IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)
e-ISSN: 2319-2380, p-ISSN: 2319-2372. Volume 12, Issue 12 Ser. I (December 2019), PP 38-45
www.iosrjournals.org

The Application of Some Species of Mycorrhizal To Increase the Red Chili Production(*Capsicum Annuum* L.) In Andisol

Azman[1*], Syafruddin[2], Muhammad Sayuthi[2]
[1]*Department of Graduate Agroecotechnology, Syiah Kuala University, Aceh, Indonesia*
[2]*Department of Agrotecnology, Syiah Kuala University, Aceh, Indonesia*
Corresponding Author: Azman

Abstract *: The research was aimed to determine the effect of mycorrhizal species to the growth and yield of some red chili varieties in Andisol and the interaction between mycorrhizalspecies and red chili varieties. The research was conducted from April to October 2018 in the Experimental Site, Faculty of Agriculture, Syiah Kuala University, Banda Aceh. The experimental was used Randomized Complete Block Design Factorial with 2 factors and 3 replications. The mycorrhizal species rates were control, Glomusemoseae, Gigasprora and Glomusemosseae + Gigasprora. The chili varieties rates were PM 999 F1, Lado F1 and Top Super. The result showed that the application of Gigaspora gave the positive effect to the growth and yield of red chili, and Top Super as good variety compared with other variety.*

Keywords*: Mycorrhiza, chili varieties, Andisol.*

Date of Submission: 28-11-2019 Date of Acceptance: 13-12-2019

I. Introduction

Red chili (*Capsicum annuum* L.) is the first species of chilli discovered by Columbus and was introduced to the worldwide. Red chili were brought by the Portuguese around 450-500 years ago to Indonesia (Berke, 2002). The production of National in 2017 amounted to 1,206,272 tons with a harvest area of 142,547 hectares. For the province of Aceh itself, red chili production in 2017 reached 53,042 tons with a harvest area of 4,972 hectares (BPS, 2018)

The effort to increase the growth of chili is the use of technology, in this case utilizing microorganisms as biofertilizers (Daryanto, 2010). According to Santosa (1989), the use of microorganisms as biological agents such as mycorrhizal fungi is the opportunity that can be done besides it can also be used as an environmental friendly technology in helping to improve plant nutrition and increase the growth of agricultural crops.

Provision of FMA in onion plants in sandy clay loam textured soil caused the soil aggregate was better, more porous and high permeability, but still has the ability to hold enough water to maintain soil moisture. Good soil structure will increase aeration and infiltration rate and reduce the soil erosion, which will increase the plant growth (Thomas *et al*., 1993. The increasing of red chili could be happend through the application of high yield chili variety. Superior varieties have one of the excellence character than local varieties. These advantages can be reflected of its nature that can produce high-yielding fruit, the response to fertilization and resistance to pests and diseases (Hayati*et al*., 2012). Varieties that are suitable to the environment are expected to grow well and get high yields (Prajnanta, 2004).

II. Material And Methods

The research was done the Plant Physiology and Experimental site Laboratory of the Faculty of Agriculture, Syiah Kuala University, Banda Aceh in April to October 2018. The red chili varities used were PM999, Lado F1, and Top Super were seeds with varieties of PM 999, Lado F1 and Top Super. The mycorrhizal used were mycorrhizae of *GlomuseMosseae, Gigasprora* and *Glomusemosseae + Gigasprora* (mixed) types. Tools which were used were hoes, polybags with a size of 300gram, pot size 14 kg, label paper, raffia, scissors / knives, analytical scales, transparent plasti, paranet, nails, filters, glass objects, cover glass, meter / ruler, calipers, microscope, and writing stationery. The soil which was used by Andisol was taken directly in the BlangKucak area of BenerMeriah Regency.

The experimental was used Randomized Complete Block Design Factorial with 2 factors and 3 replications. The mycorrhizal species rates were control, *Glomusemoseae, Gigasprora* and *Glomusemosseae + Gigasprora*. The chili varieties rates were PM 999 F1, Lado F1 and Top Super.

