The effect of mychorrizal dose interactions with varieties on growth and yield of chili (*Capsicum annum* L.) in andisol soil Bener Meriah

Syafruddin1*, Syamsuddin1, Syakur2, Jumini1, Halimursyadah1, Hasanuddin1

1 Department of Agrotechnology, Faculty of Agriculture, Universitas Syiah Kuala, Banda Aceh 23111, Indonesia
2 Department of Soil Science, Faculty of Agriculture, Universitas Syiah Kuala, Banda Aceh 23111, Indonesia

*Corresponding author’s e-mail address: syafruddin@unsyiah.ac.id

Abstract. This study aims to determine the interaction of mycorrhizal doses and varieties on the growth and yield of chili plants in Andisol soil. This research was conducted in Blang Kucak Village, Wih Pesam District, Bener Meriah Regency, Green House and Laboratory of Plant Physiology, Faculty of Agriculture, Syiah Kuala Darussalam University, Banda Aceh from January to May 2019. Analysis of the data used in this study was Randomized Block Design, with 3 x 2 factorial pattern with 3 replications. There are 2 series in this experiment namely Series A and Series B, series A is used for data collection of growth and yield of chili plants, while series B is used for data collection of mycorrhizal colonization. The factors observed in this study were mixed mycorrhizal bio-fertilizers and varieties. The dose of mycorrhizal bio-fertilizer used was control (without mycorrhizal), 5 g plant\(^{-1}\) and 10 g plant\(^{-1}\) and the varieties used were varieties of PM-999 and Perintis. The results showed a very significant interaction between mycorrhizal doses and varieties on the parameters of the number of productive branches, besides that there were significant interactions on plant height at 45 DAP, fruit weight, fruit length, number of fruits and yield potential (tons ha\(^{-1}\)). The best combination was found in the treatment of doses of 10 g mycorrhizal plants\(^{-1}\) and Perintis varieties.

1. Introduction
Chili (*Capsicum annum* L.) is a vegetable originating from America that needed by the community in large quantities as cooking ingredients, industrial raw materials such as sauces, mixed ingredients of balm, candy, medicinal ingredients and others [16]. The composition of the nutritional content of chili is high, in 100 g of fresh red chili there are 31 g calories, 1 g protein, 0.3 g fat, 7.3 g carbohydrates, 29 mg calcium, 24 mg phosphorus, 0.4 g iron, 260SI vitamins A, 0.005 mg of vitamin B1, 18 mg of vitamin C, and 90.9 g of water[6]. Therefore the availability of chili must be maintained by increasing the production of chili plants.

The productivity of red chili in Aceh tends to fluctuated, judging from the productivity of red chili in Aceh in 2015 amounting to 10.37 tons ha\(^{-1}\) and in 2016 there was an increase in productivity of 11.45 tons ha\(^{-1}\) but in 2017 the productivity of red chili in Aceh decreased to 10.64 tons ha\(^{-1}\). The decline in red chili productivity in Aceh in 2018 reached 7.08% from the
The productivity of red chili in Aceh itself still lags behind other provinces in Indonesia such as West Java and Bali. Chili productivity in Aceh has fluctuated due to poor red chili cultivation and lack of innovation in its development [3].

One of the efforts to increase crop production is fertilization, including the use of mycorrhizal as bio-fertilizers. Mycorrhizal bio-fertilizers function as bio-fertilizers and bio-protectors for the growth and production of various types of plants. Besides, mycorrhizal bio-fertilizer can produce hormones and PGP (Plant growth-promoting) and resistance to attack by root pathogens. Pollution due to heavy metals around plant roots can also be overcome by the use of mycorrhiza [12][19].

According to [2] that mixed mycorrhizal dose treatment had a very significant effect on plant wet weight, plant dry weight, plant root dry weight, number of plant in g fruit and percentage of mycorrhizal infection on the roots of chili plants. Significant results were obtained from the use of 10 g plant⁻¹ mycorrhizal doses applied to Entisol soil. Hereafter [9] in the pot scale the experiment of giving doses of mycorrhizal 10 g plant⁻¹ to Andisol soil showed the best results on plant height, stem diameter, number of leaves, root infection and number of fruit crops on chili plants. However, there is no information for research in the field about mycorrhizal doses and the best chili varieties in Andisol soil.

