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Agronomic Response of Soybean Plant in Various Dosage Bio Compos Fermented Fungus of Trichoderma sp. and Arbuscular Mycorrhizae Fungi

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Abstract:- This research is an experimental study to determine the effect of dose mycorrhizal, bio compost and interaction between dose bio compost and arbuscular mycorrhizal fungi (AMF) on the growth and yield of soybean in dryland West Lombok. This study was designed using a randomized block design (RBD) with a split-plot design treatment. The main plot is the bio compost dose factor fermented by Trichoderma sp. in 4 levels, namely b0 (without providing bio compost), b1 (bio compost 5 tons/ha), b2 (bio compost 10 tons/ha) and b3 (bio compost 15 tons/ha). The subplots had six AMF dosage levels, namely m0 (without mycorrhizae), m1 (mycorrhizae 250 kg/ha), m2 (mycorrhiza 300 kg/ha), m3 (mycorrhiza 350 kg/ha), m4 (mycorrhiza 350 kg/ha), m4 (mycorrhiza 300 kg/ha) and m5 (mycorrhiza 450 kg/ha), so that there are 24 treatment combinations and each combination is repeated three times. The results showed that the treatment of bio-compost doses of Trichoderma sp. and AMF significantly influence the growth of soybean plants such as plant height, number of leaves, and number of root nodules of soybean plants. At the same time, the interaction effect is not significant in the growth of soybean plants. The optimal dosage of bio compost application for Trichoderma sp fermentation, which can increase the growth of soybean plants is 10 tons/ha. Conversely, the AMF dose that can increase the maximum growth of soybean plants is 450 kg/ha. The higher the AMF dose will cause, the AMF population in the soil is also higher, which causes better plant growth. The biochemical treatment of Trichoderma sp, mycorrhizae, and their interactions significantly affected soybean productivity, namely the percentage of empty pods, percentage of filled pods, the weight of seeds per plant, the weight of seeds per plant, the weight of seeds per plant, the weight of seeds per plant, the weight of 100 grains and weight of dry biomass of soybean plants. The optimal dosage of Trichoderma sp. bio- compost fermentation, which can increase soybean productivity in each AMF dose treatment, is 10 tons/ha, while for AMF treatment at each dose of Trichoderma sp. bio-compost fermentation significantly affected with a dose of 450 kg/ha.

Keywords:- *Trichoderma, bio compost, mycorrhiza and soybean.*

I. INTRODUCTION

Soybean (*Glycine max* (L.) Merr.) It is the third major food commodity after rice and maize and is one of the priority commodities in the National Agricultural Revitalization program in Indonesia (Abdurachman et al., 2008). Soybean cultivation occupies 60% of technically watered paddy fields as the second crop after rice, and 40% is cultivated on dry land (Kementerian Pertanian, 2010). Of the 32.9 million hectares of total potential dry land, around 25.2 million hectares, or 76%, have been utilized (Suwardji, 2009). In Nusa Tenggara Barat (NTB) dryland agriculture is the mainstay and the mainstay of the future because 84% (1.8 million hectares) is a potential dry land as agricultural land for food crops such as maize, soybeans, green beans, sorghum and other plants with cropping patterns system such as: soybean-maize-soybean, soybean-maize-soybean or soybean intercropping corn (Wangiyana, 1995). Soybean has proven to be well adapted to dry land, even though the yield is only 1.0 ton/hectare (Adisarwanto et al., 2002).

One alternative to increase soybean yields that can be done is by using mycorrhizae that can adapt to the environment, increase plant growth and development (Setiadi, 2001). Another obstacle in the growth of soybean plants on dry land is the inability of plants to adapt to drought stress conditions, especially in the germination phase, vegetative growth and flowering (Hanum et al., 2007)

This innovations are needed to solve these problems that can improve the agronomic performance of soybean plants through the improvement of the physical and biological environment of the soil (Ma'shum et al., 2003). This can be done through an integrated system of organic agricultural cultivation of soybean, which combines various components of biological-based technology that provides a synergistic influence on plants and soil conditions. Such as the use of bio compost, mycorrhizae, and superior soybean varieties that have resistance to soil-borne pathogens (Sudantha, 2011).