Multiplication of Mycorrhizal

The mycorrhizal multiplication methods were sift the soil using a sieve so that the soil is smooth and not mixed with existing gravel, after the soil has been sifted and finely smaller, the soil is put into a 5 kg plastic bag and the plastic is bound using rubber.Then the soil is sterilized using an Autoclave at 121^0C for 30 minutes.Sterilized soil is put in a pot for planting media. In this case the planting media used as host plants are sorghum plants.Next, a planting hole is made and a mixed mycorrhizal starter is inserted with a dose of 10g / pot, then sorghum seeds is put in and the planting hole is closed again.After 45 HST (days after planting) the sorghum plant will be stressed by cutting its leaves so that the plant is in a state of stress and will form a lot of spores on its roots. Furthermore, the plants are left to dry and not watered.After the plants dry by themselves due to stressing, dismantled the plants, cut to a size of 1 cm, then the roots are mixed with zeolite media.

Nursery Media Preparation and Planting Media

Nursery and planting media used Andisolwhich was obtained from BenerMeriahDistrict. Nursery media consists of soil composition and manure with a ratio of 2:1. Nursery media was included in the nursery polybags and arranged in trays for the germination process. The planting media used Andisol before being put into a 14 kg pot, sterilized with a chemical called *Basamid*by mixing. 20 g of *Basamid*with an area of 1 m x 1 m x 1 m, then allowed to stand and covered for a week. Furthermore, the soil is ready to be inserted into a 10 kg polybag (20 x 40 cm) with a total of 72 polybags. Furthermore, in this study there were two plants in the experimental unit, so that a total of 72 plants were needed.

Mycorrhiza Application

Mycorrhizae given to plants include two stages, namely the first stage in nurseries, except treatment without mycorrhizae. While the second stage was given to each type of mycorrhizae treatment when transplanting to the research pot. Giving mycorrhizae types carried out around the planting hole and must be about the roots of plants used.Fertilization carried out in this study was manure as a basic fertilizer while the advanced fertilizer used was NPK Mutiara fertilizer with a recommended dosage of 800 kg ha^{-1} equivalent to 4 g $polybags^{-1}$. NPK Mutiara fertilizer is given in two stages, namely when the plant moves to the research media at the age of 21 HST as much as 2 g $polybag^{-1}$, and the second stage is given at the age of 35 HST as much as 2 g $polybag^{-1}$. NPK Mutiara fertilizer application is done by leaking around the roots of the plant.

Harvest

Chili is harvested after the age of 11-15 weeks after planting with the criteria of reddish chili. Harvesting is done 5 times with intervals of 5 days.The factors observed in this study include: Plant Height (cm), Plant height was measured at 15, 30 and 45 (DAP) .

Observation

Soil P Available, Plant Height (cm), Fruit Weight Planted (g), Fruit Leght (cm), Number of Fruits planted and Percentage of Mycorrhizae Infections in Plant Roots (%)

The percentage formula for mycorrhizal infection iscolonized root (%)

$$=\frac{(\text{number of roots infected with mycorrhizae})}{(\text{number of observed roots})} \text{ x } 100\ \%$$

III. Result

Soil Analysis

Soil analysis carried out in this study were 2 stages, namely: routine soil analysis. Routine soil analysis is performed prior to the start of research. Further analysis of P-available in the soil after research (after harvest). Routine soil analysis is carried out to see or find out the nutrient content in the soil before conducting research / planting. The initial soil analysis was conducted at the Soil Research Laboratory and the Faculty of Agriculture at Syiah Kuala University, Banda Aceh. The results of the initial soil analysis can be seen in Table no 1 below.

Table no 1:Results of initial soil analyzes on the research soil

Parameters	Value	Criteria
pH (H_2O)	5,96	Medium
C-organic	2,97 %	Medium
N-total	0,28 %	Medium
P Bray II	6,80 mg/100g	Very Low
Ca	9,48 cmol kg^1	Medium
Mg	0,34 cmol kg^1	Very Low
K	0,29 cmol kg^1	Low
Na	0,11 cmol kg^1	Low

Cation Exchange Capacity	20,00 cmol kg^1	Medium
Base Saturation	51,10 %	High
H-dd	0,20 cmol kg^1	-
Electrical Conductivity	0,09 cmol kg^1	-

Soil texture: Sandy Clay
Source: Soil Chemical Property Assessment Criteria (LPT, 1983)

The results of routine soil analysis (Table no 1) show that the land used is a type of Andisol soil originating from BenerMeriah Regency, precisely in the BlangKucak area. The content contained in the soil is a slightly acidic pH content (5.96), moderate C-organic content (2.97%), the total N-content also with moderate criteria (0.28%), P Bray II content on very low soils (6.80), the land cation exchange capacity is also classified as moderate with a value of 20.00 cmol kg1. Whereas for base saturation is also relatively high with a value of 51.10%.