Plants with mycorrhizal administration can grow better than without mycorrhizae. This is because mycorrhizae can increase nutrient absorption. Mycorrhizae can help plant roots absorb nutrients that are not available in the soil, so they are available to plants [7]. In addition to the use of mycorrhizae, an increase in chili production can be obtained from the use of superior varieties. Superior varieties have good adaptability to the environment. High fruit production, response to fertilization and resistance to pests and diseases is reflected in superiority [5][16].

Varieties of red chili PM-999 are curly chili which can grow in the lowlands and highlands and are resistant to diseases caused by anthracnose. PM-999 has a harvest age of 90-100 days after planting and potential yields of 20-25 ton ha⁻¹ [8]. The PM-999 variety of red chili is a hybrid type of chili which has a plant height of 110-140 cm, a fruit diameter of 0.8-1 cm and a fruit length of 10-12 cm. The characteristics of the chili fruit are round and curved long and uneven fruit skin. This variety can grow in the low to highlands with potential yields of 0.8 - 1.2 kg plant⁻¹. This chili is very adaptive if it is planted in low and medium areas, its productivity is high, the plants are compact, the size of the fruit is relatively uniform, has a lot of seeds, spicy taste, a relatively long shelf life [14].

Chili Perintis varieties are local varieties that are widely developed by the community. Perintis varieties have been tested technologically, can show optimal growth with maximum results, have a slightly shorter character than other types of chili varieties in general, but are resistant to aphids and Gemini virus attacks. These Perintis chili varieties have early maturity of 75-150 DAP and production of 20-25 tons ha⁻¹. Suitable for cultivation in the lowlands and highlands [11]. In addition to the characteristics of Andisol soil, they developed from volcanic ash with colloidal fractions dominated by allophanes with high P retention [4]. The main obstacle in the use of Andisol is that the P element is available but cannot be utilized by plants. Measures to increase soil fertility by using biological fertilizers need to be done.

Fertilizing actions, especially with the administration of mycorrhizal bio-fertilizers can increase the potential of the chemical, physical and biological properties of Andisol soil. Mycorrhiza will work effectively in nutrient-poor soils (marginal) and can help the absorption of P, N and K effectively so that it is available to plants. According to [13] reinforced earlier by [15] low organic matter causes Andisol to be very suitable for FMA development and has the potential to be a natural FMA provider. Mycorrhizal hyphae play a role in increasing the uptake of N, P and K by expanding the absorption area of the plant root system, so that it can be used to mine the residue of these elements that accumulate in the soil. The presence of mycorrhiza for nutrient availability of N, P and K on the soil, including Andisol, is absolutely necessary[19][1][10].
2. Materials and Methods

2.1. Time and Place
This research was conducted in Blang Kucak Village, Wih Pesam District, Bener Meriah Regency, Glass House and Laboratory of Plant Physiology, Faculty of Agriculture, Syiah Kuala Darussalam University, Banda Aceh from January to May 2019.

2.2. Tool and Material
2.2.1. Tool. The tools used in this study are hoes, sieves, rakes, plastic ropes, stakes, scissors, knives, meters, spoons, fat, polybags, calipers, digital scales, autoclaves, sugar plastics, cameras, Nikon microscopes with 100 magnification -400 times, glass preparations and stationery.

2.2.2. Materials. The materials used in this study were chilli seeds of PM-999 and Perintis varieties, Mixed type mycorrhizal biofertilizers, NPK fertilizers, manure, KOH solution, distilled water, and ink (Quick Parker) blue solution.

2.3. Experimental Design
This research was conducted using a factorial randomized block design (RBD) with 3 replications. The factors observed were mycorrhizal doses consisting of 3 levels, namely control, control (without mycorrhizal), 5 g plant⁻¹, and 10 g plant⁻¹ and the next factor was a variety consisting of 2 levels, namely PM-999 varieties and Perintis varieties. There are 2 series in this experiment, namely Series A and Series B, series A is used to collect data on growth and yield of chili plants, while series B is used to collect data on the mycorrhizal infection. If the F test results have a significant effect, then the analysis is continued with the Least Significant Difference test (LSD) at the level of 5%.

