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The Growth of Shallot (*Allium Ascalonicum* L) on Manure Fertilizer and Trichoderma Inoculation

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Abstract

To produce optimally good quality shallots, proper cultivation techniques are required. Efforts that can be made include modifying the environment in which plants grow. Alternative efforts to increase the quantity and quality of agricultural products, especially shallots can be done by using organic fertilizers and the use of Trichoderma sp. as a plant growth promoting agent, as well as improving the quality of organic fertilizers. The purpose of this study was to determine the role of Trichoderma in increasing the ability of plants to absorb nutrients from the growing media and to determine the best type of organic fertilizer to increase the growth and yield of shallots. The research was conducted at the experimental field of the Faculty of Agriculture, UPN "Veteran" Yogyakarta, Wedomartani, Sleman, Yogyakarta Special Region, at an altitude of approximately 104 meters above sea level. The time of the research is from May to July 2021. This study was arranged in a factorial Completely Randomized Block Design with 3 replications. The first factor is the type of manure (P1: without manure, P2: cow manure and P3: goat manure). The second factor was inoculation of Trichoderma sp isolates (I0: without inoculation of Trichoderma sp. isolates. and I1: by inoculation of Trichoderma sp. isolates). Based on the results of this study, it can be concluded that the addition of cow and goat manure was able to produce more leaves and plant height than without the addition of manure, although it did not show a significant effect on the yield of shallot bulbs. There is no significant difference between cow manure and goat manure. Trichoderma inoculation has not had a significant effect on the growth and yield of shallots

Keywords: shallots, cow manure, goat manure, Trichoderma sp

INTRODUCTION

The production of shallots fluctuates throughout the year and depends on the season. Production is reduced in the rainy season and abundant in the dry season. With the increasing number of people every year, it is necessary to increase the availability of shallots to meet domestic needs. Efforts to increase shallot production aimed at meeting domestic needs and increasing competitiveness for exports can be realized by expanding land and increasing crop productivity (Iriani, 2013). One of the things that can be done in an effort to increase land productivity is the use of beneficial microorganisms to stimulate plant growth, in addition to the use of organic materials. Trichoderma sp. is a non-pathogenic soil fungus, one of the fungi included in the Plant Growth Promoting Fungi (PGPF). Several studies have reported that this fungus has benefits for various types of plants, because it can play a role in increasing plant growth and protecting it against pathogen attack (Shivana et al., 1994). The addition of organic matter will increase PGPF activity because organic matter provides carbon as an energy source for growth (Atmojo, 2003). Manure is a source of organic matter that is widely used in the cultivation of shallots. With the application of Trichoderma as PGPF in shallot cultivation, coupled with the use of organic materials in the form of manure, it is expected to increase plant growth and yields, so as to meet the needs of shallots both in terms of quantity and quality.

LITERATURE REVIEW

Shallots (Allium ascalonicum L) are plant products in the form of tubers which are one of the world's main cooking spices, in addition to many other benefits. Along with the increase in population and people's purchasing power, there will also be an increase in demand for shallots which are an important need of the community. To add to the benefits, it is recommended to choose good quality shallots (Adhi, 2020). To produce optimally good quality shallots, proper cultivation techniques are needed. Efforts that can be made include modifying the environment in which plants grow, because the growth and yields of plants

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are affected by environmental factors. One of the growing environmental factors is soil, which functions as a place for plants to grow and provides nutrients. Because shallot is a plant that requires soil with good fertility and porosity, mixing soil with organic matter is a technique to improve structure and increase soil porosity, especially on sub-optimal land (Adhi, 2020).

An important role of organic matter is its ability to improve the physical, chemical and biological properties of the soil. Improvements in soil physical properties include improving soil structure and increasing soil moisture, so as to ensure the growth and development of plant roots. Organic matter can change soil conditions for the better, which is not too heavy and not too light so that it can facilitate soil processing, and help the soil to be stronger in holding water (Novizan, 2007). Organic matter also increases the level of air availability in the cavities of soil particles, which causes the soil structure to become more porous with higher levels of oxygen availability in the soil. In addition, the application of organic matter can increase the Cation Exchange Capacity (CEC), and maintain soil pH in a neutral condition, so that plant growth is better and can provide optimal plant yields according to their potential. One type of organic material commonly used in shallot cultivation is manure.

