INTRODUCTION

Production of cayenne pepper can be increased through an intensification system. In the sustainable intensification system, intercropping increases yield, and fertilizer per unit of land compared to a monocultural system (Li et al., 2020). In the intercropping, the same field at least two crops the simultaneous production is provided (Hu, Li, Liu, Zhao, & Lin, 2019; Li et al., 2020). In intercropping, light intensity affects the growth and development of each crop. In some cases such as sweet basil, the yield is highest in the high intensity of light or un-shaded plants (Castronuovo et al., 2019).

In Indonesia, cayenne pepper can be chosen as an intercropping crop however shading may inhibit its growth. Generally, the morphological features, the yield, and phenotype of plants are affected by the light intensity or shading conditions (Castronuovo et al., 2019; Setiawan et al., 2021; Xu, Tao, Wang, & Wang, 2016). Species and varieties of crops give different responses to the shading related to their growth and development (Díaz-Pérez, 2013; Rylski & Spigelman, 1986). In addition, shade level also influences net photosynthesis, stomatal conductance, leaf transpiration, and concentration of nitrogen (N), potassium (K), calcium (Ca), magnesium (Mg), manganese (Mn), sulfur (S), aluminum (Al), and boron (B) (Díaz-Pérez, 2013). Shading improves plant growth, fruit yield, and capsaicinoid in bell pepper (Capsicum annuum) (Jeeatid, Techawongstien, Suriharn, Bosland, & Techawongstien, 2017). Although the level of light energy received is largely determined by the level of shade applied. At high shading levels (75%), the radiation energy received is lower than those at low shading levels (25%) and it is this condition that will...
influence the resulting micro-climatic conditions. The environment is one of the determining factors in plant growth in addition to genetic factors. The environment for plant growth is identical to the environment around the plant, both above ground and below ground (Song, Kelman, Johns, & Wright, 2012).

Poor agricultural soil needs to be improved as planting media for crops. Biological agents such as rhizosphere bacteria and Vesicular Arbuscular Mycorrhiza (VAM) are potential agents to improve soil qualities. Rhizosphere bacteria that influence plant growth through several mechanisms are called plant growth-promoting bacteria (PGPR) (Gaskins, Albrecht, & Hubbell, 1985). Another term is known as Plant Growth Promoting Bacteria, which are beneficial bacteria for plants that live freely in the soil, rhizosphere, rhizoplane, and phylosphere (Bashan & De-Bashan, 2005). Whereas VAM, soil factors and nutrient balance have an effect in increasing the growth and mineral nutrition of many types of plants (Goh, Banerjee, Tu, & Burton, 1997).

The application of biofertilizers such as PGPR and VAM can be used as a technology in improving soil conditions as a place to grow a plant. PGPR activities provide benefits for the direct or indirect growth of plants. The bioprotectant as the direct effect of PGPR can facilitate the absorption of various nutrients in the soil, and synthesize the concentration of various growth-stimulating phytohormones. Inoculation of VAM in general has been widely used and has a positive impact on plant growth. VAM improved the growth and productivity of plants such as fruit dry matter, total soluble solids content, P and Fe content. Nutritional status (higher N, P, K, Ca, Mg, Fe, Zn, B, and lower Al concentration in leaf tissue) are also improved by VAM (Rouphael, Cardarelli, & Colla, 2015).

Qiu et al. (2019) reported between the root mycorrhizal colonization and available K correlates positively in VAM reclaimed soils. In poor soil condition such as soil nutrient deficiency and drought, VAM is a solution to improve soil fertility (Qiu et al., 2019). In the case of the root endophytic Serendipitaceae, VAM altered nitrogen and carbon dynamics (Hallasgo, Spangl, Steinkellner, & Hage-Ahmed, 2020). The application of VAM also provides the cell wall modifications that correlated to mycorrhizal colonization at the root, and the systemic level (Chialva et al., 2019).

The research aimed to determine the effect of biofertilizer application at different levels of shading conditions on the growth and capsaicin content of Capsicum frutescens L. and to evaluate the suitable levels of shading conditions on the growth, development, and capsaicin content of chili pepper.