2.4. Implementation of Research
2.4.1 Mycorrhizal multiplication. Mycorrhizae used in this study were mixed mycorrhizae (Glomus mosseae + Gigaspora sp.) obtained from the results of propagation in the Greenhouse of the Faculty of Agriculture, Syiah Kuala University. The methods used in the implementation of mycorrhizae are:
1. Soil sifted by using a 9 mesh size sieve to be smooth and not mixed with small rocks, after that the soil is put into a heat-resistant plastic bag of 15 plastic bags with a volume of 5 kg.
2. The soil is sterilized by autoclave at 121 °C for 30 minutes to remove all microorganisms in the soil both beneficial and harmful.
3. The finished soil is sterilized into a pot that has been prepared in a greenhouse as a planting medium. The host plants used for the cultivation of mycorrhizae are corn plants.
4. After the soil has been finished inserted in the pot, a planting hole is made and the starter of mycorrhizal is inserted as much as 1 spoon per planting hole, after that the corn seed 2 is inserted per planting hole then covered with soil.
5. After 45 DAP plants, corn plants are given a stressing treatment (attempts to inhibit or suppress the growth of host plants with certain conditions) by cutting the leaves to symbiosis with the roots of corn plants also experience pressure and will form a lot of spores on the plant roots corn.
6. After the corn plant undergoes a stressing process for 1 month and the soil becomes dry, after that the plants are dismantled and the root area is cut out by the size of 1 cm, then the roots are mixed with zeolite media.
7. Mycorrhizal bio-fertilizer is ready to be applied to chili plants.

2.5. Land Preparation
The land used for chili cultivation is carried out first by removing the weeds on the land which can host pests and diseases, then processing the soil by plowing or hoeing with a depth of 30-40 cm. The land that has been plowedis then left for 4 weeks to allow air to be
exchanged and to kill harmful pathogens in the soil. After that, making a bed that aims to prevent plant roots from being flooded during the rainy season. The beds are made with a width of 1 m, length 18 m, height 40 cm, and the distance between beds with drainage 50 cm.

2.6. Seed Preparation
The criteria for chili seeds used are seeds that avoid pests and diseases and seeds that have germination above 90%. Supported by the presence of immersion treatment using an aerator as long as the criteria for chili seeds are used which are seeds that avoid pests and diseases and seeds that have germination above 90%. Supported by the presence of immersion treatment using an aerator for 1-24 hours which aims to increase seed germination and seed resistance to pest and disease attacks.

2.7. Nursery Preparation
The seeds used in this study were varieties of PM-999 and Perintis. The seeds are sown in polybags measuring 5 x 10 cm with Andisol soil media. One seed is planted as much as one seed per polybag, then half mycorrhizal treatment is given per treatment dose per polybag according to the type of mycorrhizal treatment, aiming for the chilli seeds to be in direct contact with mycorrhizae during the nursery.

2.8. Manure Application
Manure given in this study was 18 kg\(^{-1}\) plots. The provision of manure aims to increase the value of Cation Exchange Capacity in the soil so that nutrients are not easily lost and washed, improve soil structure, and to increase the power to hold water so that more absorbed water.

2.9. Black Silver Plastic Mulch Application
The installation of black silver plastic mulch to the chili plant is done after the beds are fertilized. The installation of black silver plastic mulch aims to suppress weed growth, maintain good soil structure, and maintain soil moisture in plots.

2.10. Planting and Application of Mycorrhiza
The spacing used in this study was 60 cm × 60 cm. Making planting holes using a plastic shovel with a depth of 5 cm. Planting is done by giving mycorrhiza first in the planting hole that has been provided by giving half of the treatment dose (D0 = control, D1 = 5 g plant\(^{-1}\), D2 = 10 g plant\(^{-1}\)), then the seedlings are placed in the planting hole then covered with soil. Chili planting is done in the afternoon. Seeds are transferred to beds at the age of 20 DAP (Day After Planting). Criteria for seedlings used, selected seeds that grow well and already have 4-5 leaves.

2.11. NPK Fertilizer Application
NPK fertilizer used in this study was 50% of the recommended dosage of 225 g plot\(^{-1}\). Fertilizers are given during transplanting, 3 weeks after transplanting, and 6 weeks after transplanting by dissolving NPK fertilizer with water and splashing on the roots of plants.

