Application of Chicken manure Dosage and Plant Growth Promoting Rhizobacteria on the Growth and Yield of Shallot Plants (*Allium ascalonicum* L.)

U Dani, A N S Budiarti, and A A Wijaya*

Agrotechnology, Faculty of Agriculture, Majalengka University
Jln. KH Abdul Halim No. 103 Majalengka - West Java 45418

*Corresponding: umardani@unma.ac.id

Abstract. The study’s objective was to determine the effect of dose Fertilizer Coop Chicken and Plant Growth Promoting Rhizobacteria on growth and yield crops of onion (*Allium ascalonicum* L.). The research was conducted in the agricultural land of Sadasari Village, Argapura District, Majalengka Regency, West Java. With an altitude of 639 masl, starting from April 2020 to June 2020. The research method used a randomized block design (RBD) Factorial pattern was repeated 3 times. The treatment tested is Factor 1 is chicken manure (K), consisting of three levels: k1 = 10 tons / ha, k2 = 15 tons / ha and k3 = 20 tonnes / ha. Factor 2 is PGPR (P), consisting of three levels: p1 = 5 ml / litre water , p2 = 10 ml / litre water , and p3 = 15 ml / litre water . The difference in the average treatment was tested using Duncan's Multiple Range Test at the 5% level. The results showed that there was an interaction between the dose of 20 ton / ha of chicken manure and 10 ml / l of PGPR of water on the average number of leaves aged 28 and 35 hst. The independent effect of chicken manure had a significant effect on the average plant height at 14 days and 35 days of planting, tuber diameter, average tuber wet weight per hill, and the average tuber dry weight per hill. The independent effect of PGPR has a significant effect on all observed parameters.

1. Introduction

Shallots (*Allium ascalonicum* L.) are a horticultural commodity that is widely consumed by the public as a spice mixture after chilies. Shallots or in the Javanese language also called brambang are seasonal plants and have layered tubers. The shallot plant originates from Central Asia which is one of the most widely consumed horticultural commodities. The potential for shallot development is still wide open not only for domestic but also foreign needs [1].

Along with the increasing population and demand, both local and national, it is necessary to increase the productivity of shallots. One of the efforts to increase shallot production is the use of organic fertilizers. Increasing the efficiency of fertilization and reducing the use of inorganic fertilizers in improving soil quality can be done by applying organic fertilizers. Manure is an alternative organic fertilizer that can improve soil physical, chemical, and biological properties [2].
One source of organic fertilizer that is widely available around farmers is chicken manure. Fertilizer cage chicken has great potential, because of the number of breeding chickens to be used as fertilizer. According to Hasibuan [3] that is whole dirt contains 55% H₂O; 1.00% N; 0.80% P₂O₅ and 0.04% K₂O. From the results of the research, manure cage chicken give the effect is very good for the fertility of soil and growth of plants, and even can improve the results of production [4] (Pradana et al., 2012). The results of research by Melati and Adiyanti [5] were given a dose of 5 tons / ha and 10 tons / ha of chicken manure to increase vegetative and generative development of soybean plants.

Another effort that can be made is the application of PGPR (Plant Growth Promoting Rhizobacteria). PGPR is a group of beneficial soil microorganisms that actively colonize the root area (rhizosphere) and thrive in soil rich in organic matter [6]. PGPR can act as a bioprotectant and bio-stimulant [7]. So that with the addition of organic matter and PGPR able to provide plant nutrients optimally. After experiencing the complete decomposition process, it will affect the sustainability of the environment and living things in the soil [8].

Based on these problems, the aim of this study was to determine what is the best dose of giving chicken manure and plant growth promoting rhizobacteria and is there an effect on the growth and yield of shallot plants.

2. Materials and Methods

This experiment was carried out from March 2020 to June 2020. The materials used in the experiment were chicken manure, PGPR, Bali Karet cultivar onion seeds, Urea fertilizer, KCL and SP-36 as supplementary fertilizers, Amistartop pesticides, Trigard, Endure and Daconil.