One of the benefits of using mycorrhizae is increasing the resistance of soybean plants to water stress, while bio compost can reduce the use of inorganic fertilizers or chemical pesticides. Based on the description above, a study was conducted on "the effect of doses of bio compost

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and mycorrhizal application on the growth and yield of soybean plants in a dry land."

II. MATERIALS & METHODS

➢ *Experiment Method and Data Analysis*

This research was conduct with an experimental method with field trials conducted in Montong Are Village, Kediri District, West Lombok Regency, from January 2019 to April 2019. This study was designed using a randomized block design (RBD) with a split-plot design. The main plot is bio compost fermented Trichoderma sp. doses factor in 4 levels, namely b0 (without giving bio compost), b1 (5 tons of bio compost/ha), b2 (10 tons of bio compost/ha) and b3 (15 tons of bio compost/ha). Subplots were factor FMA doses in 6 levels: m0 (without mycorrhizae), m1 (250 kg mycorrhizae/ha), m2 (300 kg mycorrhizae/ha), m3 (350 kg mycorrhiza/ha), m4 (400 kg mycorrhizae)/ha) and m5 (450 kg mycorrhizae/ha), so that 24 treatments were obtained. Each of which was repeated three times, so that there were 72 experimental units. Data were analyzed using an analysis of two ways ANOVA and Tukey's HSD (Honestly Significant Difference) means-tested at a 5% level of significance.

➢ *Implementation of the Experiment*

Arbuscular mycorrhiza fungi (AMF) obtained from the Institute for Biotechnology Assessment Agency for the Assessment and Application of Technology, with the trademark Technofert. Whereas compost is made with cow dung and pieces of rice straw that are first dried, then the compost material is put into a fermentation tub. The compost was arranged in a 30 cm thick layer, which was supplemented with 5 cm thick rice bran supplement, then splashed with Biotricon solution, a mixture of *T. koningii* endophytic fungi (ENDO-04 isolate) and *T. harzianum* saprophytic fungi (SAPRO-isolate) 07) evenly while the compost material is stirred. Furthermore, the pile of compost material is tightly closed with a tarpaulin and left for three weeks with a reversal once every week. How to make *Biotricon* solution, i.e., *T. koningii* endophytic fungi (ENDO-04 isolates) and *T. harzianum* saprophytic fungi (SAPRO-07 isolates) were destroyed in 1 liter of water, then added 2.5 g of sugar. Bio compost doses are given according to treatment.

Soybean seeds used in the study were Anjasmoro varieties obtained from the Central Rice Seed Institute, Palawija, and Horticulture, NTB Province Jl. Raya Peninjauan Km 8, Narmada, West Lombok Regency. Seed needs per plot are 36 g or 0.036 kg. The total number of seeds needed for 72 plots is 2,592 kg or around 2.6 kg.

Planting land is prepared simply. The soil is first hoped or plowed as deep as 15-20 cm, then made as many as 72 plots of test plots with size (one plot measuring 2 x 2 m^2). Around the land, a 50 cm wide moat was made with a depth of 30 cm. Between one plot and another plot is made a ditch as an irrigation channel and 30 cm deep and between blocks as irrigation channel and as deep as 50 cm, the land is ready for planting seeds.

Soybean seeds are planted with a distance of 25 x 20 cm; seeds are inserted into the planting hole that has been prepared, each planting hole is planted three seeds of soybean seeds as deep as 2.0 cm. At the age of the one-week plant, spacing was carried out, leaving two plants per planting hole.

Plant maintenance includes fertilization, weeding, irrigation, and pest control. Fertilization N (urea) is done twice; each half of the treatment dose given to the first fertilization is carried out when planting by means of the plant into the planting hole, and the second is done four weeks after planting. P and K fertilization are given together at the time of the first N (urea) fertilization. The second fertilization with urea ½ dose is given at the age of 4 weeks after planting by immersing it in the soil.