2.12. Maintenance
Maintenance of chili plants is done every day after planting so that the growth of chili plants is better. Maintenance of chili plants:
1. Embedding is done when the chili plant is before the age of 14 DAMP (Day After Moving Plant).
2. Watering is carried out 2 x 1 day in the morning and evening.
3. Weeding is done by cleaning the grass around the beds.
4. Disposal of water shoots is done mechanically using scissors at the age of 7-20 DAMP and carried out twice a week to stimulate the growth of chili plants to grow better.
5. Installation of stakes is done after chili 14 DAMP plants using material from wood with a height of 100 cm which aims to support the chili plants so as not to fall easily.

6. Pest and disease control is carried out by spraying using pesticides if it has attacked more than 20% of the population.

2.13. Harvesting

Chili harvesting was carried out at the age of 90, 95, 100, 105, 110, 115, and 120 DAMP with the criteria of solid and red chili. Harvesting is done by picking the fruit with the stem so that the fruit stays fresh and lasts longer when stored.

2.14. Observation Parameters

2.14.1. Plant Height (cm). Measurement of plant height was carried out when plants were 15, 30, and 45 DAP. Measurements were made starting from the base of the stem to the highest growing point of the plant using a meter.

2.14.2. Stem Diameter (mm). Stem diameter measurements were carried out when the plants were 30, 40 and 45 days after transplanting (DAT). Measurements are carried out using a sliding length at the base of the stem that has been marked before.

2.14.3. Number of productive branches (branches). Calculation of the number of productive branches is carried out when the plant is 60 DAT. Observation of the number of productive branches is done by counting the number of branches that produce flowers and fruit.

2.14.4. Plant Weight (g). Weighing the wet weight of the plants was carried out after the 120 DAT plants were dismantled and washed with water at the root, then cut the roots of the plants, then weighed the plant weight using analytical scales.

2.14.5. Dry Plant Weight (g). Weighing the dry weight of plants is done after the plants have been heated for 2 x 24 hours with a temperature of 60°C or reaching a constant weight. Weighing is done using analytical scales.

2.14.6. Root Wet Weight (g). The weighing of the root wet weight was carried out after the plants were 120 DAP and the plants were dismantled and washed with water at the root, then cut the roots of the plants and separated from the plants then weighed the roots using analytical scales.

2.14.7. Dry Root Weight (g). The weighing of root dry weight is carried out after the root of the plant has been heated for 2 x 24 hours at a temperature of 60°C or has reached a constant weight then weighed using the analytical scales.

2.14.8. Fruit Weight per Plant (g). The weighing of fruit weight per plant was carried out after the chili fruit was harvested up to 5 harvests at the ages of 90, 95, 100, 105, 110, 115 and 120 HST. Fruit weighing per plant was carried out by weighing chili fruit using analytical scales.

2.14.9. Fruit Length (cm). The measurement of fruit length is done when finished harvesting, that is by taking 5 samples at each harvest and then taking the average value. The measurement starts from the base of the fruit to the end of the fruit.

2.14.10. Amount of Fruit per Plant (fruit). The number of fruits calculated is fruit harvested at the ages of 90, 95, 100, 105, 110, 115, and 120 DAP. Calculation of the number of fruit plants is done by adding the first fruit to the last harvest.
2.14.11. Percentage of Roots Infected by Mycorrhiza (%). The percentage of the level of association between fungi and root samples of host plants can be done by staining the roots of plants with the following steps:
1. Took 3 destructive plant samples aged 45 DAT to be observed. The plant is dismantled and the roots are cut into 2 cm long pieces.
2. The cut roots are then washed using distilled water until clean and soaked in 10% KOH solution for 24 hours to whiten the roots.
3. Then the roots are soaked using a blue Trypan solution (Quink Parker) for 2x24 hours.
4. Doing soaking again using clean water (distilled water) so that the roots are clean of ink color.
5. Selected 5 roots of chili plants randomly then placed on the glass preparation, then observed using a Nikon microscope with 100 - 400 times magnification, then calculate the percentage using the formula:

\[
\text{Infected roots (\%) = \frac{\text{Number of roots infected with mycorrhiza}}{\text{Number of roots observed}} \times 100}\% \quad (1)
\]