The Effect of Mycorrhiza on Chili Yield

The average growth and yield of chilli plants due to mycorrhizal treatment after being tested with HSD 0.05 can be seen in Table no 2

Table no 2:Average growth and yield of chilli plants due to the treatment of various types of mycorrhiza

Parameters		MycorrhizalVariety				$HSD^{0,05}$
		Control	*Glomuse*	*Gigaspora*	*Mixed*	
Plant height (cm)	15 HSPT	14,68	15,89	15,44	15,00	-
	30 HSPT	22,78 ab	23,83 ab	25,67 b	22,11 a	3,41
	45 HSPT	42,19 ab	43,22 ab	49,33 b	41,89 a	7,22
Weight of Planted Fruits (g)		99,69ab	88,53 a	122,80 b	92,09 a	27,39
Number of Planted Fruits (number)		39,22 ab	36,89 a	50,70 b	38,37 ab	13,54
Fruit length (cm)		10,33 a	10,63 ab	11,58 b	10,67 ab	0,98
Percentage of mycorrhizae infections (%)		1,40 a	31,35 b	33,22 b	37,29 b	11,40
P Available		31,29 ab	29,81 a	29,46 a	32,25 b	2,24

Note: Numbers followed by the same letters in the same column are not significantly different at the 0.05 level (HSD Test); data outside the brackets is the data that has been transformed using arcsin transformation $x = arcsin\ \sqrt{1/_{4n}}$ %)

Table no 2 shows that plant height at the age of 15 daya after planted (DAP) tends to be higher in the *Glomuse mosseae* mycorrhiza, although statistically different is not significant with other mycorrhizal types. High plant age at 30 and 45 (DAP) was higher in the treatment of mycorrhizal *Gigasprora* types that were significantly different from mycorrhizae treatment of *Glomuse mosseae* + *Gigasprora*, but not significantly different from the treatment without mycorrhizae (control) and *Glomuse mosseae*.

Furthermore, the highest plant fruit weight and the number of crop fruits due to mycorrhizae species were highest in *Gigasprora* mycorrhizae which were significantly different from *Glomuse mosseae* mycorrhizae, but were not significantly different from the control and mycorrhizae treatments of *Glomuse mosseae* + *Gigasprora* types. The highest fruit length was found in the treatment of *Gigasprora* mycorrhiza types which were significantly different from the treatment without mycorrhizae, but were not significantly different from the treatment of mycorrhizae *Glomuse mosseae* and mycorrhizae *Glomuse mosseae* + *Gigasprora*.The higher percentage of mycorrhizae infections in the roots of chili plants was found in the treatment of mycorrhizae species *Glomuse mosseae* + *Gigasprora* which was not significantly different from the types of mycorrhizae *Glomuse mosseae* and mycorrhizae *Gigasprora* but significantly different from without treatment (control).

The Effect of Varieties on Yields Chili Plants

The average growth and yield of chilli plants due to the treatment of varieties after being tested with HSD 0.05 can be seen in Table no 3.

Table no 3: Average growth and yield of chilli plants due to variety treatment

Parameters		Chili Variety			$HSD^{0,05}$
		PM 999 (V1	Lado F1 (V2)	Top Super (V3)	
Plant Height (cm)	15 HSPT	16,13 b	16,46 b	13,18 a	1,67
	30 HSPT	23,08 a	26,22 b	21,38 a	2,68
	45 HSPT	42,06 a	48,00 b	42,42 ab	5,66
Weight of Planted Fruits (g)		98,80 ab	90,03 a	113,50 b	21,48
Number of Planted Fruits (number)		41,17 ab	35,78 a	46,94 b	10,62
Fruit length (cm)		9,36 a	11,73 b	11,30 b	0,77
Percentage of mycorrhizae infections (%)		21,55	25,56	30,26	-