**MATERIALS AND METHODS**

The research was conducted from February to June 2019 at the experimental garden, Faculty of Agriculture, Universitas Brawijaya. Bhaskara, a chosen chili pepper variety was used and planted in a polybag. Thirteen treatments and three replications were arranged in the randomized design with nest pattern (Nested). The treatments were application of several plants shade in combination with biofertilization, there are NP0 (Control without shading and bio fertilization), NP1 (25% shading and no biofertilizer), NP2 (25% shading and PGPR), NP3 (25% shading and VAM), NP4 (25% shading, PGPR and VAM), NP5 (50% shading and no biofertilizer), NP6 (50% shading and PGPR), NP7 (50% shading and VAM), NP8 (50% shading, PGPR and VAM), NP9 (75% shading only), NP10 (75% shading and PGPR), NP11 (75% shading and VAM) and NP12 (75% shading, PGPR and VAM). For each treatment, totally of ten polybags, one plant of chili pepper was planted into each polybag. In total, there were 390 plants in the polybags.

**Preparation of the Planting Media**

The process of making planting media was started by sifting the soil. The poor nutrients of soil were mixed with cow manure (soil and manure ratio were 9:1 respectively in kg). The mixture media was stirred using a shovel until blended and then put into the 35 x 35 cm of polybags with a weight of 10 kg. The planting media for each polybag was characterized by five centimeters distance from the top of the polybag, and then each polybag was planted into the ground level and arranged with a distance between the polybags of 60 x 40 cm. In addition, the 30 cm distance was made between each combination of treatments and replications.

**The Shading Arrangement**

The bamboo was designed as a shading frame. The 25%, 50% and 75% shading net were used to cover each shading frame. The 25%, 50% and 75% shading net were used to cover each shading frame.
treatment was designed with a 21.5 m in length, 3 m in width, and 1.5 m in height. The one side of the shading net building was arranged to be used as a door for easier maintenance and observation.

The Biological Fertilizer Application

Plant Growth Promoting Rhizobacteria (PGPR) and Vesicular Arbuscular Mycorrhizae (VAM) were used as biological agents as fertilizers. The PGPR formulation was inoculated four times, namely at the seedling, at the transplanting, at the 7, and at 14 days after transplanting (DAT). Firstly, the PGPR solution was diluted into the clean water with a concentration of 10 ml/l. Before being inoculated, the circle hole around the plant with ca. 3 cm in depth were made, then poured the solution of PGPR into the circle hole in the planting media with the 3 cm distance from the plant with a dose of 30 ml per plant (Gul et al., 2012). By this procedure, PGPR can colonize into the plant roots quickly. For the VAM, the application of VAM was carried out three times, namely at the nursery period, at the transplanting, and at 14 DAT by putting 5 g per plant VAM granules or approximately 25 spores of VAM into the planting media. The VAM was put around plant roots or into seed holes. The inoculation time was carried out in the afternoon to avoid evaporation and high temperatures during the day which can cause death to the biological agents (Musfal, 2010).

Observation Parameters

Observations were carried out by observing the six harvested plant samples. Harvesting time was allowed after 70 DAT, and harvesting was done every three days until 100 DAT. The harvest samples were analyzed based on the dry weight, nutrient plant analysis, fresh weight, and Capsaicin content.

Dry Weight

Plant dry weight was observed at harvesting time. By separating the roots and stover, then drying it at 80°C for ca. 2 x 24 hours to obtain a constant dry weight. The results of measurements of root dry weight, stover, and total dry weight were expressed in units of g per plant.

Nutrient Plant Analysis (N, P and K mg per plant)

The absorption content of N, P, and K was investigated at the end of harvest by separating shoot and root organs. Analysis of the total N content used the Kjeldahl semi-micro method. The determination of the element P content used the UV-V was spectrophotometric method, while the K element content used the flame-photometer method. Nutrient uptake analysis was carried out at harvest.

Fresh Weight

The fruit weight per plant (g per plant) was calculated as the total fruit weight at the time of fruiting for the first time until the end of the harvest period from six plant samples then averaged.

Capsaicin Content (mg/g)

Capsaicin content analysis was carried out at harvest time by using the HPLC method (Thaib, Katja, & Aritonang, 2015). In this research, the capsaicin content was described in mg/g.

Data Analysis

The data were analyzed using Analysis of Variance with 5% of α. The 5% Honesty Significant Difference (HSD) was chosen as post hoc to show the distances between each treatment and replication. Microsoft Excel was used as statistical software to conduct this analysis.