2.14.12. Yield Potential (ton ha\(^{-1}\))
Yield potentialable calculated by converting from the yield of fruit weight per plant using the following formula:

\[
\text{Yield (ton ha}^{-1} = \frac{1}{\text{Plant space}} \times \text{Fruit Weight (g)} \quad (2)
\]

3. Results and Discussion
3.1. Characteristics of Andisol Soil
Based on Table 1, the soil fertility rate of Andisol Bener Meriah is categorized as medium. Therefore, the management of the land must be inputted outside, both the administration of various doses of mycorrhizal bio-fertilizer and other nutrients (NPK) of 50% of the recommended dosage.

| No. | Soil parameter                              | Value | Unit      | Criteria     |
|-----|--------------------------------------------|-------|-----------|--------------|
| 1   | Soil Texture                               |       | %         |              |
|     | Sand, filtering                            | 52    | %         |              |
|     | Slit, Pipette                              | 43    | %         |              |
|     | Clay, Pipette                              | 5     | %         |              |
|     | Texture Class                              | 1     |           |              |
| 2   | Soil reaction                              |       |           |              |
|     | pH (H\(_2\)O) (1:25)-Electrometric         | 5.96  |           | Neutral      |
|     | pH (KCl) (1:25)-Electrometric              | 5.37  |           | Acid         |
| 3   | C-Organik (organic C, (Wakley& Black)      | 2.97  | %         | Medium       |
| 4   | N-total (total N, Kjeldahl)                | 0.28  | %         | Medium       |
| 5   | P available (available P)                 | 6.80  | mg kg\(^{-1}\) | Very low |
| 6   | Exchanged Base Cations(excavations, 1N NH\(_4\)COOCH\(_3\) p H 7) | 9.48  | Cmol.Kg\(^{-1}\) | Medium |
|     | Ca-exchangeable(exch, Ca)                  | 0.34  | Cmol.Kg\(^{-1}\) | Very low |
|     | Mg-exchangeable(exch, Mg)                  | 0.29  | Cmol.Kg\(^{-1}\) | Medium |
|     | Na-exchangeable (exch, Na)                 | 0.11  | Cmol.Kg\(^{-1}\) | Low |
| 7   | Cation exchange capacity = CEC             | 20.00 | Cmol.Kg\(^{-1}\) | Medium |
| 8   | Base Saturation(KB)                       | 51.10 | %         | High         |
| 9   | Potential acidity (1 M KCl) :             |       |           |              |
|     | Al- exchangeable(exch, Al)                 | tu    | Cmol.Kg\(^{-1}\) |              |
|     | H- exchangeable(exch, H)                   | 0.20  | Cmol.Kg\(^{-1}\) |              |
| 10  | Electrical conductivity-EC                 | 0.09  | mS cm\(^{-1}\) | Very low     |

Sources: Laboratory analysis, 2019
The use of different mycorrhizal doses affects the growth and yield of chili varieties. This is due to mycorrhizal bio-fertilizers capable of increasing the process of P absorption and other nutrients. If seen from the soil pH value including the neutral criteria and cation exchange capacity, the criteria are medium.

3.2. Interaction of Mycorrhizal Doses and Varieties

The results of variance analysis (F test) showed that there was a very significant interaction between mycorrhizal doses and varieties on the parameters of the number of productive branches. Significant interactions between mycorrhizal doses and varieties were found in plant parameters age 45 DAT, fruit weight per plant, fruit length, number of fruits and yield potential ton ha\(^{-1}\). There was no interaction between mycorrhizal doses and varieties on the parameters of plant age at 15, 30 DAT, plant diameter aged 15, 30, 45 DAT, plant wet weight, dry weight, plant weight, root weight, and percentage root colonization by FMA.

Table 2 showed that the highest chili plant age of 45 DAT was found in the treatment of mycorrhizal dose of 10 g plant\(^{-1}\) with Perintis varieties of 76.41 cm which was significantly different from all other combinations of treatments. In the number of productive branches, the most chili plants were found in the treatment of 10 g plant\(^{-1}\) mycorrhizal doses with Perintis varieties, namely 31.66 branches which were significantly different from all other treatment combinations. The weight of the fruit per the heaviest plant was found in the treatment of 10 g plant\(^{-1}\) mycorrhizal doses with the Perintis variety of 435.61 g which was significantly different from all other treatment combinations.