Available of P analyst		26,03 a	35,46 c	30,63 b	1,75

Note: Numbers followed by the same letters in the same column are not significantly different at the 0.05 level (HSD Test); data outside the brackets is the data that has been transformed using arcsin transformation $x = arcsin\ \sqrt{1/4n}$ %)

Based on Table no 3 shows that the height of chilli plants at the age of 15 (DAP) was found higher in the treatment of LADO F1 varieties that was significantly different from the TOP SUPER varieties, but not significantly different from the use of PM 999 varieties. Significantly different from the TOP SUPER and PM 999 varieties. Furthermore, the plant height at 45 (DAP) was higher in the treatment of the LADO F1 varieties which was significantly different from the PM 999 varieties, but was not significantly different from the TOP SUPER varieties.Plant fruit weight and number of crop fruits due to the treatment of higher varieties was found in TOP SUPER chili varieties which was significantly different from LADO F1 varieties, but not significantly different from PM 999 varieties.

The highest fruit length due to variety treatments was found in different LADO F1 varieties markedly with PM 999 varieties and not significantly different from TOP SUPER varieties.On the parameter of mycorrhizal infection level in the roots of chili plants due to various treatment varieties was not statistically significantly different in all treatments. Mycorrhizae infections tend to be higher in TOP SUPER chili varieties. Analysis of P available in table 8 shows that P-available in the highest soil was found in the treatment of different types of Super Super varieties with different varieties PM 999 and Lado F1.

The Effect of The Interaction of Mycorrhizae Types and Chili Varieties on The Yield of Chili Plants

The average interaction between mycorrhizal types with chili varieties on the growth and yield of chilli plants after being tested with HSD 0.05 can be seen in Table no4.

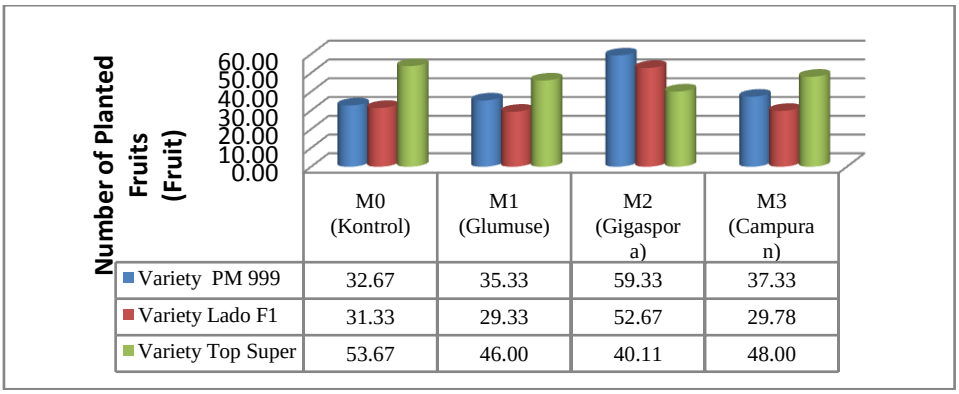
Table no 4 : Interactions between mycorrhizal types and chili varieties on plant fruit weight height, number of crop fruit, fruit length and wet weight of the generative phase of plants.

Parameters	Mycorrhizal Variety	Chili Variety			$HSD^{0,05}$
		PM 999 (V1)	LADO F1 (V2)	CTH-01 (V3)	
Fruit Weight Per Plant (g)	Control	78,40 Aa	91,87 Aab	128,80 Aa	53,38
	Glomuse	84,80 Aa	70,40 Aa	110,40 Aa	
	Gigaspora	142,40 Ab	126,40 Ab	99,60 Aa	
	Mixed	89,60 Aab	71,47 Aa	115,20 Aa	
Number of Planted Fruits (Fruit)	Control	32,67 Aa	31,33 Aa	53,67 Aa	26,40
	Glomuse	35,33 Aab	29,33 Aa	46,00 Aa	
	Gigaspora	59,33 Ab	52,67 Aa	40,11 Aa	
	Mixed	37,33 Aab	29,78Aa	48,00 Aa	
Fruit Length (cm)	Control	9,25 Aa	11,62 Ba	10,11 ABa	1,97
	Glomuse	9,86 Aa	11,52 Aa	10,49 Aa	
	Gigaspora	9,73 Aa	12,24 Ba	12,77 Bb	
	Mixed	8,62 Aa	11,55 Ba	11,84 Bab	
Wet Plant Weight of Generative Phase (g)	Kontrol	56,59 Aa	67,05 Aa	52,79 Aa	25,97
	Glomuse	48,31Aba	45,63 Aa	72,42 Ba	
	Gigaspora	65,61 Aa	68,04 Aa	76,36 Aa	
	Campuran	46,41 Aa	61,55 ABa	72,65 Ba	

