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Growth Of Three Tomato Lines (*Lycopersicum Esculentum* Mill) Using *Trichoderma Sp* In Vegetative Phase

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Abstract

The Successful of breeding tomato plants will be determined by the availability of various genetic sources of tomatoes. The purpose of this study was to obtain the performance of the F line with tomato (Lycopersicum esculentum Mill) growth in the superior generative phase by administering Trichoderma sp and obtaining a good Trichoderma sp dose and its interactions. The research was conducted in July 2020 at the Wedomartani experimental garden in Yogyakarta. The field experiment method used a 2-factor Completely Randomized Design (CRD) with 3 replications. The first factor is the Servo F1, F2, and F3 tomato lines. The second factor was the dosage of Trichoderma sp, namely 30 g, 40 g, and 50 g. The parameters observed data were plant height, number of leaves, branches. and the diameter of the stem. The observed data were analyzed using analysis of variance (ANOVA) at the 5% level, so tested using by Duncan's Multiple Range Test at 5% level. The results showed that giving Trichoderma sp 40 g / plant could increase the number of Servo F1 tomato leaves. at age 7 must. Servo F1 tomatoes have a higher vegetative phase at the age of 5 and 7 mst, and the number of leaves is 5 mst. Treatment of Trichoderma sp 50 g / plant increased plant height by 7 mst and number of leaves by 5 mst.

Keywords: Tomato lines, Trichoderma sp

I. INTRODUCTION

The tomato plant is a genus of the Solanaceae family which is classified as a vegetable. Tomatoes are a source of nutrition, contain vitamin C and secondary metabolites which are very important for human health (Bhowmik *et al.* 2012) as well as alternative foods that have economic value and have many health benefits. Tomato plants can be consumed in the form of fresh and processed fruit. The vitamin C content in tomatoes can support the immune system against various types of diseases, including the Coronavirus (Covid-19) which is currently sweeping the world.

Tomato plant production from 2015 to 2019 experienced fluctuations in succession, namely 16.09 ton/ha, 15.31 ton/ha, 17.31 ton/ha, 18.04 ton/ha, and 18.63 ton/ha, with the percentage growth of 3.27% (Central Statistics Agency and Directorate General of Horticulture, 2019). Currently, in the midst of the Covid 19 pandemic, consumer demand for tomatoes has increased. The causes of

decreased tomato productivity include plant genotype, pest attack, fruit that is not large enough and requires loose, nutrient-rich soil.

There are several ways to increase the productivity of this plant, one of which is through plant breeding programs. The assembly of a superior variety that has a high yield and is resistant to pests and diseases is the right solution in increasing plant productivity. Efforts to obtain these superior varieties require large amounts of germplasm and high genetic diversity. Several tomato plant lines need to be tested over several

generations (F) to observe the character of plant growth and yield and resistance to disease. Besides that, to spur plant growth, fertile soil is needed.

II. LITERATURE REVIEW

Tomato is an annual plant that experiences a vegetative and generative phase in its growth cycle for a year. Vegetative growth is the increase in the volume, number, shape, and size of vegetative organs such as leaves, stems, and roots starting from the formation of leaves in the germination process until the beginning of the formation of the generative organs. Meanwhile, generative growth is the growth of generative organs that begins with the formation of flower primordia until the fruit is ripe. Both processes and growth phases are determined by genetic and environmental factors, where the plant grows (Syukur *et al*, 2018) so that there are differences in time and phase between different types, varieties, and environments. In a good vegetative phase will determine the generative growth of plants, thereby increasing yield. The tomato genotype will grow well if it is supported by the provision of organic fertilizers containing macro and micronutrients.

Some of the literature that is the reference for this study, among others: Herlina and Pramesti's (2017) research shows that giving *Trichoderma harzianum* 250 g active compost affects the growth of chili plants, can increase the number of lateral roots, chlorophyll content, and dry weight of chili plants. Application of *Trichoderma sp*. 30 g given 6 hst was more effective in slowing down the incubation period and suppressing the development of Fusarium wilt disease and better in increasing the growth and yield of tomato plants. Application of *Trichoderma sp*. 30 grams during planting also greatly affects the growth and yield of tomato plants. Tomato fruit can be harvested at the age of 10 MST to 12 MST. The highest total number of fruits was 88 fruit with fruit weights of 219.94 grams in W3D2 treatment (Berliance *et al*, 2017).