Watering is done by watering until the planting media is moist (field capacity) from the time of planting to maximum pod filling. Just before harvest, the soil should be dry. Weeding is done by pulling outgrowing weeds.

The parameters observed in this study were: plant height (cm), number of leaves, number of root nodules, percentage of pods, percentage of pods contained, plant dry weight/clumps, seed weight per clump, and weight of 100 seeds.

III. RESULTS AND DISCUSSION

➢ *Soybean Plant Growth*

Results of analysis of variance (ANOVA) of soybean plant growth, including plant height eight weeks after showing (WAS), the number of leaves of 8 WAS. The number of root nodules due to bio compost dosage treatment of *Trichoderma* and AMF fermented fungi showed that there was no real interaction between the two treatment factors. Dosage of bio compost application from fermented *Trichoderma* sp. and the AMF inoculant application dose significantly affected plant height and a number of leaves. In contrast, based on the number of nodules, the results of diversity analysis (ANOVA) showed that the application of bio compost produced by fermentation of *Trichoderma* sp. and the interaction of the two treatment factors had no significant effect. Still, the dose of AMF application has a significant effect on the number of root nodules (Table 1).

Observation Parameters	Bloc	Biocompos	AMF	Interaction
Plant Haight	ns	s	s	ns
Number of Leaves	ns	s	s	ns
Number of Root Nodules	ns	ns	s	ns

Table 1:- Summary of analysis results (ANOVA) on plant height and number of leaves at 8 WAS and number of root nodules (ns = non-significant, s = significant)

Judging from the bio compost dose of fermented *Trichoderma* sp, the average height of soybean plants (Table 2) was highest in the treatment dose of 10 tons/ha and the lowest in the treatment without-bio compost. Bio compost dosage treatment of fermented *Trichoderma* sp. 10 tons/ha can increase plant height by 0.62 cm/day. These results are consistent with the results of the study of Astiko et al. (2013) on maize plants, which concluded the package of mycorrhiza in combination with cattle manure under maize cropping system. This treatment contributed significantly to improve soil chemical properties, particularly for total organic-C, N, available P and K on sandy loam of Northern Lombok.

Treatment	Plant Haight	Number of Leaves	Number of Root Nodules
Biocompos			
0 tons/ha	57.23 b*	25.14 c	19.97 a
5 tons/ha	57.26 b	27.99 b	23.14 a
10 tons/ha	61.56 a	30.17a	21.75 a
15 tons/ ha	59.31 b	30.93 a	21.22 a
HSD	2.15	1.94	2.68
Inoculum AMF			
0 kg/ha	54.28 c	24.97 a	18.04 a
250 kg/ha	58.42 b	28.36 b	18.38 a
300 kg/ha	58.22 b	28.97 b	24.00 b
350 kg/ ha	58.96 b	30.04 b	20.00 a
400 kg/ha	59.03 b	28.77 b	22.96 ab
450 kg/ha	64.12 a	30.25 b	25.75 b
HSD	2.64	2.38	3.28

Table 2:- Average plant height, number of leaves and number of root nodules at each treatment of bio compost doses of fermented *Trichoderma* sp. and AMF application dosages (* figures followed by the same letters in the same column are not significantly different in the 5% HSD test)

Furthermore, Gaur (1980) reported that soil organic matter has a role in improving the physical, biological, and chemical properties of the soil so that it can increase plant growth. The application of *Trichoderma* sp. in soybean plants can increase plant height by 14.79%. The fungus Trichoderma causes the role sp. produce IAA in the form of auxin and gibberellins. In addition to the activity of *Trichoderma* sp, can help plants absorb nutrients from the soil (Setiyaningrum et al., 2016).