Note: Numbers followed by the same letter are not significantly different at the 0.05 level (HSD Test). Capital letters are notations in rows, lowercase letters are notations in columns.

a. Number of Planted Fruits (Fruit)

Based on Table no 4 shows that the best combination of mycorrhizae types and varieties of chili is found in the type of *Gigasprora* mycorrhizae with the use of PM 999 chili varieties which is significantly different from other treatments. The relationship between the types of mycorrhizae with chili varieties on the number of planted fruit can be seen in Figure 1.

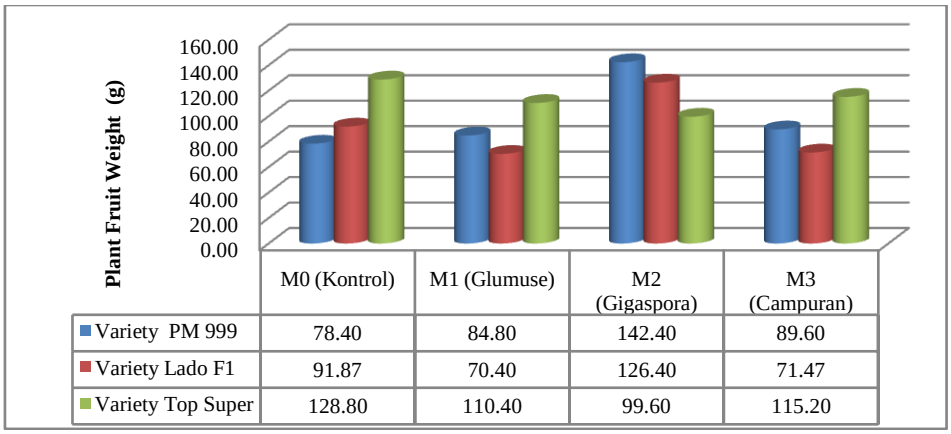


	M0 (Kontrol)	M1 (Glumuse)	M2 (Gigaspora)	M3 (Campuran)
Variety PM 999	32.67	35.33	59.33	37.33
Variety Lado F1	31.33	29.33	52.67	29.78
Variety Top Super	53.67	46.00	40.11	48.00

Figure 1. Interactions between mycorrhizal types and chili varieties on the number of fruit plants

b. Plant Fruit Weight (g)

Based on Table no 4 shows that the best combination of mycorrhizal types and varieties of chili is found in the type of *Gigasprora* with the use of PM 999 varieties which is significantly different from other treatments. The relationship between mycorrhizal types and chili varieties on the fruit weight of the crop is seen in Figure 2.

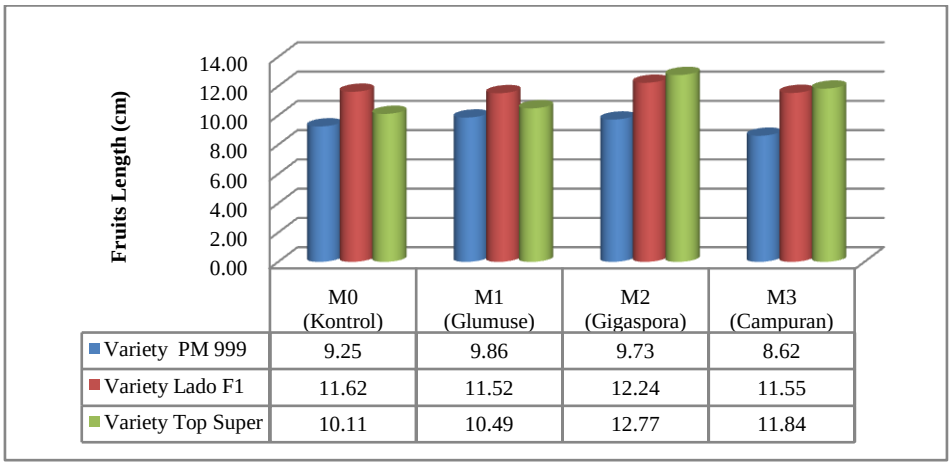


	M0 (Kontrol)	M1 (Glumuse)	M2 (Gigaspora)	M3 (Campuran)
Variety PM 999	78.40	84.80	142.40	89.60
Variety Lado F1	91.87	70.40	126.40	71.47
Variety Top Super	128.80	110.40	99.60	115.20