The environmental design that will be used is an experimental method in the field using polybags with a diameter of 20 x 20 cm, the distance between polybags is 50 x 50 cm and the distance between replications is 60 cm. The research method used a factorial randomized block design (RBBD) which was repeated 3 times (repetitions r = 3). The first factor, namely the dose of chicken manure (K) consists of three levels: k₁, = 10 tons / ha, 40 grams / polybags, k₂ = 15 tons / ha, 60 grams / polybags, k₃ = 20 tons / ha, 80 grams / polybag. The second factor is the PGPR dose (P) consisting of three levels, namely: p₁, = 5 ml / l water, p₂, = 10 ml / l water, p₃, = 15 ml / l water.

The responses observed in this experiment were the number of leaves per clump (strands), number of tubers per clump (tubers), number of tillers (tubers), tuber diameter per tuber (mm), tuber wet weight (grams) per clump and dry weight. tubers (grams) per clump) and Soil Analysis.

3. Results

Soil analysis is one of the supporting observations made before the experiment is carried out which aims to determine soil characteristics. The results of soil analysis carried out at the Soil Science Laboratory of Padjajaran University showed that the soil used in the experiment had a pH: H₂O of 6.75 with neutral criteria, and a KCl 1 N pH of 4.76. The organic C content is 1.11%, total N-0.15%, so this experimental soil has a C/N of 7 which is included in the low criteria, so it is necessary to provide organic fertilizers. The content of P₂O₅·HCl 25% is 64.00 mg / 100g which is included in the very high criteria, P₂O₅·HCl 15.86 ppm P which is included in the low criteria and K₂O·HCl 25% is 62.19 mg / 100g which is Very High criteria. This experimental soil has a sandy clay texture with a ratio of 47% sand, 27% dust, and 26% clay.

The content of organic matter in the form of C-organic is included in the low criteria, so applying organic fertilizers is one way to increase the organic matter content in the soil. One
of the organic fertilizers that can increase the organic matter content of the soil is chicken manure. Chicken manure contains nitrogen, phosphorus and potassium higher than other manure \([9]\). In addition, chicken manure also plays a role in improving the physical properties of the soil which makes the soil have a crumb structure, and soil aeration is better because the porosity or pore space increases so that it affects root development. Organic C in the soil must be maintained at no less than 2 percent, so that the organic matter content in the soil is returned to the soil, does not decrease with time due to the mineralization decomposition process, so during soil cultivation, the addition of organic matter absolutely must be given every year \([10]\).

Based on the results of statistical analysis, the observation of the average number of leaves showed that the treatment of the effect of Chicken Manure and PGPR did not have an effect on the number of leaves aged 14 DAP but showed an independent effect (Table 1). meanwhile, the number of leaves aged 28 days and 35 days showed an interaction with the provision of Chicken Manure and PGPR (Tables 2 and 3). The differences in each treatment were tested by Duncan's Multiple Range Test at the 5% level.

**Table 1. Main Effect of Chicken Manure Doses and PGPR to the amount of leaves per clump (strands) at the age of 14 DAP**

| Treatment | Number of Leaves |
|-----------|-----------------|
| Chicken Manure |                 |
| k₁ (Chicken Manure Doses 10 ton/ha) | 24.67 a |
| k₂ (Chicken Manure Doses 15 ton/ha) | 26.50 a |
| k₃ (Chicken Manure Doses 20 ton/ha) | 26.33 a |
| P GPR |             |
| p₁ (PGPR 5 ml/l water) | 24.50 a |
| p₂ (PGPR 10 ml/l water) | 28.83 b |
| p₃ (PGPR 15 ml/l water) | 24.17 a |

The mean value are followed by letters are the same in the column are the same, not significantly different according to Duncan's Multiple Distance Test at 5% level.

Table 1 shows that the independent effect of Chicken Manure treatment on plant height at 14 days of age did not have a significant effect on each treatment. The PGPR administration showed p₁ (PGPR 5 ml/l water) was significantly different from p₂ (PGPR 10 ml/l water) but not significantly different from p₃ (PGPR 15 ml/l water), while p₂ was significantly different from p₁ and p₃. The best dose is shown in treatment p₃ namely 10 ml/l water.

