadi *et al.,* 2013): , with

n = number of observations, Y = severity or occurrence of the disease at observation (i), t = Age of onset (Y) at observation (i), and i = observation (1, 2, 3, etc.)

Plant resistance response to bacterial leaf blight

AUDPC can determine plant resistance to disease (Lisanto *et al.,* 2013), with resistance categories based on Table 2 (Sinaga, 2003).

Table 1. Categories Score of Leaf Blight Attack

Attack Category Score	Description
0	Leaf area of observed plants in healthy condition (without symptoms)
1	≤ 25% of leaf area showing symptoms (mild criteria)
2	> 25% - 50% of leaf area showing symptoms (moderate criteria)
3	> 50% - 75% of leaf area showing symptoms (severe criteria)
4	> 75% of leaf area showing symptoms (very severe criteria)

Table 2. Categories of Plant Resistance to Disease Based on AUDPC Values

Resistance Category	AUDPC Value
Highly Resistant	0,0 – 50,0
Resistant	50,1 – 100,0
Moderately Resistant	100,1 – 250,0
Susceptible	> 250,0

Data analysis

The data obtained were analyzed in The SAS System for Windows 9.4 program for analysis of variance (ANOVA) to determine if there was an effect and the various criteria tested on the desired results, with α = 5% level. Suppose the result of the analysis shows that there is a significant effect (P<0.05). In that case, a further test will be conducted using the Tukey Honestly Significance Difference (HSD) to compare all pairs of treatment means after the analysis of variance test is carried out and to see the most influential variables, with a level of α = 5%.

RESULTS

Growth Response of Bean Plants to LOF and Trichocompost Application: The analysis of variance showed that the application of POC and trichocompost singly or their interactions did not significantly affect all growth observation variables (Table 3). The average plant height, number of compound leaves, root length, root wet weight, and root dry weight are presented in Table 4. POC application showed a pattern that the higher the dose given, the higher the plant height, while the other parameters did not show the same pattern. While the provision of trichocompost shows a pattern of increasing the dose given, the plant height, root length, root wet weight, and root dry weight will increase.

The average plant height in treating POC 200 mL/plant and trichocompost 200 g/plant showed a consistently higher increase from week 3 to week 7 (except week 5) than other treatments. In week 5, the treatment of POC 150 mL/plant and trichocompost 100 g/plant, as well as POC 200 mL/plant and trichocompost 100 g/plant, showed a higher average than the other treatments, but the increase was not consistent in the previous week, and the week after. The average plant height in the treatment of POC 300 mL/plant and trichocompost 0 g/plant was lower than the other treatments in weeks 3 to 4, then in weeks 5 to 7, the average plant height was lower than the other treatments in the treatment of POC 0 mL/plant and trichocompost 100 g/plant.

The average number of leaves in the treatment of POC 200 mL/plant and trichocompost 200 g/plant showed a consistently higher increase from week 3 to week seven than in other treatments. The average number of leaves in the treatment of POC 300 mL/plant and trichocompost 0 g/plant was lower than the other treatments in week 3, then in weeks 4 to 7, the average number of leaves was lower than the other treatments in the treatment of POC 250 mL/plant and trichocompost 100 g/plant, and POC 150 mL/plant and trichocompost 0 g/plant alternately.

Table 3. ANOVA Recapitulation of Bean Plants Growth Response to the Application of POC and Trichokompost

Treatment	P-value				
	Plant height	Number of trifoliate leaves	Root length	Root wet weight	Root dry weight
POC	0,5981^{ns}	0,3808^{ns}	0,2753^{ns}	0,3473^{ns}	0,2839^{ns}
Trichokompost	0,3668^{ns}	0,0869*	0,3537^{ns}	0,4639^{ns}	0,4991^{ns}
POC*Trichokompost	0,7167^{ns}	0,5925^{ns}	0,6256^{ns}	0,2458^{ns}	0,3624^{ns}

*Note: ns= not significantly different in Tukey test (P<0.05), *significantly different in Tukey test (P<0.1)*

Table 4. Growth Response of Bean Plants to POC and Trichocompost Application

Treatment	Plant height (cm)	Number of trifoliate leaves (leaf blade)	Root length (cm)	Root wet weight (g)	Root dry weight (g)
POC					
0 mL/plant	39,25	11,4	27,92	3,64	1,41
150 mL/plant	43,03	13,0	21,94	2,79	1,16
200 mL/plant	42,36	13,1	23,32	2,68	1,16
250 mL/plant	41,63	11,7	26,18	3,19	1,41
Trichokompost					
0 g/plant	39,93	11,98	22,28	2,69	1,20
100 g/plant	41,11	11,29	25,16	3,25	1,24
200 g/plant	43,66	13,67	27,08	3,28	1,42

Note: Numbers followed by the same letter in the same column indicate not significantly different in Tukey test (P<0.05)

Response of Bean Yield to POC and Trichocompost Application: The analysis of variance showed that the application of POC and trichocompost singly or the interaction of both had no significant effect on all observational variables of production (Table 5). The average pod length, pod fresh weight, pod dry weight, and number of pods per plant are presented in Table 6. The application of POC with a dose of 200 mL/plant showed a better average for each parameter of bean yield. The application of trichocompost at a dose of 100 g/plant showed a better average on the parameter of pod length.