When viewed from the AMF dose, the highest average soybean plant height (Table 2) was found in the AMF treatment dose 450 kg/ha, and the lowest was in the treatment without AMF. Shows that the higher AMF dose causes higher soybean plants. The AMF dosage treatment can increase plant height by 15.35%. According to Linderman (1988), mycorrhizal fungi have been to stimulate plants in the absorption of immobilized elements such as P, Zn, and Cu as well as mobile elements such as S, Ca, K, Fe, Mg, Mn, Cl, Br and N from the soil. This plant grows to be faster and healthier than plants that do not suffer from mycorrhizae, especially in soils with low fertility.

Judging from the dosage of bio compost produced by fermentation of *Trichoderma* sp., The average number of leaves (Table 2) was highest in the treatment dose of 15 tons/ha and the lowest in the treatment without-bio compost. These results indicate that the *Trichoderma* sp. on soybean plants has a linear effect on increasing the number of leaves, namely the higher dose of bio compost fermented by *Trichoderma* sp., which is applied to soybean plants. The growth of the number of leaves of soybean plants increases, and the lower dosage of bio compost produced by fermentation of *Trichoderma* sp. which is applied to soybean plants, the increase in the number of leaves is also low (Sudantha, 2011).

Baihaqi et al. (2013) stated that the application of *Trichoderma* sp. of 10 ml.l^{-1} did not have a significant effect on growth parameters and yields of potato plants. But there is an interaction between the treatment levels of *Trichoderma* sp. and the time of application, which shows a real effect only on the parameters of the time when a blight attack (*Phytophthora infestans*) appears. However, it did not have a significant effect on growth parameters and yields of potato plants (*Solanum tuberosum* L.). Application time *Trichoderma* sp. every two days does not affect the growth parameters and tuber yields of potato plants.

According to Santoso et al. (2014), organic matter in the form of litter, green leaf material, compost, and manure plays a significant role in increasing and maintaining land productivity. The effect of organic matter will be seen if given in large quantities or high quantities. In implementing agriculture, to overcome these problems, farmers provide green fertilizer or manure. Organic waste in the form of crop residues and livestock manure cannot be given directly to plants, but must first be composted by soil microbes into nutrients that can be absorbed by plants (Sudantha, 2011).

Similar to the effect of bio compost doses on the number of leaves of soybean plants, so when viewed from AMF doses, the highest average number of leaves (Table 2) found in the highest dose treatment that is 450 kg/ha and the lowest in the treatment without mycorrhizae. Sasli (2004) reported that the benefits of mycorrhizae for the development of host plants include: increasing nutrient absorption in the soil, increasing host resistance to drought and increasing growth-promoting hormones, to trigger growth in the number of leaves of soybean plants.

Judging from the AMF dose, the highest average number of soybean root nodules (Table 2) found in the highest AMF dose treatment that is 450 kg/ha, and the lowest was in the treatment without AMF. Shows that a high AMF population in the soil can trigger the growth of soybean root nodules. Treatment of AMF 450 kg/ha can increase the number of nodules of soybean plants from 10.04 to 25.75.

These results are consistent with the results reported by Mosse (1981), that the association between AMF fungi and host plants such as mycorrhizae Glomus sp. can infect soybeans, string beans, onions, cassava, oranges, and tobacco, to stimulate the growth of root nodules in plants. The direct role of mycorrhizae is to help roots increase water absorption from soil pores when plant roots have difficulty absorbing water (Setiadi, 2001).

➢ *Soybean Plant Yields*

The results of the analysis of variance (ANOVA) on soybean crop yield components (Table 3), namely the percentage of empty pods and filled pods, showed that the bio compost fermented by Trichoderma sp. does not have a significant effect, but the AMF dose and the interaction of the two factors have a significant effect on the percentage of empty and filled pods. In contrast, the treatment of bio compost doses of fermented Trichoderma sp. and AMF dose and interaction between the two factors have a significant effect on the weight of seeds per clump, the weight of 100 seeds, and a dry crop of soybean.