**Table 2. Interaction between Effect of Dose Chicken Manure and PGPR against Number of leaves per clump (strands) at the age of 28 DAP**

| Treatment | p₁ (PGPR 5 ml/l water) | p₂ (PGPR 10 ml/l water) | p₃ (PGPR 15 ml/l water) |
|-----------|------------------------|------------------------|------------------------|
| k₁ (Chicken Manure doses 10 ton/ha) | 19.50 a | 19.83 ab | 20.17 a |
| k₂ (Chicken Manure doses 15 ton/ha) | A | A | A |
| k₃ (Chicken Manure doses 20 ton/ha) | 20.17 a | 18.00 a | 17.50 a |
| k₄ (Chicken Manure doses 20 ton/ha) | A | A | A |
| k₅ (Chicken Manure doses 20 ton/ha) | 15.67 a | 23.00 b | 15.50 a |
| k₆ (Chicken Manure doses 20 ton/ha) | A | B | A |

The mean followed by the same letter in the same column (lowercase), and on the same row (uppercase) is not significantly different based on the Duncan Multiple Distance Test at 5% level.
Table 2 shows that the number of leaves at the age of 28 days after birth occurred an interaction between the dose of Chicken Manure and PGPR. The K factor at the p1, and p2, levels showed no significant difference. The level k1 was not significantly different from the level k2 and level k3. Level k2 (Fertilizer for Chicken manure 15 ton / ha) showed no significant difference on the effect of PGPR dose. Level k3 (20 tonnes / ha of chicken manure) treatment p1 and p2 were not significantly different, p3 was significantly different with treatment p1 and p2. Whereas at the level p1 (PGPR 5 ml / l water) showed no significant difference to all k treatments (Chicken Manure). The level of p2 (PGPR 10 ml / l water) treatment k1, k2, and k3 showed significantly different. The level of p3 (PGPR 15 ml / l of water) showed no significant difference in the effect of the dose of chicken manure in both k1, k2, and k3 treatments. The best interaction was shown by k3p2 (Chicken manure 20 ton / ha and PGPR 10 ml / l water).

**Table 3. Interaction between Effect of Dose Chicken Manure and PGPR against Number of leaves per clump (strands) at the age of 35 DAP**

| Treatment                  | p1 (PGPR 5 ml / l water) | p2 (PGPR 10 ml / l water) | p3 (PGPR 15 ml / l water) |
|----------------------------|--------------------------|---------------------------|---------------------------|
| k1 (Chicken manure doses 10 ton / ha) | 17.50 a                  | 19.50 a                   | 19.00 a                   |
|                            | A                        | A                         | A                         |
| k2 (Chicken manure doses 15 ton / ha) | 21.67 a                  | 18.50 a                   | 20.00 a                   |
|                            | A                        | A                         | A                         |
| k3 (Chicken manure doses 20 ton / ha) | 16.83 a                  | 24.50 a                   | 16.83 a                   |
|                            | A                        | B                         | AB                        |

The mean followed by the same letter in the same column (lowercase), and on the same row (uppercase) is not significantly different based on the DUncan Multiple Distance Test at 5% level.

Table 3 shows that the number of leaves at the age of 35 days after which an interaction occurs between the dose of Chicken Manure and PGPR. At the level of k1 (chicken manure 10 ton / ha), both p1, p2, and p3 treatments did not have a significant effect on the number of leaves (strands) aged 35 dap. Level k2 (Fertilizer Chicken manure 15 ton / ha) all p treatments did not have a significant effect on the number of leaves (strands) aged 35 dap. Level k3 (Chicken Manure 20 ton / ha) treatment p3 was significantly different from p1 and p2.

Whereas at the level of p1 (PGPR 5 ml / l water) showed no significant difference in the effect of the dose of chicken manure. The level of p2 (PGPR 10 ml / l water) of k1 and k2 treatments was not significantly different to the number of leaves (strands) aged 35 DAP, k3 was not significantly different from the k1 and k2 treatments. The levels of p3 (PGPR 15 ml / l water) of k1 and k2 treatments were not significantly different to the number of leaves (strands) aged 35 DAP, k3 was significantly different from the k1 and k2 treatments. The best interaction was shown by k3p2 treatment (Chicken manure 20 ton / ha and PGPR 10 ml / l water).