The longest parameters of the longest chili fruit were found in the treatment of 10 g plant\(^{-1}\) dosage mycorrhizae with Perintis varieties i.e. 13.30 cm which was not significantly different from the combination of 5 g plant\(^{-1}\) and Perintis varieties, but significantly different from the others. The highest number of chili fruits was found in the treatment of 10 g plant\(^{-1}\) mycorrhizal dose with Perintis varieties, namely 98.10 fruits which were significantly different from other combinations of treatments. The highest potential yield of chili plants was found in the treatment of 10 g plant\(^{-1}\) mycorrhizal doses with Perintis varieties which were 10.28 tons ha\(^{-1}\) which was significantly different from other combinations of treatments.

The results of this study gave various doses of mycorrhizae and tried varieties showing that the better growth and yield of chili plants were found in a combination of 10 g plant\(^{-1}\) and Perintis varieties. The dose can support the growth of Perintis varieties of chili plants. This is in accordance with research conducted by [9] on the scale of pottery on the land of Andisol Saree Aceh Besar and Munawar's study of Perintis varieties [11].

Mixed mycorrhiza(\textit{Glomus} dan \textit{Gigaspora}) has good adaptability in polluted areas and tropical areas[17]. Environmental factors influence the effectiveness of mycorrhizae in infecting roots. Things that must be considered are pH, temperature, soil moisture content, soil organic matter, nutrient availability, light intensity, heavy metals and fungicides [19].

Based on [20] research, the dose of mycorrhizal 10 g plant\(^{-1}\) gave a good response to the growth and yield of chili plants compared to the control treatment and other doses of mycorrhiza. [2] states that different types of plants and varieties will show different correlations to the percentage of mycorrhizal infections which will affect the growth and productivity of chili plants.

In addition to the use of mycorrhizal bio-fertilizer, the growth and yield of chili plants can be improved by using superior varieties that are resistant to pests and diseases [5]. The varieties and suitability of environmental conditions are expected to provide good results for crop production [16].

According to [18] that mycorrhizal infection in plant roots can dissolve P bound in the soil, thereby increasing the absorption of phosphorus through mycorrhizal hyphae and phosphatase enzymes produced by fungi, so that it can catalyze hydrolysis of complex phosphorus into phosphorus which dissolves and can be absorbed by plants. Next[19] stated that plants that are colonized by mycorrhiza will provide better growth.
**Table 2.** The average growth of chili plants due to the interaction of types of mycorrhiza with varieties