Observation Parameters	Bloc	Biocompos	AMF	Interaction
Percentage of Empty Pods	ns	ns	s	s
Percentage of Pods Containing	ns	ns	s	s
Seed Weight Per plant	ns	s	s	s
Weight of 100 Seeds	ns	s	s	s
Dry biomass weight	ns	s	s	s

Table 3:- Summary of the analysis of the results of variance (ANOVA) on the percentage of empty pods, filled pods, seed weight per plant, the weight of 100 seeds and dry biomass weight of soybean plants (ns = non-significant, s = significant)

The results of observations of soybean yield parameters include the percentage of empty pods, percentage of filled pods, the weight of seeds per plant. The weight of 100 seeds and dry weight of plant biomass in the application of bio compost dosage treatment of fermented Trichoderma and AMF fungi can be seen in Table 4-9.

Mycorrhizae	Compos			
	0 tons/ha	5 tons/ha	10 tons/ha	15 tons/ha
0 kg/ha	9.38 a *	3.20 a	10.29 a	4.14 a
250 kg/ha	5.65 b	6.34 b	6.41 b	4.76 a
300 kg/ha	5.47 b	4.82 ab	5.00 b	9.01 b
350 kg/ha	6.18 b	9.19 c	4.81 b	9.24 b
400 kg/ha	6.77 b	6.82 bc	6.70 b	5.88 a
450 kg/ha	5.68 b	8.06 cd	1.43 c	1.90 c
HSD	2,55			

Table 4:- Average Percentage of Empty Pods (g/plants) of Soybean Plants to Interaction Treatment of Biocompost Fermentation Dose of *Trichoderma* sp. and AMF (* numbers followed by the same letter in the same column are not significantly different in the 5% HSD test).

Judging from the interaction between the two treatment factors, the average percentage of empty pods due to AMF dosage treatment at each dose of bio compost produced by fermentation of Trichoderma sp. (Table 4), it appears that the highest percentage of empty pods was in the treatment without AMF and the lowest was in the highest AMF treatment dose of 450 kg/ha. This shows that the higher AMF dose causes the empty pods of soybean plants to be lower. The AMF dosage treatment can increase pod filling so that the percentage of empty pods is low.

According to Astiko et al. (2013a), the application of AMF plus manure increases the concentration of N, P, K, and soil organic matter content, thereby increasing nutrient uptake, growth, and yield of soybean plants. Application of AMF plus manure contributes significantly to soybean crop nutrient uptake (N, P, K, and Ca) so that the percentage of soybean vacuum pods are low because nutrients are fulfilled for pod filling.

Mycorrhizae	**Compos**			
	0 tons/ha	**5 tons/ha**	**10 tons/ha**	**15 tons/ha**
0 kg/ha	90.60 a*	96.80 a	89.70`a	95.83 a
250 kg/ha	94.33 b	93.63 bc	93.60 b	95.27 a
300 kg/ha	94.50 b	95.17 ab	95.00 b	91.00 b
350 kg/ha	93.83 b	90.83 c	95.20 b	90.77 b
400 kg/ha	93.23 b	93.17 bc	93.30 b	94.13 a
450 kg/ha	94.30 b	91.97 c	98.53 c	98.10 c
HSD	2.55			

Table 5:- Average Percentage of Contained Pods (g / plant) Soybean at the Interaction of Dose Biocompost Fermentation of Fungi Trichoderma sp. and AMF (* numbers followed by the same letter in the same column are not significantly different in the 5% HSD test).

I was judging from the interaction between the two treatment factors, the average percentage of pods containing soybean plants due to AMF dose treatment at each dose of bio compost produced by fermentation of Trichoderma sp. (Table 5). It appears that the highest percentage of pods contained in the highest AMF application dose is 450 kg/ha, and the lowest is in the treatment without AMF. This means that the higher AMF dose is applied to the plant, the soybean pod filling is maximum.