Trichoderma sp. is a non-pathogenic fungus that is beneficial for plant growth, a member of the Plant Growth Promoting Fungi (PGPF) (Shivana et al., 1994). Through its role in promoting growth and protecting plants from pathogen attack, PGPF has been tested on almost all types of cultivated plants. Several strains of Trichoderma have been reported to have a direct effect on plants by increasing growth and nutrient absorption, efficiency in fertilizer use, and stimulating plant resistance to damage caused by biotic and abiotic factors (Shoresh et al., 2010). Alternative efforts to increase the quantity and quality of agricultural products, especially shallots can be done by using organic fertilizers and the use of Trichoderma sp. as a plant growth promoting agent, as well as improving the quality of organic fertilizers. The main problem that becomes the priority of this research is the study of shallot cultivation techniques with the addition of manure and Trichoderma, the role of Trichoderma in increasing the ability of plants to absorb nutrients from the planting medium and how organic matter can support Trichoderma activity as PGPF. In addition, determining the best type of organic matter to increase the growth and yield of shallot plants.

RESEARCH METHOD

The research was conducted at the experimental field of the Faculty of Agriculture, UPN "Veteran" Yogyakarta, Sempu, Wedomartani, Ngemplak, Sleman, Yogyakarta Special Region, with an altitude of approximately 104 meters above sea level. The research was carried out from May to July 2021.

The materials used were shallots of Lokananta variety, NPK fertilizer, Trichoderma sp, cow manure, and goat manure.

This study was arranged in a factorial Completely Randomized Block Design with 3 replications. The first factor is the type of manure (P1: without manure, P2: cow manure and P3: goat manure), each is given at a dose of 20 tons/ha. The second factor was inoculation of Trichoderma sp isolates. I0: without inoculation of Trichoderma sp. isolates. and I1: by inoculation of Trichoderma sp. isolates. Observational data were tested for their response to the effect of treatment by analysis of variance (ANOVA). To determine the differences between treatments, it was tested using Duncan's multiple range test (DMRT) method (Gomez and Gomez, 1995).

FINDING AND DISCUSSION

The results of observations on the effect of adding various manures with and without Trichoderma sp. on the number of leaves on shallot plants can be seen in table 1, where there is an interaction between the addition of various kendang fertilizers and inoculation of Trichoderma sp. on growing media.

Table 1. The number of leaves (pieces) of shallot plants at week 6, with the addition of various manures, with and without Trichoderma sp. inoculation

	No inoculation		Inoculated		Average
No manure	19.22	c	23.89	bc	21.56
Cow manure	27.78	ab	27.89	ab	27.83
Goat manure	31.00	a	25.11	b	28.06
Average	26.00		25.63		(+)

Note: Numbers with the same alphabet in the same column show no significant difference at α 5% (+):interaction occurs (-): no interaction

Without the addition of manure, the number of leaves produced by shallot plants showed lower yields than the addition of manure to the growing media, but when inoculated with Trichoderma sp., the crop yields were not significantly different from the addition of cow and goat manure. This indicates that the addition of manure has a positive effect on plant vegetative growth, including the number of leaves. As stated by Qin et al. (2015) that the application of manure increases soil fertility. According to Lakitan (2011) the most influential element on leaf growth and development is N. The large number of leaves is generally caused by the high content of N elements. The availability of nitrogen in manure will accelerate the formation of plant vegetative parts where the meristem tissue will carry out cell division, elongation and enlargement of new cells and protoplasm so that plant growth takes place properly (Rosmarkam and Yuwono, 2002). Therefore, without the application of manure it will produce fewer leaves than the addition of manure to the growing media. Inoculation of Trichoderma sp. able to encourage an increase in the number of leaves so that when compared with shallot plants that were given manure, there was no significant difference in growth.This is in accordance with the report of Sharma et al. (2012) that several studies showed that Trichoderma was able to stimulate plant growth such as increasing root development, crop yields, secondary root propagation, fresh weight of sprouts and leaf area. Martinez-Medina et al. (2014) also stated that some Trichoderma isolates were able to increase plant growth and tolerance to stress, by affecting the phytohormonal tissue of the host plant. In addition, it can directly affect plant pathogens.

Without Trichoderma sp. inoculation, the addition of goat manure to the growing media resulted in a higher number of shallot leaves than those inoculated, although it was not significantly different from the addition of cow manure with or without Trichoderma sp. inoculation. Fungi are heterotrophs because they get "food" by absorbing it from the surrounding environment (Sridianti, 2016). Fungi break down organic matter to obtain nutrients. They absorb their nutrients. As a fungus, Trichoderma sp will absorb nutrients from the manure applied to the shallot growing media, because these organic materials provide the substrate for the overhaul process involving soil fauna and microflora, such as bacteria, fungi and earthworms known as primers, secondary and tertiary consumers (Saidy, 2018). The steps taken by fungi to obtain nutrients: fungi spray certain enzymes into their environment, which in turn will play a role in breaking down large organic molecules into available forms of nutrients that can be absorbed by fungi (Sridianti, 2016).