Figure 2. Relationship between mycorrhizal types and chili varieties on the weight of plantedfruit (g).

c. Fruits Length (cm)

Based on table no 4 shows that the best combination of mycorrhizae types with chili varieties is found in *Gigasprora* mycorrhizal types with the use of TOP SUPER varieties which is significantly different from other treatments on fruit length observations. The relationship between mycorrhizal types with chili varieties on fruit length (cm) can be seen in Figure



	M0 (Kontrol)	M1 (Glumuse)	M2 (Gigaspora)	M3 (Campuran)
Variety PM 999	9.25	9.86	9.73	8.62
Variety Lado F1	11.62	11.52	12.24	11.55
Variety Top Super	10.11	10.49	12.77	11.84

Figure 3. Interactions between mycorrhizaetypes and chili varieties on fruit length (cm)

d. Wet Weight of Generative Phase Plants (g)

Table no 4 shows that the combination of mycorrhizal types with chili varieties to the best wet weight of chilli plants was found in *Gigasprora* mycorrhizal types with TOP SUPER varieties which is significantly different from other treatments. The interaction between mycorrhizal types and chili varieties on the wet weight of plants in the generative phase can be seen in Figure 4.

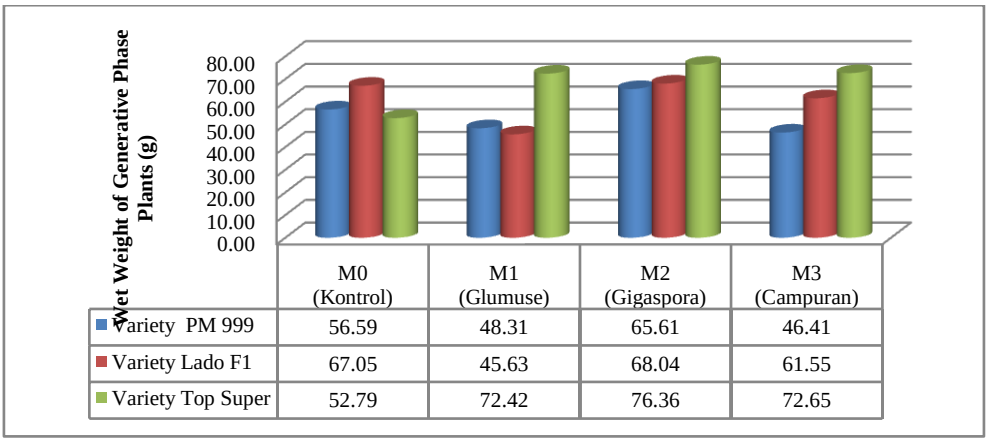


Figure 4. Interaction between mycorrhizae types with chili varieties on the fresh weight of chilli plants in the generative phase

IV. Discussion

Soil Analysis

Based on the results of the soil analysis carried out in two stages namely at the time of the initial analysis carried out before the study as well as the analysis of the P-available on the soil after harvest (final analysis), the type of soil obtained is the Andisol soil type. According Darmawijaya (1992), Andisol soil is a dark black soil, very porous containing organic material and amorphous type silt, especially allophane. Its morphological characteristics, Al's horizon is thick, dark, brown to black, very porous, very loose, not tough, not sticky, crumb or granular structure, feels oily because it contains 8-30% organic matter with a pH of 4.5-6. The physical and chemical properties of Andisol soils, have low base saturation, high cation and KTA exchange capacity, contain high C and N low C / N ratios, low P levels due to strong fixation, difficult peptization, specific gravity less than 0.85 and capacity field humidity of more than 15%. In the beginning analysis, the available P in the soil is very low. This is presumably because the P element is bound to an amorphous soil caloid or bound by Al and Fe groups so that it is not available to plants (Subagyo *et al*. 2000).