These results are consistent with the results reported by Setiadi (2001), that mycorrhizae play a direct role in helping roots increase water absorption from soil pores when plant roots have difficulty absorbing water. Also, the use of mycorrhizae as biological fertilizers in agriculture can improve plant growth, productivity, and quality without reducing the quality of soil ecosystems (Sasli, 2004). The application of mycorrhizae can also help rehabilitate critical land and increase the productivity of agricultural crops, plantations, and forestry on marginal lands (Yusrizal et al., 2018).

Biocompos	**Mycorrhizae**					
	0 kg/ha	**250 kg/ha**	**300 kg/ha**	**350 kg/ha**	**400 kg/ha**	**450 kg/ha**
0 tons/ha	9.45 b*	7.8 b	9.37 a	10.11 a	8.08 a	7.04 a
5 tons/ha	10.48 b	10.23 a	12.3 b	11.42 a	13.52 b	12.25 b
10 tons/ha	9.12 ab	15.83 c	13.01 b	18.32 b	11.65 b	21.87 c
15 tons/ha	15.39 c	15.25 c	11.3 ab	18.04 b	14.34 b	21.87 bc
HSD 5%	2.05					

Table 6:- Average Weight of Seeds (g/plant) of Soybean Plants in the Interaction of Doses Biocompost Fermented *Trichoderma* sp. and AMF (* numbers followed by the same letter in the same column are not significantly different in the 5% HSD test).

Based on Table 6, it can be seen that the weight of seeds per soybean plant is significantly different due to the treatment of bio compost doses of fermented Trichoderma sp. at each AMF dose. The highest average weight of seeds per clump is at a dose of 10 tons/ha. This means that the optimum dosage of the synergistic *Trichoderma* sp fermentation of the fungus Trichoderma sp is at a dose of 10 tons/ha, this dosage level can increase the weight of the seeds per soybean plants.

This is because bio compost can function as a growth medium for mycorrhizae, where microbes in bio compost can synergize with mycorrhizae so that the interaction of these two factors can increase the weight of seeds per soybean plant. Trichoderma sp. can increase seed weight per soybean plant, Trichoderma sp. quickly develops in the rhizosphere, and application of the fungus Trichoderma sp. can increase plant growth and productivity (Apzani et al., 2015).

Furthermore, Pujianto (2001) said that organic matter is an essential component of soil composition besides water and air. The amount of AMF spores correlates positively with the content of organic matter in the soil. The maximum number of spores is found in soils containing 1-2 percent organic matter, while in organic soils less than 0.5 percent, the content of mycorrhizal spores is deficient. Astiko and Sudantha (2019) also reported an increase in soybean yields could be done with the application of organic fertilizer from the eggshell valley and AMF in the dry land of North Lombok. The interaction of 500 kg AMF ha^{-1} and 200 kg ha^{-1} eggshell can increase the yield, number of AMF spores, and the percentage of infections in the roots.

Biocompos	**Mycorrhizae**					
	0 kg/ha	**250 kg/ha**	**300 kg/ha**	**350 kg/ha**	**400 kg/ha**	**450 kg/ha**
0 tons/ha	15.92 a*	15.48 a	13.28 a	15.63 a	16.34 a	14.10 a
5 tons/ha	15.81 a	15.76 a	17.15 b	15.17 a	16.83 a	14.61 a
10 tons/ha	14.66 a	15.95 a	18.65 b	17.15 a	16.52 a	24.14 b
15 tons/ha	16.38 a	13.93 a	15.85 c	17.12 a	15.27 a	21.32 c
HSD 5%	2.26					

Table 7:- Average Weight of 100 Soybean Seeds on the Interaction of Biocompost Dose Fermentation of Trichoderma sp and AMF Fungi (* the numbers followed by the same letters in the same column were not significantly different in the 5% HSD test)

Based on Table 7 it can be seen that the weight of 100 soybean seeds is significantly different due to the dosage of the bio compost dosage of fungal fermentation of Trichoderma sp. at AMF doses of 300 kg/ha and 450 kg/ha, while at other AMF doses it was not significantly different. In both AMF doses, the highest weight of 100 soybean seeds was found in bio compost doses of 10 tons/ha. This means that the optimum dosage of Trichoderma sp., which synergizes with AMF is 10 tons/ha, this dosage level can increase the weight of 100 soybean seeds.