Sopialena (2018) research results show the dose of 40 g of *Trichoderma sp.* most effective in controlling *F. oxysporum* wilt disease in tomato plants, which increased the production of Lantana, Permata, and Ratna varieties of tomatoes, amounting to 293.48 g *Trichoderma sp.* Compost. In the soil medium at the time of the chili seedlings, the results were not significantly different from the Simatri compost treatment, indicated by the time of shoot emergence, plant height, and a number of leaves. Treatment of Trichoderma sp. shows the fastest time in variable time when shoots appear during seedlings (Setyadi *et al*, 2017). Followed by giving soil media + compost *Trichoderma sp*. (1: 1) in the field can increase the variables of plant height, a number of leaves, and fruit yields of chili plants (Setyadi *et al*, 2017).

From the results of previous research, it is necessary to conduct research on the vegetative growth phase of three generations of tomatoes with various doses of *Trichoderma sp*. The hypothesis underlying this study is suspected that the F3 tomato line was given compost Trichoderma sp. 40 g can increase the performance of plant growth.

III. RESEARCH METHODOLOGY

The materials used in this study were Tomato Servo Varieties F1, F2, and F3, *Trichoderma sp,* planter bag, and soil. The tools used are trays, buckets, stakes, sprayers, hoes, rulers, calipers, scissors, ropes, scales, label paper, and stationery.This study uses a Field Experiment method in a completely randomized design (CRD) 2 factors. The first factor was the tomato genotype (F), namely Sevro F1, F2, F3 tomatoes, and the second factor was the dose of *Trichoderma sp* (K). namely 30, 40, and 50 g /plant. Each treatment was repeated 3 times. From the two treatments, 9 treatment combinations were obtained, each experimental unit contained 6 plants so that the total plants were 162 plants. For the observation parameters, 3 sample plants are needed.

The stages of implementation are F1, F2, and F3 tomato seed nursery in soil nursery media and compost (1: 1), placed in the shade. Furthermore, maintenance of the nursery. When the age of 3 must the seeds are moved to a place exposed to sunlight. At the age of 3 must the nursery was transplanted in a 30 kg planter bag in soil media and compost (2: 1). *Trichoderma sp* was administered at the age of 2 weeks after transplanting with a dose according to treatment. Furthermore, maintenance is carried out including watering, weeding, installing stakes, and cleaning weeds. Growth observation parameters in the vegetative phase consist of the plant height and the number of leaves in 4 and 6 must age, so stem diameter and number of productive branches at 6 MST age.

IV. FINDING AND DISCUSSION

The results of the analysis of the variety of height of tomato plants at the age of 5 must and 7 mst showed that the strain treatment (F) had a significant effect, but the *Trichoderma sp* dose treatment had no significant effect. There is no interaction between the two treatments. The average plant height values at 5 mst and 7 mst can be seen in Table 1.

Table 1. The average height of tomato plants at the age 5 must and 7 mst (cm)

Treatment Line (F)	Height of tomato plant 5 MST	Height of tomato plant 5 MST
Servo F1	47,111 a	71,722 a
Servo F2	40,500 b	58,889 b
Servo F3	37,222 b	56,944 b
Trichoderma		
30 g/plant (K1)	39,556 p	58,944 p
40 g/pant (K2)	42,444 p	62,778 p
50 g/plant (K3)	42,833 p	65,833 p
	(-)	(-)

Note: The average treatment followed by the same letter shows no significant difference for Duncan's multiple range test (DMRT) at a 5% level. Sign (-) indicates there is no interaction

Table 1 shows that the Servo F1 Tomato was significantly higher than other treatments at the age of 5 must and 7 mst. Nazirwan *et al.* (2014) stated that the difference in plant height is influenced by genetic factors of each line/number and environment such as light intensity and nutrient availability. Servo F1 tomato plants are very suitable for planting in the lowlands to medium, high plant character. The F1 generation contains the characteristics of both parents with a unique genotype and a uniform phenotype (Syukur, 2018). The generations F2 and F3 are generated due to the breeding of two organisms of the same species.In *Trichoderma sp* treatment there was no significant difference between treatments. The ability of plants to respond to *Trichoderma sp* in various doses is the same. Giving *Trichoderma sp* in soil media will increase the microorganisms besides the microorganisms in the soil media will also be encouraged to develop. The process of further decomposition by microorganisms will continue but does not interfere with plant growth (Setyadi *et al*., 2017).

The results of the analysis of the variety of the number of leaves of tomato plants at the age of 5 must show that the strain treatment (F) and the *Trichoderma sp* dose had a significant effect. There is no interaction between the two treatments. Table 2 shows that the average number of leaves at the 5 most age.

Table 2. The average number of productive tomato leaves at 5 most age.