Based on the results of the analysis of P available after harvesting obtained a significant effect on the treatment of mycorrhizal type and variety treatment. This shows that the mycorrhizal fungus is able to release the P element which is bound by heavy metals to become available to plants. Mycorrhizae is able to increase the activity of acid phosphatase in the soil so that organic P compounds in the soil can be available to plants after being hydrolyzed by the enzyme phosphatase (Fang *et al*. 2003).

Effect of Mycorrhizal Type on Growth and Yield of Chili

Based on the results of the study showed that the type of mycorrhiza significantly affected the treatment given. The treatment of *Gigasprora* mycorrhizae is a good treatment to increase the growth and yield of chili plants. This is presumably because *Gigasprora* mycorrhizae can increase P absorption in the soil. This is in accordance with Halis *et al*., (2008) that the application of *Gigasprora* mycorrhizae can increase P absorption. According to research Syamsyiah *et al*., (2012) that high N and P nutrient uptake is found in plants that are given mycorrhizae because mycorrhiza encourages the development of external hyphae which helps in absorption of nutrients that can be utilized by plants which results in an increase in plant biomass, the number of spores and also root infection (Chalimah *et al*., 2007).

The percentage of mycorrhizal infections in the roots of chili plants in this study were classified as moderate or categorized as moderate. This is due to environmental factors around the plant. Mycorrhizal colonization is influenced by spore type, as well as host compatibility and environmental factors that greatly influence root induction. Referring to the opinion of Fakuara (1988), that an increase in the percentage of mycorrhizal infections due to inoculation can be associated with an increase in the number of spores in the soil. Infection occurs due to exudates or typical compounds produced and released by plant roots that cause the development of aroused mycorrhizae.

Effect of Chili Varieties on Growth and Yield of Chili Plants

Based on the results of research that has been tested, there are several varieties of chili that have a significant effect on the observed parameters. The results showed that the LADO F1 and TOP SUPER varieties were varieties that had an effect on increasing growth and yield of chilli plants. The LADO F1 variety looks better on the parameters of plant height, stem diameter, and fruit length. Whereas the TOP SUPER variety looks better on the parameters of the wet and dry weight of vegetative and generative plants, the weight of planted fruit, the number of planted fruit, and the level of mycorrhizae infection. Although there are some parameters that statistically do not show any real effect, but the TOP SUPER variety as a whole is better than the other two varieties. This is allegedly because the TOP SUPER variety has the characteristics of good adaptability to the environment around the planting area so that it succeeds in providing the best results compared to other varieties. TOP SUPER varieties are local superior varieties in the highlands where the soil in the area is the same as the soil which tested with Andisol soil types. The research results of Adisarwanto (2000), explain that varieties which can adapt to their environment can grow well and also have superior characteristics when planted in suitable conditions will be able to produce good potential results. Research Prajnanta (2004), states that the types of varieties that are in accordance with environmental conditions are expected to grow well and get high yields. According to Sieverding (1991), different types of plant varieties will show different infections and mycorrhizal development in the roots of these plants.

Effect of Interaction of Mycorrhizal Types and Chili Varieties on Growth and Yield of Chili Plants

Based on research conducted, obtained several interactions between the types of mycorrhizae with varieties of chili on the growth and the yield of chilli plants on Andisol soil. The interaction between mycorrhizae types with chili varieties to good combinations was found in the type of *Gigaspora* mycorrhizae with PM 999 and TOP SUPER varieties. This can be seen in the parameters of plant fruit weight, number of fruit plantations, parameters of fruit length and wet weight of the generative phase of plants. The use of mycorrhizae and varieties which are appropriate to their environment can increase the yield of chili plants. Mokoriza hyphae which infect plants will expand the area of nutrient absorption by extending hyphae which are in the roots. This hyphae produces a phosphatase enzyme that can release phosphate elements that are bound in the soil and then absorbed and converted into polyphosphates which are distributed to plants. This is supported by Prasasti *et al*. (2013), that mycorrhizae that infects plant roots will produce external hyphae tissue so that it can increase the root capacity in the absorption of water and nutrients, especially phosphate (P) needed by plants. The success of mycorrhizal symbiosis with host plants is influenced by host plant species and the environment. Overall, the use of mycorrhizae types of *Gigaspora* and PM 999 chili varieties is able to show a good mutualism relationship, so that it can support the growth and the yield of chili plants. In addition, the use of the TOP SUPER variety also gives a real influence on the growth and yield of chilli plants, this is because the TOP SUPER variety is a local variety and this variety grows and produces high production on Andisol soil types. Besides that the suitable environment also influences plant growth and yield. This is in accordance with the statement of Prajnanta (2004), that varieties of varieties that are in accordance with environmental conditions are expected to grow well and get high yields. According to Sieverding (1991), different types of plant varieties will show different infections and mycorrhizal development in the roots of these plants.