Based on Table 4, it shows that the observation of the number of tubers per hill of chicken manure treatment did not have a significant effect on the number of tubers per hill. Whereas the PGPR treatment had a significant effect, the p1 treatment (PGPR 5 ml / l water) was significantly different from p2 and p3. The best dose was shown in treatment p3, namely 5 ml / l water.

Based on the observation of the number of tillers per clump in Table 4, the application of chicken manure did not have a significant effect on each treatment. While the provision of PGPR showed a significant effect, treatment p3 was significantly different from p1 and p2.
Table 4. Main Effect of Dose Chicken Manure and PGPR against Total Bulbs per hill, number of tillers per hill and tuber diameter (mm)

| Treatment | Total Bulbs per hill | Number of tillers/ hill | Tuber diameter (mm) |
|-----------|---------------------|-------------------------|---------------------|
| **Chicken Manure** | | | |
| k₁ (Chicken Manure Doses 10 ton/ha) | 13.67 a | 10.67 a | 81.44 b |
| k₂ (Chicken Manure Doses 15 ton/ha) | 14.33 a | 10.83 a | 74.62 a |
| k₃ (Chicken Manure Doses 20 ton/ha) | 14.00 a | 10.50 a | 75.51 a |
| **PGPR** | | | |
| p₁ (PGPR 5 ml / l water) | 16.17 c | 12.67 c | 72.97 a |
| p₂ (PGPR 10 ml / l water) | 14.50 b | 11.50 b | 78.14 b |
| p₃ (PGPR 15 ml / l water) | 11.33 a | 7.83 a | 80.46 b |

Mean value are followed by letters are the same in the column are the same, not significantly different according to Duncan's Multiple Distance Test at 5% level

Based on Table 4, the application of chicken manure has a significant effect on the k₁ treatment (10 tons/ha) of the tuber diameter on the tuber diameter when compared to k₂ and k₃. Meanwhile, the PGPR treatment p₁ (PGPR 10 ml / l water) and p₂ showed no significant difference but significantly different from p₃.

Based on observations and results of statistical analysis, the effect of chicken manure dose and PGPR on shallot plants did not show any interaction on the parameters of the average tuber wet weight per hill and tuber dry weight per hill. The differences in each treatment were tested by Duncan's Multiple Range Test at the 5% level seen in Table 5.

Table 5. Main Effect of Dose Chicken Manure and PGPR against average weights Wet Bulbs per clump and Average Dry Weight of Tubers per clump (grams)

| Treatment | Average weights Wet Tuber per clump | Average Dry Weight of Tubers per clump (grams) |
|-----------|-------------------------------------|-----------------------------------------------|
| **Chicken Manure** | | |
| k₁ (Chicken Manure Doses 10 ton/ha) | 174.00 b | 127.33 b |
| k₂ (Chicken Manure Doses 15 ton/ha) | 145.67 a | 103.50 a |
| k₃ (Chicken Manure Doses 20 ton/ha) | 139.17 a | 99.17 a |
| **PGPR** | | |
| p₁ (PGPR 5 ml / l water) | 140.50 a | 100.00 a |
| p₂ (PGPR 10 ml / l water) | 169.67 b | 120.83 b |
| p₃ (PGPR 15 ml / l water) | 148.67 ab | 109.17 ab |

Mean value are followed by letters are the same in the column are the same, not significantly different according to Duncan's Multiple Distance Test at 5% level

Based on Table 5, the observation of tuber wet weight per clump shows that the treatment of k₁, chicken manure (10 ton/ha) is significantly different from the k₂ and k₃ treatments, while the k₁ and k₃ treatments are not significantly different. The best dose is shown in treatment k₁, namely 10 t/ha. The PGPR treatment p₁ (PGPR 5 ml / l water) was significantly different from p₂ but not significantly different from p₃, while p₁ was not significantly different from p₃. The best PGPR dose was shown in the treatment p₂, 10 ml / l water and p₃, 15 ml / l water.