Treatment	Trichoderma 30 g/plant (K1)	Trichoderma 40 g/plant (K2)	Trichoderma 50 / plant (K3)	Average
Servo F1	60,167)	74,667	68,833	67,889 a
Servo F2	54,167	54,167	72,833	60,389 ab
Servo F3	49,833	53,333	62,833	55,333 b
Average	54,722 q	60,722 pq	68,167 p	(-)

Note The average treatment followed by the same letter no significant difference for Duncan's multiple range test (DMRT) at a 5% level. Sign (-) indicates there is no interaction

Table 2 shows that the Servo F1 Tomatoes had significantly more leaves at the age of 5 must than F3 but not significantly different from F2. Servo F1 tomatoes are a hybrid of the two parents to produce superior traits. Tomato plants are self-pollinating, although sometimes they can cross-pollinate less than 1% (Poespodarsono, 1988). The type of pollinating plant itself produces homozygote individuals. In general, the lines from F2 or F3 have shown genetic diversity (Qosim, 2018).

The administration of Trichoderma sp 50 g / time (K3) had significantly more leaves at 5 MST than K1 but was not significantly different from K2. *Trichoderma sp*. able to increase the number of leaves because it helps increase the activity of microorganisms in the soil media maintains soil fertility and decomposes nutrients that were not available from organic matter and minerals. *Trichoderma sp.* if it has infected the roots of the host plant, it will be able to help the host plant absorb certain nutrients, especially phosphorus (Bryla and Koide, 1998).

Table 3. The Average number of tomato leaves at the aged 7 MST

Treatment	Trichoderma 30 g/plant (K1)	Trichoderma 40 g/plant (K2)	Trichoderma 50 g/plant (K3)	average
Servo F1	63,000 b	84,167 a	78,667 ab	75,278
Servo F2	68,000 b	68,000 b	80,167 ab	72,056
Servo F3	67,500 b	63,000 b	73,833 ab	68,111
average	66,167	71,722	77,556	(+)

Note: The average treatment followed by the same letter shows no significant difference for Duncan's multiple range test (DMRT) at a 5% level. Sign (+) indicates there is the interaction

Table 3 shows that the combination of Servo F1 and *Trichoderma sp* 40 g / plant tomato treatments had more leaves than other treatments at the age of 7 must. The interaction between F1 tomatoes which have superior, healthy genotypes, with Trichoderma administration is able to produce more leaves at the age of 7 must. Servo F1 T tomatoes are very vigorous, resistant to Geminivirus and bacterial wilt, as well as very tolerant of hot climates and well adapted to lowlands with an altitude of 145 - 300 m asl. Supported by Indahyani's research (2019) that Servo F1 plants are quite resistant to leaf spot and phytophthora attacks in lowland planting locations, can be planted in dry and rainy season planting. The administration of *Trichoderma sp* 40 g / plant as a biological agent is able to suppress disease attacks. Djafaruddin (2000) states that biological activity in soil occurs because antagonistic microorganisms compete in food, produce antibiotics that are toxic, and carry out parasitism against pathogens. In addition, *Trichoderma sp* helps the absorption of nutrients and water are more plant growth, so increase development through photosynthesis that occurs in leaves. Plant growth and development is the increase in cell tissue produced by the increase in cell size by Pardosi *et al.* (2016). Increasing the number of plant leaves will affect the yield of tomatoes. Vegetative and generative growth of plants requires nutrients and water, which is influenced by the ability of the roots to absorb these nutrients and water (Baihaki *et al*, 2013). Salisburry and Ross (1995) stated that plant development and productivity are closely related to the number of leaves produced by these plants.

Table 4. The average number of branches and diameter of tomato stems aged 7 MST

Treatment Line (F)	number of branches	diameter of stems
Servo F1	10,278 a	1,041 a
Servo F2	10,111 a	1,126 a
Servo F3	9,889 a	1,166 a
Trichoderma		
30 g/plant (K1)	10,167 p	1,101 p
40 g/palnt (K2)	10,500 p	1,081 p
50 g/plant (K3)	9,611 p	1,150 p
Average		(-)

Note: The average treatment followed by the same letter shows no significant difference for Duncan's multiple range test (DMRT) at a 5% level. Sign (-) indicates there is no interaction

In the parameters of the number of branches and trunk diameter aged 7 mst in the treatment of *Trichoderma sp*. Lines and doses, there was no significant difference between treatments. The existence of no significant difference indicates the growth response in the vegetative phase of the plant is the same, it is possible that in the generative phase different plant development is obtained. *Trichoderma sp* has not responded to the growth in the number of branches and stem diameter.

V. CONCLUSION AND FURTHER RESEARCH

1. The administration of *Trichoderma sp* 40 g / plant can increase the number of Servo F1 tomato leaves at 7 mst.
2. Servo F1 tomatoes have a higher vegetative phase at the age of 5 and 7 mst, and the number of leaves is 5 mst.
3. Treatment of *Trichoderma sp* 50 g / plant can increase plant height by 7 mst and number of leaves by 5 mst.

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