The response of plants in increasing plant height and yield of shallot bulbs is presented in Figure 1, Figure 2 and Table 2 below

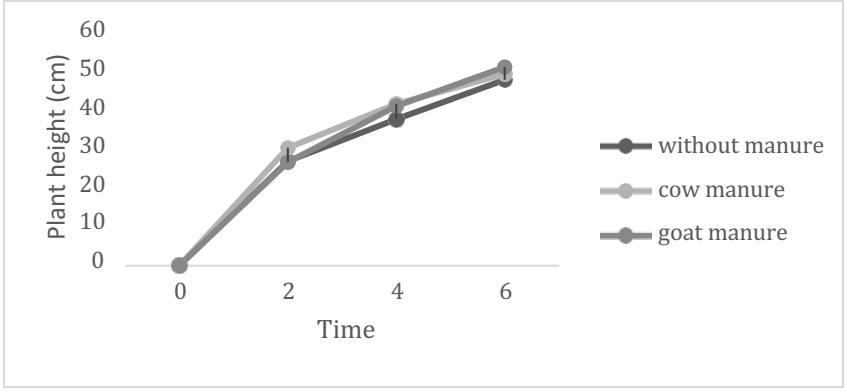

Figure 1. Shallot plant height (cm) on application of various manures

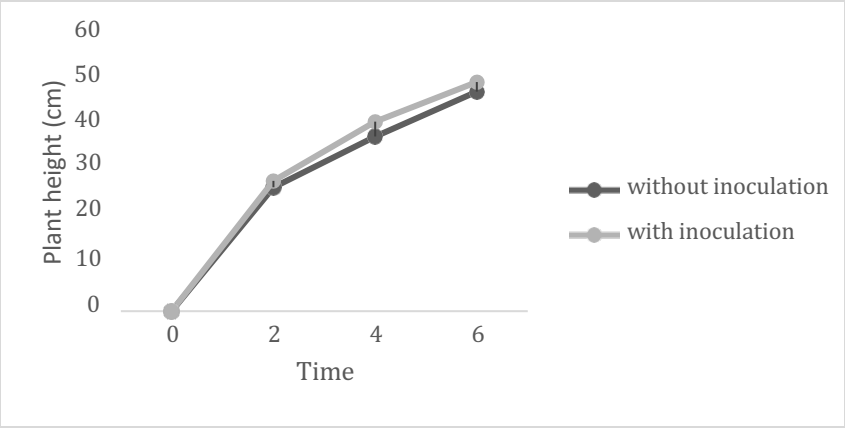

Figure 2. Shallot plant height (cm) with and without *Trichoderma* sp.

Figure 1 shows that up to 4 weeks after planting, the addition of cow manure to the growing media resulted in higher plant height than goat manure and without the use of manure. After that, the yield of plant height with the addition of goat manure tends to increase until the 6th week so that it is not significantly different from the yield on the addition of cow manure and is higher than without the addition of manure. At the beginning of growth, inoculation of Trichoderma sp. did not show significantly different results than the inoculated plants. In the second week to the sixth week, plants with Trichoderma sp. showed higher plant height than shallots without Trichoderma sp. (Figure 2).

Figure 3 shows the dry weight of tubers (g) of shallots given various manures and Trichoderma sp.