The results of Setiadi's (2001) research on growth and yields on green bean plants (*Phaseolus radiatus* L.) showed that mycorrhizal treatment with a dose of 10 g/plant and compost fertilizer of 10 tons/ha showed the best results at a weight of 100 grains. Malik et al. (2017), reported that AMF could help increase soybean production in ultisol soils, increasing the production of soybeans that experience short periods of drought in the growth and yield phases as well as increasing plant tolerance to drought conditions.

Biocompos	**Mycorrhizae**					
	0 kg/ha	**250 kg/ha**	**300 kg/ha**	**350 kg/ha**	**400 kg/ha**	**450 kg/ha**
0 tons/ha	16.00 a*)	19.17 a	27.00 a	18.33 a	17.67 a	27.83 a
5 tons/ha	21.5o b	28.5 b	32.67 b	18.33 a	25.83 b	28.67 a
10 tons/ha	30.17 c	19.83 a	20.83 c	28.5 b	26.33 b	19.17 b
15 tons/ha	50.67 d	27.00 b	35.17 b	40.83 c	31.67 c	17.67 b
HSD 5%	4.52					

Table 8:- Average Dry Biomass Weights of Soybean Plants Due to Interaction of Doses of Biocompost and Mycorrhizae (g/plant) (* the numbers followed by the same letters in the same column were not significantly different in the 5% HSD test).

Based on Table 8 it can be seen that the dry weight biomass of soybean plants is significantly different due to the treatment of the dosage of fungal fermentation of *Trichoderma* sp. at each AMF dose. This faculty addressed the dosage of fungal fermentation bio compost *Trichoderma* sp. at each AMF does produce different dry biomass weights of soybean plants. Dried biomass per soybean plant at each AMF dose was found at 15 tons/ha bio compost dose, and this shows that the higher bio compost dose of fermentation of *Trichoderma* sp. then the dry biomass of soybean plants is also getting higher.

Trautman and Olynciw (1996) reported that the fungus *Trichoderma* sp. also produce cellulase enzymes and convert them into lignin-cellulose compounds and convert them into simpler compounds that can dissolve in water so that it can be used directly for plant growth and development. This indicates the nutrient content in the soil becomes high so that it increases plant growth, which increases the dry weight of plant biomass.

Furthermore, Sasli (2004) also reported that the use of mycorrhizae as biological fertilizer in agriculture improves the growth, productivity, and quality of plants without damaging the soil ecosystem. The application of mycorrhizae can also help rehabilitate critical land and increase the productivity of crops on marginal land (Yusrizal et al., 2018).

IV. CONCLUSION

Bio compost dosage treatment of *Trichoderma* sp. and AMF significantly influence the growth of soybean plants such as plant height, number of leaves, and number of root nodules of soybean plants. At the same time, the interaction effect is not significant in soybean plant growth. The optimum dosage of bio compost application for fermentation of *Trichoderma* sp., which can increase the growth of soybean plants is 10 tons/ha. In contrast, the AMF dose that can increase the maximum growth of soybean plants is 450 kg/ha. The higher the AMF dose will cause, the AMF population in the soil is also higher, which causes plant growth for the better. Bio compost dosage treatment of *Trichoderma* sp, mycorrhizae, and its interaction has a significant effect on soybean productivity, namely the percentage of empty pods, percentage of filled pods, the weight of seeds per plant, the weight of 100 seeds and weight of dry biomass of soybean plants. The optimum dosage of fungal fermentation bio compost *Trichoderma* sp., which can increase soybean productivity in each AMF dose treatment, is 10 tons/ha, while for AMF treatment in each dose of Trichoderma sp. fermentation bio compost f. Significantly affected at a dose of 450 kg/ha.

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