V. Conclusion

The treatment of *Gigaspora* mycorrhizae in general results in better growth and yield of chili plants. TOP SUPER variety is a better variety, seen from the parameters of growth, plant fruit weight, number of plant fruit. Better interactions are found in *Gigaspora* mycorrhizae types with TOP SUPER varieties on the fruit length parameters and the wet weight of the generative phase plants.

References

[1]. Badan Pusat Statistic. 2018. Produksi sayuran di Indonesia, Hlm 45-46.
[2]. Berke TG. 2002. Hybrid Seed Production in Vegetable: Rationale and Methods inSelected Crops. New York: Food Products Press. Hlm.49-67.
[3]. Daryanto. 2010. Analisis Efisiensi Teknis Produksi Usahatani Cabai Merah Besar dan Perilaku Petani dalam Menghadapi Risiko. Jurnal Agro Ekonomi. Vol. 28 No. 2 hal. 153-188.
[4]. Hayati E., T. Mahmud, Riza Fazil. 2012. Pengaruh jenispupukorganik dan varietas terhadap pertumbuhandan hasil tanaman cabai. Jurnal Floratek 7:173-181.
[5]. Prajnanta, F. 2004. Budidaya Cabai Hibrida. Penebar Swadaya. Jakarta.
[6]. Santosa, D. A., 1989. Teknik dan Metode Penelitian Mikoriza Vesikular Arbuskular. Laboratorium Biologi Tanah. Jurusan Ilmu Tanah Fakultas Pertanian IPB. Bogor.
[7]. Thomas, R. S., R. L. Franson, and G. J. Bethlenfalvay. 1993. Separation of arbuscular mycorrhizal fungus and root effect on soil aggregation. Soil Sci. Soc. Am. J. 57: 77-81.
[8]. Chalimah, S., Muhadiono, Aznam L, Haran S, Mathius, N. T. 2007. Perbanyakan Gigaspora sp. dan Acaulospora dengan kultur pot di Rumah Kaca. Jurnal Biodiversitas. Vol. 7 (4): 12-19

[9]. Halis, Murni, P., dan Fitria, A. B., 2008. Pengaruh jenis dan dosis cendawan mikoriza arbuskular terhadap pertumbuhan cabai (*Capsicum annuum* L.) pada tanah Ultisol. Jurnal Biospecies. Vol.1 (2):59-62
[10]. Prasasti, O. H., K. I Purwani, & S. Nurhatika. 2013. Pengaruh mikoriza *Glomus fasciculatum* terhadap pertumbuhan vegetatif tanaman kacang tanah yang terinfeksi patogen *Sclerotium rolfsii*. J. Sains dan Seni Pomits 2 (2): 74 –78
[11]. Syamsiyah, J., Bambang, H. S., Eko, H dan Jaka, W. 2012. Pengaruh inokulasi jamur mikoriza arbuskular terhadap glomalin, pertumbuhan dan hasil padi. Jurnal. Fakultas Pertanian. Universitas Gajah Mada. Yogyakarta.
[12]. Fang, G., Y.C. Song, X.L. Li, & P. Christie. 2003. Contribution of arbuscular mycorrhizal fungi to utilization of organic sources of phosphorus by red clover in a calcareous soil. Appl Soil Ecol. 22:139–148.
[13]. Subagyo, H., Suharta &A.B. Siswanto. 2000. Tanah-tanah Pertanian di Indonesia, dalam Sumberdaya lahan di Indonesia dan Pengelolaannya. Pusat Penelitian Tanah dan Agroklimat.Jakarta.

Azman. "The Application of Some Species of Mycorrhizal To Increase the Red Chili Production(Capsicum Annuum L.) In Andisol. "IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS) 12.12 (2019): PP- 38-45.