Based on the observation of the dry weight of the tubers in the table above, it shows that the treatment of k₁, chicken manure (10 t/ha) was significantly different from the k₂ and k₃ treatments, while the k₂ and k₃ treatments were not significantly different. The best dose was shown in treatment k₁, namely 10 t/ha. PGPR treatment p₁ (PGPR 5 ml / l water) was
significantly different from p , but not significantly different from p , while p , was not significantly different from p . The best PGPR dose was shown in the treatment p , 10 ml / l water and p , 15 ml / liter water.

3. Discussion
Chicken Cage Fertilizer dosage treatment and Plant Growth Promoting Rhizobacteria showed an interaction on the parameter of the number of leaves aged 28 days and 35 days. The best interaction was shown by the treatment of 20 ton / ha Chicken Manure and 10 ml / l PGPR of water. This is presumably because the Chicken Manure involved higher nitrogen than manure another and coupled with the provision of PGPR, can help optimize plant in getting enough nutrients for the growth phase. In addition, the addition of PGPR which contains bacteria can react well with manure so that the nutrient content contained in the soil can provide good food for shallot plants. In accordance with the opinion of Wedhastri [11], Azotobacter sp. requires energy sources such as carbon and phosphate to fix nitrogen. Manure plays a role in increasing soil fertility through its function as a nutrient provider for Azotobacter sp. availability of nutrition for Azotobacter sp. can help optimize its role in maintaining or increasing soil fertility. In line with the opinion of Dwi and Sudiarso [8], organic chicken manure also acts as a source of energy and food for PGPR microbes so that it can increase the microbial activity in the supply of plant nutrients. So the addition of organic chicken manure in addition to being a source of nutrients for plants, as well as a source of energy and nutrients for microbes.

The provision of chicken manure fertilizer had a significant effect on the average plant height of 14 days and 35 days of age, tuber diameter, average tuber wet weight per hill, and average tuber dry weight per hill. Treatment dose of chicken manure 10 tons / ha is the best dose compared to other doses. This is because the content of chicken manure can increase the growth and yield of shallot plants. Organic fertilizers play a role in improving the physical properties of the soil, such as structure, consistency, porosity, water binding capacity, and maintaining soil resistance to erosion. Organic fertilizers also contain growth hormones from the auxin and gibberellins which are capable of stimulating growth from sprouts to fruiting [12]. In addition, chicken manure is a good source of macro and micro nutrients and is able to increase soil fertility and become a substrate for soil microorganisms and increase microbial activity so that it decomposes more quickly so that even at a dose of 10 tonnes / ha, the availability of nutrients can filled for use by plants [13].

Giving chicken manure with a higher dose does not guarantee that plants will grow better or give higher yields, especially if internal and external factors such as the environment are less supportive. The ability of plants to absorb different nutrient content, when onion plants given a dose of 10 tonnes of chicken manure / ha are able to grow better than those given 20 tonnes / ha of chicken manure, then the nutrient adequacy zone needed by onion plants red only up to the limit dose of 10 tonnes / ha and when given a dose of 20 tonnes / ha the growth of shallot plants actually decreases. According to Aris [14], the application of fertilizer must be in the right amount so that optimal results are obtained in the growth of shallot plants. This is also supported by the research results of Siti et al. [15] that the dose of chicken manure of 10 tons / ha is able to provide nutrients needed by shallot plants so that they can be used in the process of growth and development of shallots.

The provision of Plant Growth Promoting Rhizobacteria had a significant effect on all observed parameters. The PGPR dose treatment of 10 ml / liter of water was the best dose compared to other doses. This is because PGPR is able to increase the growth and yield of shallot plants. With the presence of bacteria contained in PGPR, it is able to anchor, dissolve and provide nutrients needed by plants, so that giving PGPR to shallot plants can produce significant changes for the growth and yield of shallot plants.

Based on the results of research on the application of PGPR followed by increased
growth and yield on shallot plants, it can indicate that the bacteria contained in PGPR are effective in helping to increase nutrient absorption by plants and are able to produce growth hormones so that it can be beneficial for metabolism and physiological processes of shallot plants. In line with Vacheronet’s statement [16] states that in increasing plant growth, PGPR has several roles, namely as a biostimulant in synthesizing and regulating the concentration of various growth regulators (phytohormones) such as cytokines, auxins and gibberellins, as a biofertilizer in providing nutrients such as nitrogen fixation and dissolves phosphate nutrients so that it is easily absorbed by plants, as a bioprotectant by producing various anti-pathogenic metabolites. This is also supported by Iswati’s statement [17] that PGPR bacteria can provide benefits in plant physiology and growth processes such as producing and changing the concentration of various plant growth-promoting phytohormones, increasing the availability of nutrients for plants by providing and mobilizing nutrient absorption in the soil and suppressing development. pests or diseases.