RESULTS AND DISCUSSION

Dry Weight

The shoot, root, and total of dry weights showed differences between treatments especially based on combinations of different shading conditions and biofertilizers (PGPR and VAM). The average value of dry weights is described in Table 1. The 50% shading treatment reduces the shoot dry weight by 42% compared to the control. However, a combination of the 50% shading and biofertilizer did not produce differences to the control based on the shoot dry weight. In addition, the 50% and 75% shading conditions decreased the shoot, root, and total dry weights of chili pepper.
Plant growth described in plant dry weight on the 75% shading condition can be stimulated by the application of PGPR and VAM. The highest value of the dry weight of the shoots, roots and total plants were obtained in the 25% shading with PGPR and VAM in a consortium, average weight was 21.23, 7.17, and 28.40 g per plant respectively. Rylski & Spigelman (1986) reported that shading condition inhibits shoot development. Changes in plant development due to shade in fruit bunch, the number of fruits per plant, location of fruit on plants, fruit development and yield. In the case of fruit production, the highest yield of high-quality fruits was obtained from lower shading conditions for example for sweet pepper ca. 12 till 26%. For plant growth and development of the bell pepper, a moderate level of shading (ca. 30% and 47%) was the most favorable (Díaz-Pérez, 2013). In case of soybean, plant growth and development were the highest under full radiation or the low shading condition (Wu et al., 2017). Based on the dry weight of shoots and roots (Table 1), the shading condition is lower than control, because the highest shading causes the lowest light compensation point and provides poor growth (Xu, Tao, Wang, & Wang, 2016).

Table 1. The average dry weight of shoots, roots and total plants

| Treatments                        | Dry weight (g per plant) |          |          |          |
|-----------------------------------|--------------------------|----------|----------|----------|
|                                   | Shoots                  | Roots    | Plant Total |
| Control                           | 20.7<sup>b</sup>        | 5.9<sup>bc</sup> | 26.7<sup>cd</sup> |
| 25% shading only                  | 15.1<sup>ab</sup>       | 4.9<sup>abc</sup> | 20.1<sup>abc</sup> |
| 25% shading & PGPR                | 17.7<sup>ab</sup>       | 5.8<sup>abc</sup> | 23.5<sup>bc</sup> |
| 25% shading & VAM                 | 19.9<sup>b</sup>        | 6.6<sup>bc</sup> | 26.5<sup>cd</sup> |
| 25% shading & PGPR & VAM          | 21.2<sup>b</sup>        | 7.2<sup>c</sup> | 28.4<sup>d</sup> |
| 50% shading only                  | 11.9<sup>a</sup>        | 3.2<sup>a</sup> | 15.2<sup>a</sup> |
| 50% shading & PGPR                | 17.9<sup>ab</sup>       | 4.2<sup>ab</sup> | 22.1<sup>abcd</sup> |
| 50% shading & VAM                 | 16.5<sup>ab</sup>       | 4.4<sup>ab</sup> | 20.9<sup>abcd</sup> |
| 50% shading & PGPR & VAM          | 19.6<sup>b</sup>        | 5.6<sup>bc</sup> | 25.2<sup>bc</sup> |
| 75% shading only                  | 11.4<sup>a</sup>        | 3.1<sup>abc</sup> | 14.5<sup>a</sup> |
| 75% shading & PGPR                | 13.8<sup>ab</sup>       | 3.1<sup>a</sup> | 16.9<sup>ab</sup> |
| 75% shading & VAM                 | 14.7<sup>ab</sup>       | 4.8<sup>abc</sup> | 19.5<sup>abc</sup> |
| 75% shading & PGPR & VAM          | 19.7<sup>b</sup>        | 5.1<sup>abc</sup> | 24.8<sup>bcd</sup> |
| HSD test (5%)                     | 7.6                      | 2.6      | 7.9      |

Remarks: The superscript same letters at the same column are not significantly different based on the 5% HSD test.

Content of Nitrogen, Phosphor and Potassium in the Shoots and Roots

Crop production and quality are closely related to nutrient absorption. In the chili pepper, the nutrient absorption (N, P, and K) of the shoots and roots are significantly affected by a combination of shading level and biofertilizers (PGPR and VAM) in a single and consortium. Table 2 showed that the 25% shading condition decreased the total N uptake in the shoots is 38% less than the control. The VAM application under the 50% shading showed the differences compared to the control based on the total N uptake, and it also decreased ca. 59% and 39% total N absorption in the shoots compared to the control. The combination of 50% shading and biofertilizers (a consortium of PGPR and VAM) increased the absorption of N total on the shoots of chili pepper by 68% and 88% compared to the 50% shading only. On the roots of the chili pepper, the average rate of P absorption was presented in Table 3, and it described that that single application of biofertilizers (PGPR or VAM) under the 50% shading showed a significant difference compared to the control.
Table 2. Total absorption of N, P and K in shoots