Table 5. ANOVA Recapitulation of Bean Plants Production Response to the Application of POC and Trichokompost

Treatment	P-value			
	Pod length	Pod fresh weight (total)	Pod dry weight (total)	Number of pods per plant
POC	0,6532^{ns}	0,2651^{ns}	0,2406^{ns}	0,2214^{ns}
Trichokompost	0,5761^{ns}	0,4495^{ns}	0,2945^{ns}	0,8467^{ns}
POC*Trichokompost	0,9336^{ns}	0,4952^{ns}	0,5058^{ns}	0,1435^{ns}

Note: ns= not significantly different in Tukey test (P<0.05)

Table 6. Production Response of Bean Plants to POC and Trichocompost Application

Treatment	Pod length (cm)	Pod fresh weight per plant (g)	Pod dry weight per plant (g)	Number of pods per plant
POC				
0 mL/plant	6,15	1,76	0,30	1,78
150 mL/plant	5,03	4,53	0,52	3,81
200 mL/plant	6,69	6,66	0,82	5,03
250 mL/plant	6,42	2,82	0,37	2,44
Trichokompost				
0 g/plant	5,66	5,75	0,80	3,79
100 g/plant	6,97	2,79	0,35	2,90
200 g/plant	5,60	3,29	0,37	3,10

Note: Numbers followed by the same letter in the same column indicate not significantly different in Tukey test (P<0.05)

Resistance Response of Bean Plants to Bacterial Leaf Blight Disease: The results of the analysis of variance in Table 7 showed that the application of trichocompost was significantly different in disease incidence (P<0.05) and tended to be significantly different in disease severity (P<0.1). Application of trichocompost at a dose of 200 g/plant showed a significant effect on disease incidence compared to other doses (Table 8).

The response of plant resistance to bacterial leaf blight in treating POC at a dose of 150 mL/plant and Trichocompost at a dose of 200 g/plant showed an increase in the resistance category from susceptible to somewhat resistant. Following Table 9, bacterial leaf blight (AUDPC) development was low in the POC treatment at a dose of 150 mL/plant and Trichocompost at 200 g/plant, respectively at 206.94 units and 225.00 units.

DISCUSSION

The findings of this study indicate that Trichoderma sp., as a biological agent in trichocompost, increases plant resistance to bacterial leaf blight disease compared to its role as a nutrient supplier to enhance plant growth. Following the report of Hermawan *et al.,* (2013), the role of *Trichoderma* sp. is not as a direct provider of nutrients but through disease control and degradation of organic matter so that its application does not directly impact the yield component per plant. This study also found that the trichocompost treatment showed a lower disease intensity level than the control, with a pattern that the higher the dose of trichocompost, the lower the incidence and severity of disease and AUDPC (Tables 8 and 9).

The best dose of trichocompost in increasing the resistance of Bean plants to bacterial leaf blight was 200 g/plant. At this dose, trichocompost increased the resistance category from susceptible to somewhat resistant (Table 9). The mechanism of plant resistance by *Trichoderma*contained in trichocompost is in the form of induced resistance, which is a mechanism to activate the plant defence system by stimulating the existing resistance mechanism in the plant (Susanna *et al.,* 2021). The resistance induction mechanism of *Trichoderma* sp. begins after the spores or propagative structures of *Trichoderma* sp. make contact with the surface of the plant roots, which will then induce the plant to produce at least three chemical substances such as peptides, proteins, and low molecular compounds that can increase plant resistance (Marsella and Ali, 2017). In addition, Trichoderma in compost can inhibit pathogens directly through nutrient competition by suppressing pathogen development during its life cycle and producing secondary metabolites in the form of antibacterial toxins that can increase plant resistance to pests (Wardahni *et al.,* 2022). Meanwhile, the LOF treatment did not show the same pattern as trichocompost due to the nature of organic fertilizers that decompose slowly, resulting in absorption by plants that is not optimal, so there is no effect on disease severity.