| Parameter                                | Mycorrhiza Dose | Variety | LSD<sub>0.05</sub> |
|------------------------------------------|-----------------|---------|---------------------|
|                                          | PM-999          | Perintis|                     |
| Plant height 15DAT (cm)                  | Control         |         |                     |
|                                          | 22.03           | 30.43   | -                   |
|                                          | 5 g plant<sup>1</sup> | 23.77   | 36.23               |
|                                          | 10 g plant<sup>1</sup> | 28.90   | 36.97               |
| Plant height 30DAT (cm)                  | Control         |         |                     |
|                                          | 35.46           | 46.62   | -                   |
|                                          | 5 g plant<sup>1</sup> | 37.71   | 52.71               |
|                                          | 10 g plant<sup>1</sup> | 43.69   | 54.83               |
| Plant height 45DAT (cm)                  | Control         |         |                     |
|                                          | 50.98 Aa        | 52.34 Aa| 3.98                |
|                                          | 5 g plant<sup>1</sup> | 60.79 Ba| 61.14 Ba            |
|                                          | 10 g plant<sup>1</sup> | 69.13 Ca| 76.41Cb             |
| Stem diameter 15DAT (cm)                 | Control         |         |                     |
|                                          | 3.98            | 4.74    | -                   |
|                                          | 5 g plant<sup>1</sup> | 4.23    | 5.34                |
|                                          | 10 g plant<sup>1</sup> | 4.62    | 5.50                |
| Stem diameter 30DAT (cm)                 | Control         |         |                     |
|                                          | 4.43            | 5.66    | -                   |
|                                          | 5 g plant<sup>1</sup> | 5.10    | 5.46                |
|                                          | 10 g plant<sup>1</sup> | 5.20    | 6.45                |
| Stem diameter 45DAT (cm)                 | Control         |         |                     |
|                                          | 5.93            | 7.37    | -                   |
|                                          | 5 g plant<sup>1</sup> | 6.37    | 7.57                |
|                                          | 10 g plant<sup>1</sup> | 6.72    | 8.33                |
| Number of productive branches (branches) | Control         |         |                     |
|                                          | 16.00 Aa        | 16.73 Aa| 1.53                |
|                                          | 5 g plant<sup>1</sup> | 20.80 Ba| 21.46 Ba            |
|                                          | 10 g plant<sup>1</sup> | 27.86 Ca| 31.66Cb             |
| Plant Weight per Plant (g)              | Control         |         |                     |
|                                          | 104.11 Aa       | 127.63 Aa| 35.99              |
|                                          | 5 g plant<sup>1</sup> | 249.72 Ba| 288.07 Ba          |
|                                          | 10 g plant<sup>1</sup> | 341.98 Ca| 435.61Cb           |
| Fruit Length (cm)                        | Control         |         |                     |
|                                          | 7.37 Aa         | 9.95 Ab  | 1.44                |
|                                          | 5 g plant<sup>1</sup> | 7.56 Aa | 12.46 Bb            |
|                                          | 10 g plant<sup>1</sup> | 7.80 Aa | 13.30 Bb            |
|                                          | Control         | 47.76 Aa| 49.00 Aa            | 8.94 |
| Amount of Fruit per Plant (fruit)        | Control         |         |                     |
|                                          | 62.50 Ba        | 59.73 Ba|                     |
|                                          | 5 g plant<sup>1</sup> | 83.60 Ca| 98.10Cb             |
|                                          | 10 g plant<sup>1</sup> | 83.60 Ca| 98.10Cb             |
| Wet Plant Weight (g)                     | Control         |         |                     |
|                                          | 186.72          | 252.63  | -                   |
|                                          | 5 g plant<sup>1</sup> | 202.75  | 332.77              |
|                                          | 10 g plant<sup>1</sup> | 240.25  | 354.61              |
| Dry Plant Weight (g)                     | Control         |         |                     |
|                                          | 57.36           | 77.47   | -                   |
|                                          | 5 g plant<sup>1</sup> | 61.17   | 93.51               |
|                                          | 10 g plant<sup>1</sup> | 73.42   | 99.39               |
| Root Wet Weight (g)                      | Control         |         |                     |
|                                          | 12.96           | 15.66   | -                   |
|                                          | 5 g plant<sup>1</sup> | 13.34   | 17.83               |
|                                          | 10 g plant<sup>1</sup> | 15.05   | 18.53               |
| Dry Root Weight (g)                      | Control         |         |                     |
|                                          | 3.72            | 5.55    | -                   |
|                                          | 5 g plant<sup>1</sup> | 4.48    | 5.66                |
|                                          | 10 g plant<sup>1</sup> | 4.46    | 6.37                |
| Yield Potential (ton ha<sup>-1</sup>)    | Control         |         |                     |
|                                          | 2.45 Aa         | 3.01 Aa | 0.84                |
|                                          | 5 g plant<sup>1</sup> | 5.89 Ba | 6.80 Bb             |
|                                          | 10 g plant<sup>1</sup> | 8.07 Ca | 10.28Cb             |
| Percentage of Roots Infected by AMF(%)   | Control         |         |                     |
|                                          | 4.29            | 4.29    | -                   |
|                                          | 5 g plant<sup>1</sup> | 49.76   | 45.47               |
|                                          | 10 g plant<sup>1</sup> | 48.45   | 50.20               |

Note: The number followed by the same letter is different is not real based on the Smallest Significant Difference test (LSD) at the level of α = 0.05. Capital letters are notations in lines, lowercase letters are notations in columns.
4. Conclusions
There was a very real interaction between mycorrhizal doses and varieties on the parameters of the number of productive branches and real interactions on plant height at 45 DAP, fruit weight, fruit length, number of fruits and potential yield. The best combination was found in the treatment of doses of 10 g mycorrhizal plants\(^{-1}\) and Perintis varieties. We recommend to increase the production of chili in Bener Meriah can use Perintis varieties by giving 10 g of mycorrhizae per plant.