| Treatments                          | Total absorption in Shoots (mg per plant) |   |   |   |
|------------------------------------|------------------------------------------|---|---|---|
|                                    | N                                        | P | K  |
| Control                            | 1053.25<sup>d</sup>                      | 60.13<sup>cde</sup> | 520.41<sup>*</sup> |
| 25% shading only                   | 658.3<sup>bcd</sup>                      | 43.9<sup>cde</sup>  | 335.9<sup>bcd</sup> |
| 25% shading & PGPR                 | 852.9<sup>def</sup>                      | 49.6<sup>bcd</sup>  | 418.5<sup>cde</sup> |
| 25% shading & VAM                  | 1006.6<sup>def</sup>                     | 61.8<sup>de</sup>   | 480.4<sup>de</sup>  |
| 25% shading & PGPR & VAM           | 1087.2<sup>f</sup>                       | 74.3<sup>a</sup>    | 552.1<sup>*</sup>   |
| 50% shading only                   | 433.2<sup>a</sup>                        | 27.5<sup>a</sup>    | 153.2<sup>a</sup>   |
| 50% shading & PGPR                 | 726.3<sup>cde</sup>                      | 44.8<sup>bcd</sup>  | 324.6<sup>bcd</sup> |
| 50% shading & VAM                  | 643.5<sup>abc</sup>                      | 41.3<sup>bcd</sup>  | 336.6<sup>bcd</sup> |
| 50% shading & PGPR & VAM           | 812.8<sup>cde</sup>                      | 53.01<sup>bcd</sup>| 453.5<sup>cde</sup>|
| 75% shading only                   | 392.2<sup>a</sup>                        | 27.4<sup>a</sup>    | 142.5<sup>a</sup>   |
| 75% shading & PGPR                 | 502.3<sup>ab</sup>                       | 33.1<sup>ab</sup>   | 223.6<sup>ab</sup>  |
| 75% shading & VAM                  | 602.7<sup>abc</sup>                      | 39.7<sup>abc</sup>  | 280.8<sup>abc</sup> |
| 75% shading & PGPR & VAM           | 894.4<sup>cde</sup>                      | 51.2<sup>bcd</sup>  | 449.2<sup>cde</sup>|
| HSD test (5%)                      | 344.9                                    | 21.3                | 166.4               |

Remarks: The superscript same letters at the same column are significantly different based on the 5% HSD.

Table 3. The total absorption of N, P and K in roots

| Treatments                          | Total absorption in roots (mg per plant) |   |   |   |
|------------------------------------|------------------------------------------|---|---|---|
|                                    | N                                        | P | K  |
| Control                            | 149.4<sup>def</sup>                      | 16.1<sup>fg</sup>  | 108.3<sup>g</sup>  |
| 25% shading only                   | 118.8<sup>bcd</sup>                      | 12.4<sup>cde</sup> | 80.2<sup>cde</sup> |
| 25% shading & PGPR                 | 143.2<sup>de</sup>                       | 13.23<sup>def</sup>| 89.1<sup>de</sup>  |
| 25% shading & VAM                  | 173.6<sup>f</sup>                        | 17.2<sup>g</sup>   | 99.7<sup>gfg</sup>|
| 25% shading & PGPR & VAM           | 207.1<sup>f</sup>                        | 20.8<sup>f</sup>   | 130.4<sup>f</sup>  |
| 50% shading only                   | 67.1<sup>a</sup>                         | 5.8<sup>ab</sup>   | 29.6<sup>ab</sup>  |
| 50% shading & PGPR                 | 84.7<sup>abc</sup>                       | 7.5<sup>abc</sup>  | 44.3<sup>abc</sup> |
| 50% shading & VAM                  | 88.0<sup>abc</sup>                       | 8.8<sup>bcd</sup>  | 55.0<sup>bcd</sup> |
| 50% shading & PGPR & VAM           | 125.3<sup>bcd</sup>                      | 12.3<sup>cdef</sup>| 72.4<sup>cdef</sup>|
| 75% shading only                   | 58.9<sup>a</sup>                         | 5.3<sup>a</sup>    | 24.9<sup>a</sup>   |
| 75% shading & PGPR                 | 68.9<sup>ab</sup>                        | 5.7<sup>ab</sup>   | 31.5<sup>ab</sup>  |
| 75% shading & VAM                  | 107.6<sup>bcd</sup>                      | 8.6<sup>bcd</sup>  | 60.3<sup>bcd</sup> |
| 75% shading & PGPR & VAM           | 115.1<sup>bcd</sup>                      | 11.1<sup>bcd</sup> | 65.2<sup>bcd</sup> |
| HSD test (5%)                      | 60.5                                     | 5.7                | 35.6               |