Table 7. ANOVA Recapitulation of Bacterial Leaf Blight Disease Response to the Application of POC and Trichokompost

Treatment	P-value	
	Disease incidence	Disease severity
POC	0,1103[ns]	0,7110[ns]
Trichokompost	0,0196[**]	0,0881[*]
POC*Trichokompost	0,8746[ns]	0,6736[ns]

*Note: ns= not significantly different in Tukey test (P<0.05), *significantly different in Tukey test (P<0.1), ** significantly different in Tukey test (P<0.05)*

Table 8. Resistance Response of Bean Plants to POC and Trichocompost Application

Treatment	Disease incidence (%)	Disease severity (%)
POC		
0 mL/plant	38,89	13,89
150 mL/plant	25,00	12,50
200 mL/plant	41,67	18,75
250 mL/plant	52,78	15,97
Trichokompost		
0 g/plant	50,00[a]	21,88
100 g/plant	45,83[ab]	14,58
200 g/plant	22,92[b]	9,38

Note: Numbers followed by the same letter in the same column indicate not significantly different in Tukey test (P<0.05)

Table 9. Area Under Disease Progress Curve (AUDPC) Value in Each Treatment

Treatment	AUDPC (unit)	Resistance category
POC		
0 mL/plant	272,22	Susceptible
150 mL/plant	206,94	Moderately Resistant
200 mL/plant	311,11	Susceptible
250 mL/plant	286,11	Susceptible
Trichokompost		
0 g/plant	288,54	Susceptible
100 g/plant	293,75	Susceptible
200 g/plant	225,00	Moderately Resistant

The unreal effect on Bean plants' growth parameters and yield are thought to be due to the nutrients contained in LOF and trichocompost that have yet to be absorbed perfectly. According to (Nugroho *et al.,* 2020), organic fertilizers are slow to decompose, so plants cannot absorb them perfectly. Organic fertilizers need to be faster in releasing nutrients, resulting in plants not optimally absorbing nutrients (Hartatik *et al.,* 2015; Rahman *et al.,* 2020). Plant growth is also influenced by soil pH, either directly or indirectly. The acidity level affects nutrient availability in the soil for plant growth (Mualif and Kusumawati, 2021). In this study, the soil pH before adding chicken manure, LOF and Trichocompost had an acidic pH of 3.7. Acidic soil has a relatively high Fe and Al content; Fe and Al can bind phosphorus in this condition, so it is unavailable in the soil. Phosphorus plays a role in stem and root formation and is one of the macronutrients needed for plant growth. (Ramadhana *et al.,* 2019). The addition of dolomite to the soil can be done as an effort to increase nutrient uptake. Giving dolomite can neutralize soil acidity by raising soil pH so plants can absorb nutrients well, which supports plants in growing more optimally (Sudianto *et al.,* 2018).

Another effort that can be made to increase nutrient uptake is to increase the incubation time of trichocompost. Soil incubation needs further attention so that the reaction between organic matter and soil can occur ideally. The results of the mineralization of chemically decomposed organic matter play a role in determining the cation exchange capacity, which significantly affects the availability of nutrients in the soil (Sianturi *et al.,* 2018). Research conducted by (Yandi *et al.,* 2016) stated that the incubation time of organic fertilizer for 30 days is sufficient time for organic fertilizer to decompose appropriately, as evidenced by the results of the lowest C-organic analysis (29.12%), as well as the highest total nitrogen (1.22%), total phosphorus (2.45%), and total potassium (2.21%) compared to the incubation time of organic fertilizer 10 days and 20 days.

Although statistically not significantly different, plants treated with LOF numerically showed a higher average plant height, number of leaves, pod fresh weight, pod dry weight, and number of pods per plant than those without LOF treatment. According to (Hujemianti *et al.,* 2022), plants that are given organic fertilizers get more nutrient supply so that they can accelerate the growth process, while plants in the control treatment do not get additional nutrients from organic fertilizers so that the growth process takes place as it is without an increase in nutrients. Trichocompost also has the potential to increase plant growth, as indicated by the average plant height, number of compound leaves, root length, root wet weight, and root dry weight in plants treated with 200 g/plant of trichocompost, although statistically not significantly different. Trichocompost has a role in improving soil's physical and biological properties (Suharman *et al.,* 2016) so that the soil becomes looser and allows roots to develop well (Eko *et al.,* 2016).

The average yields of pod length, pod fresh weight, and number of pods per plant were meagre compared to the description of the Gypsy bean variety. One of the factors that cause low yields is the low content of phosphorus nutrients (P2O5), which is 0.01% in LOF and 0.13% in trichocompost compared to the P2O5 content standard in the Minister of Agriculture Regulation Number 261/KPTS/SR.310/M/4/2019 minimum of 2-6% in LOF and 2% in solid organic fertilizer. The nutrient phosphorus (P) plays a vital role in cell division, albumin formation, flower, fruit, and seed formation, stimulates root growth, and improves fruit quality. Phosphorus deficiency will inhibit pod formation, resulting in low yields (Hartati *et al.,* 2014). In addition, (Marlina *et al.,* 2015) stated that phosphorus deficiency can result in many empty pods and few flowers forming.

CONCLUSION

The conclusion obtained from this study is that the application of LOF and trichocompost singly or their interaction has not increased Bean plants' growth and yield. However, the single application of trichocompost at a dose of 200 g/plant increased Bean plants' resistance to bacterial leaf blight from the low category to moderately resistant with disease incidence and severity and low AUDPC values. Further research is needed to explore other organic materials such as biochar, vermiculite, green manures, and others that can synergize with trichocompost to improve plant growth and resistance to bacterial leaf blight.

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