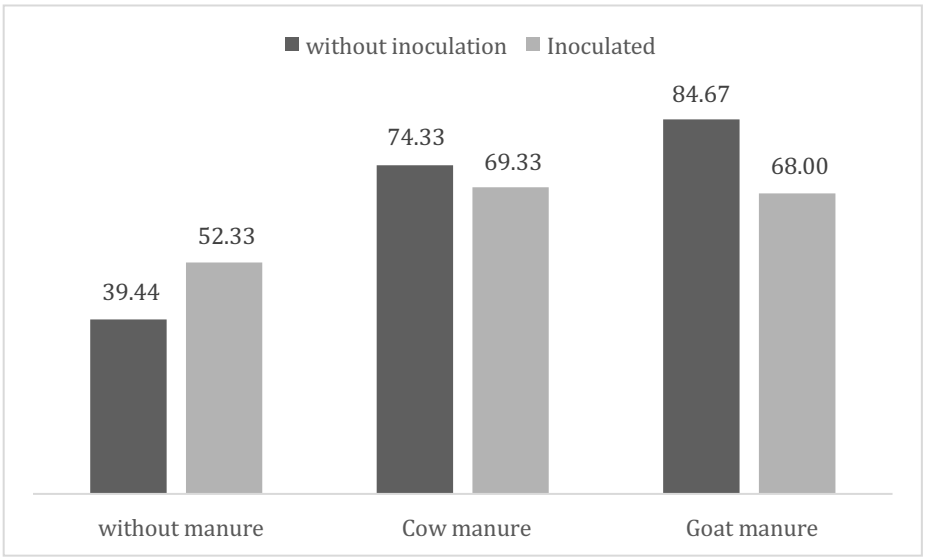

Figure 3. Dry weight of bulbs (g) of shallot plants (cm) on application of various manures and inoculation of *Trichoderma* sp.

From Figure 3, it can be seen that the addition of cow or goat manure in the planting media resulted in better drying weight of shallot bulbs than without the addition of manure. Without manure, inoculation of Trichoderma sp. resulted in better drying weight of shallot bulbs than without Trichoderma sp., while the addition of cow and goat manure on the growing media inoculated by Trichoderma sp. turned out to produce a lower dry weight of tubers than those that were not inoculated. However, the results of data analysis showed that there was no significant difference between giving cow and goat manure with no manure (Table 2).

From Table 2 it can be seen that the addition of cow manure and goat manure did not show significantly different plant height yields, although both showed higher yields than without the addition of manure to

the growing media. Plant height was also not significantly different, in shallot plants that were inoculated or not inoculated with Trichoderma sp.. Dry weight of shallot bulbs showed no significant difference between plants that were not given additional manure and those that were given additional cow or goat manure. Likewise, between plants inoculated or without inoculation of Trichoderma sp.. This is possible because the addition of manure, both cow manure and goat manure, can improve the growth of shallot plants, which is indicated by higher plant height yields than without manure in the planting medium. However, the addition of manure did not affect the yield, in the form of dry weight of shallot bulbs. According to Anwar and Sudadi (2013) the role of organic matter is divided into several functions, namely physical function (helping the formation of good soil structure and water content), chemical function (contributing to the active nature of soil colloids), nutrient function (contributing to nutrient sources, especially N, P, and S for plant growth) and physiological functions either directly or indirectly, due to organic compounds that can function as growth hormones. The increase in plant height is related to the nitrogen element contained in manure (Sutrisno & Yusnawan, 2018). According to Novizan (2002) nitrogen is needed at the stage of plant height growth. Nitrogen is used by plants to form amino acids which will be converted into proteins in addition to being needed to form compounds such as chlorophyll, nucleic acids, and enzymes. Kuntyastuti et al. (2015) also stated that the level of N and P uptake was correlated with plant vegetative growth. According to Atmaja et al. (2019) all variables were not affected by the application of goat manure and cow manure. However, the number of tubers per clump was significantly affected by the interaction between the treatment of goat manure and cow manure. Likewise, maximum plant height was significantly affected by the treatment combination, while other variables were not affected. On the other hand, in their research on maize, Sutrisno & Yusnawan (2018) reported that in a short period, manure did not significantly affect seed yield. In the observed plants, the combination of organic and inorganic fertilizers caused an increase in secondary metabolites, but did not significantly affect crop yields.

Allegedly, during the shallot planting period, Trichoderma sp that was inoculated on the growing media had not been able to develop properly so it had not shown any activity in influencing plant growth and yield.

Table 2. Plant height at week 6 and dry weight of shallot bulbs in the addition of various manures with and without *Trichoderma* sp.

	Plant height (-)	Dry Weight of Bulbs (-)
No manure	44.91 q	45.89 p
Cow manure	50.31 p	71.83 p
Goat manure	49.82 p	76.33 p
Average	48.35	64.68
No inoculation	47.67 a	66.15 a
By inoculation	49.02 a	63.22 a
Average	48.35	64.68

Note: Numbers with the same alphabet in the same column show no significant difference at α 5% .
(+): interaction occurs (-): no interaction

CONCLUSION AND FURTHER RESEARCH

As a conclusion from this study, it can be stated that the addition of cow and goat manure resulted in a better number of leaves and plant height than without the addition of manure, although it did not have a significant effect on the yield of shallot bulbs. There was no significant difference between cow dung and goat dung in influencing the growth of shallot plants. Trichoderma inoculation has not significantly affected the growth and yield of shallot plants.
As a further study, manure can be applied by inoculation of various types of Trichoderma sp to see the growth response and yield ofshallots.

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