Acknowledgment
Thanks to the Indonesian Ministry of Higher Education for funding this research through skim PPUPT 2018-2020.

References
[1] Abdollahi L, Hansen E M, Rickson R J and Munkholm L J 2014 *J Soil & Tillage Res.* 145 29-36
[2] Azman, Syafruddin and Jumini 2016 The effect of the application of mixed mycorrhizal doses (*Glomus Mosseae* dan *Gigaspora* sp.) on the growth and yield of several chili varieties (*Capsicum annuum* L.) on entisol soil *Thesis* Agrotechnology Department, Faculty of Agriculture, Syiah Kuala University, Banda Aceh
[3] Badan Pusat Statistik dan Direktorat Jenderal Hortikultura 2018 Big Chili Productivity by Province 2012-2016 [http://www.pertanian.go.id] [accessed by Maret 14, 2018]
[4] Hardjowigeno H S 2008 *Soil Classification and Pedogenesis* (Jakarta: Akademika)
[5] Hayati E, Mahmud T and Fazil R 2012 *J. Floratek.* 7 173-181
[6] Harwimuka 2010 *Red Chili Cultivation* Insan Cendikia Surabaya p 66
[7] Langer I, Syafruddin S, Steinkellner S, Puschenreiter M and Wenzel W W 2010 *J.Plant Soil.* 332 339–355
[8] Luthfi H 2016 The effect of the application of arbuscular mycorrhizal fungi on the growth and production of several curvy red chili varieties (*Capsicum azenetiaannum* L.) *Thesis* Agrotechnology Department, Faculty of Agriculture Lampung University, Indonesia
[9] Maulana M, Syafruddin and E Keusumawati 2016 Effect of Varieties and Mycorrhizal Doses on Growth and Yield of Chili Plants (*Capsicum annuum* L.) In Andisol Soil (Green House Experiment) *Thesis*. Agrotechnology Department, Faculty of Agriculture, Syiah Kuala University Banda Aceh
[10] Medina A and R Azcon 2010 *J. Soil Sci. Plant Nutr.* 10 54-372
[11] MunawarK 2017 *Cabe Perintis* [http://steemit.com/agriculture/@munawarkhalid/cabe-perintis-a861f5bb1e3ab/] (accessed by Mei 8, 2018)
[12] Nurmasiyah, Syafruddin and Sayuthi M 2013 *J.Agrista.* 17 103 -110
[13] Pal S, H B Singh, A Raid and A Rakshit *IJAE* 6 557-562
[14] Piay S S, D M Yuwono, A Tyasdja, K B Prayogo, F R P Hantoro, and A S Romdon 2010 *Cultivation and post-harvest of red chili (*Capsicum annuum* L.)* Ungaran, Central Java Institute for Agricultural Technology Research p 68
[15] Prasetya C A B 2011 *J.AGRIVITA.* 33 85-92
[16] Safrianto R, Syafruddin and Sriwati R 2015 The Growth and Yield of Chili Peppers on Andisol Using Various Organic Manure Fertiliser and Endomycorrhizae. *Thesis*. Agroecotehnology Master Program, Postgraduate School, Syiah Kuala University. Banda Aceh.
[17] Syafruddin, S Syakur and Hasanuddin 2017 *The technique of multiplying mycorrhizal biofertilizer and adoption of innovation as a biofertilizer and bioprotector for increasing chili production in the Inceptisols Krueng Raya Aceh Besar Competency Based Research Final Report*. Syiah Kuala University, Banda Aceh.
[18] Syafruddin 2017 *Int. J. Agric Research.* 12 36-40
[19] Syafuddin S, S Syakur and T Arabia 2016 *Int. J. Agric. Res.* **11** 69 - 76
[20] Zeti F J, Syafuddin S and S Syamsuddin 2018 Effectiveness of mycorrhizal doses *Gigaspora sp.* on the growth and yield of several chili varieties (*Capsicum annuum* L.) on the land of Andisol Burni Telong, Bener Meriah Regency. *Thesis* Agrotechnology Department, Faculty of Agriculture, Syiah Kuala University, Banda Aceh