Remarks: The superscript same letters at the same column are significantly different based on the 5% HSD.
The 50% shading decreased the P absorption on the root by 64% more than the control. The application of biofertilizers (PGPR and VAM consortia) under the 50% shading increased the absorption of P in the root of 116% compared to the 50% shading only. The 75% shading condition with and without biofertilizer in a single application (PGPR or VAM) showed the differences in the absorption of P into the roots compared to control, and it reduced P absorption. Biofertilizers that contain microorganisms are able to carry out plant growth promotion, pest and disease, and weed control. It can be beneficiary microorganisms applied to either the soil or the plant in order to improve productivity and crop health (Alori & Babalola, 2018). Application of PGPR and VAM singly and consortium increase plant growth by enhancing nutrient uptake especially N, P, and K from the field as part of an integrated nutrient management system (Adesemoye, Torbert, & Kloeppe, 2008).

The absorption of N in the healthy plant stimulates plant growth. In the affected plant the total N uptake was related to the dry weight positively ($R^2 = 0.96$) (Fig. 1). The increasing of N total absorption in a plant also increases the dry matter accumulation (Ju et al., 2009). Nitrogen uptake supports vegetative growth such as root (Dal Cortivo et al., 2018; Graca & Hamilton, 1981), shoot (Graca & Hamilton, 1981), and leaf (Wada et al., 2015). If the vegetative growth increases, the dry weight will also increase. In addition, nitrogen uptake affects the level of nitrogen and increases the dry material (Ju et al., 2009). *Azotobacter, Azospirillum, Rhizobium, Bacillus*, and *Pseudomonas* are the genus that classified into the PGPR that contributes to increasing nutrient absorption for the plant (Maheshwari, 2011). VAM-PGPR biofertilizer for root expansion and to enhance nutrient absorption for low mobility, which has the potential to provide relevant environmental benefits (Dal Cortivo et al., 2018).

**Fig. 1.** The regression relationship between N total absorption and dry weight.
Fruit Weight

Based on the average of total plant fruit weight, the 25% shading condition with biofertilizers (PGPR and VAM in the consortium) was higher and significantly different than all combinations of treatment under 50% and 75% shading levels (Table 4). However, the 25% shading level combined with PGPR and VAM in the consortium (324 g per plant) was no significant compared to control (352 g per plant). Inoculation of VAM into the plant contributes to increasing the dry matter accumulation such as roots, and fruits (Bona et al., 2017; Chialva et al., 2019). Large fruits in mycorrhizal plants associated with the triggering of auxins and sugar synthases to promote fruit cell expansion by causing an increase in cell wall extensibility (Nzanza, Marais, & Soundy, 2012). Finally, VAM influences yield and nutrient content (Nzanza, Marais, & Soundy, 2012). Flower and fruit production, larger fruit size, and higher concentrations of sugars and ascorbic and folic acid can be stimulated by inoculation of VAM and PGPR, and it means that rhizosphere microorganisms affect fruit crop quality (Bona et al., 2015).

Capsaicin in Fruits

Based on the average capsaicin content, the 25% shading condition with biofertilizers (PGPR and VAM in the consortium) was higher and significantly different than all combinations of treatment under 50% and 75% shading levels (Table 4). However, the 25% shading level combined with PGPR and VAM in the consortium (6.98 mg per fruit) was no significant compared to control (6.60 mg per fruit). Under low shading condition, chili pepper that applied by biofertilizers increase the capsaicin content. It occurs because PGPR and VAM stimulate plant growth and development of chili pepper by increasing the nutrient absorption such as N, P and micronutrients (Dal Cortivo et al., 2018; Maheshwari, 2011; Mantelin & Touraine, 2004; Razaq, Zhang, Shen, & Salahuddin, 2017), and especially for VAM, absorption of other nutrients such as K, Cu, Zn and Mg can be increased (Nadeem, Ahmad, Zahir, Javaid, & Ashraf, 2014). In addition, PGPR increases the plant health by several mechanisms such as: lowering of ethylene, phytohormone production, Exopolysaccharides production, Induced systematic resistance, P solubilization, N fixation and Siderophores production (Maheshwari, 2011; Nadeem, Ahmad, Zahir, Javaid, & Ashraf, 2014). Improved nutrition, enhanced antioxidant system, modification of root architecture, enzyme production, and water use efficiency are mechanisms provided by VAM (Nadeem, Ahmad, Zahir, Javaid, & Ashraf, 2014).

Table 4. Total fresh weight of fruit and average level of Capsaicin

| Treatments                  | Fruit weight (g per plant) | Capsaicin Content (mg per fruit) |
|-----------------------------|----------------------------|---------------------------------|
| Control                     | 352.7f                     | 6.6gh                           |
| 25% shading only            | 214.2bcde                  | 5.5fg                           |
| 25% shading & PGPR          | 255.8def                   | 5.9fg                           |
| 25% shading & VAM           | 298.3def                   | 5.3fg                           |
| 25% shading & PGPR & VAM    | 324.8ef                    | 6.9h                            |
| 50% shading only            | 65.4a                      | 2.3ab                           |
| 50% shading & PGPR          | 146.3abc                   | 3.4ac                           |
| 50% shading & VAM           | 134.4ab                    | 4.2ade                          |
| 50% shading & PGPR & VAM    | 187.3bcd                   | 4.2ade                          |
| 75% shading only            | 57.2a                      | 1.9a                            |
| 75% shading & PGPR          | 143.5abc                   | 4.1ab                           |
| 75% shading & VAM           | 197.6bcd                   | 3.9bc                           |
| 75% shading & PGPR & VAM    | 203.8bcd                   | 4.8cde                          |

HSD (5%) 116.6 1.37

Remarks: Numbers followed by the small same letters at the same column are not significantly different in the HSD test at 5% level.
Based on Fig. 2, there is a positive relationship between the total fresh weight per plant and the capsaicin content \((R^2 = 0.8865)\). Based on the structure of fruit, capsaicinoids, and glycosylated compounds were located in the placenta and pericarp respectively (Cervantes-Hernández, Alcalá-González, Martínez, & Ordaz-Ortiz, 2019). Chili pepper fruit contains capsaicinoids, a kind of bioactive compound that provides a distinctive sharp taste. Capsaicin and dihydrocapsaicin as two main compounds in the chili pepper are accountable for 90% of the total sharp strong taste of pepper fruit (El Saber Batiha et al., 2020).

Fig. 3 describes that there is a relationship between the capsaicin content and the N absorption and the N uptake in plants \((R^2 = 0.7393)\) (Fig. 3). Nitrogen uptake is strongly influenced by the biofertilizers and shading levels. The ratio of ammonium and nitrate influence chili pepper fruit. The change of N source contributes to the composition of the placenta including capsaicin (Zhang et al., 2020). In the chili pepper fruits, there are capsaicin and numerous associated chemicals that have straight-chain alkyl vanillylamides and homologous series branched (Idrees, Hanif, Ayub, Hanif, & Ansari, 2020). Based on this research, the capsaicin content of chili pepper significantly affected by low shading level (25%) which combined with biofertilizers (PGPR and VAM consortium). The capsaicin content increased up to 5.75%, it indicated good quality of chili pepper-based on spicy level. The increasing nitrogen increases the total content of alkaloids. The higher N absorption, the more increase the total content of alkaloids such as capsaicin. It is related to the capsaiconoid contents increases in crops that supply by the higher nitrogen (Monforte-González, Guzmán-Antonio, Uuh-Chim, & Vázquez-Flota, 2010). Synthesizing growth regulators, as nutrient providers, such as a symbiotic fixing nitrogen (N2) from the air and dissolving phosphorus (P) nutrients in the soil is provided by PGPR (Maheshwari, 2011).

![Fig. 2. The regression relationship between weight of chili fruits and capsaicin content based](image-url)
CONCLUSION

The application of biofertilizers consisted of PGPR and VAM consortium, under the lowest shading condition (25%) increased the total dry weight of chili, the nutrients absorption, and the capsaicin content. The capsaicin content is influenced by the weight of chili and plant nitrogen uptake. Generally, biofertilizers in consortium application and the lowest shading condition contribute to supporting the growth and development of chili pepper.

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