Giving PGPR on the growth component of the average number of leaves aged 28 days and 35 days was able to stimulate growth in both plant height and number of leaves. This is because the provision of PGPR is able to stimulate the growth of plant root systems and inhibit harmful bacterial fungi, and is able to optimize the absorption and utilization of nutrients and the vegetative phase. Yield components such as the number of tubers per clump, the number of tillers per clump, tuber diameter, average wet weight and average dry weight of tubers per clump, can be affected by the provision of PGPR. The increase in the number of tubers will be in line with the increasing number of tillers, this is due to the hormones produced by PGPR. According to Putra [18] PGPR can produce IAA, cytokinins, and gibberellins which are important hormones in stimulating plant growth. Cytokinins and gibberellins both function in spurring plant growth in cell division to form new plant organs and cell extension so that these two hormones influence the number of onion plant tillers.

The diameter of the tuber is usually determined by the number of layers that make up the tuber, which is caused by the leaves that stick together and form the tuber so that the more layers that make up the tuber, the larger the diameter that is formed. According to Sumarni [19] onion bulbs are formed from layers of leaves that stick together and enlarge to form tubers. The average tuber wet weight and the average dry weight of the tubers in this study showed the effect of providing PGPR. This is due to the results of photosynthate obtained from the photosynthesis process. In addition, due to the optimal growth of shallot plants, increased photosynthesis yields followed by an increase in tuber development to a maximum so as to increase yields. The results of Imam's research [20] the treatment of P. flourescens and P. polymyxa with a solution concentration of 10 ml / l showed that it was the best treatment based on the results of the dry and wet weight analysis of tubers. It is assumed that the dry weight will be directly proportional to the wet weight if the drying temperature is the same as the other treatments.

4. Conclusion
Based on the research results, it can be concluded as follows:
1. There was an interaction between the dose of 20 ton / ha of chicken manure and 10 ml / l of PGPR of water on the average number of leaves (strands) at the age of 28 dap and 35 dap.
2. Chicken manure treatment of 10 tonnes / ha gave the best results and had a significant effect on the growth and yield of shallots on the parameters of average plant height, tuber diameter per tuber, average tuber wet weight per hill and average dry weight per hill.
3. PGPR treatment of 10 ml / l of water gave the best results and had a significant effect on all parameters.
REFERENCES

[1] Surnyani, N. 2011. Onions Bring Profits. Cultivation of Shallots and Shallots. Atma Pustaka's light. Yogyakarta. Retrieved December 6, 2019.

[2] A’an, AM, & M, MD (2019). The Effect of Organic-Inorganic Fertilizer Composition and the Concentration of Giving PGPR on the Growth and Yield of Shallots (Allium cepa L. var. Ascalonicum) Bauji Variety , Faculty of Agriculture, Brawijaya University. East Java. 7 (3): 392 – 399

[3] Hasibuan, BE, 2006. Pupuk dan Pemupukan. USU Press. Field.

[4] Pradana N. T , Elfarisna, and Rosdiana . 2012. Response to Growth and Production of Tomato Plants (Lycopersicon e sculentum Mill.) Against Dose of Chicken Manure and Doses of NPK Fertilizer . Proceedings of the National Seminar on Mathematics, Science and Technology. Volume 4, Year 2013

[5] Melati, M., and W, Andiyani. 2005. The Effect of Chicken Manure and Green Fertilizer Calopogonium mucunoides on the Growth and Production of Organic Cultivated Young Soybean. Argohorti Bulletin . 33 (2): 8-15

[6] Compant, S., B. Duffy, J. Nowak, C. Cle’Ment, and EDA Barka 2005. Use of Plant Growth Promoting Bacteria for Biocontrol of Plant Diseases: Principles, Mechanisms of Action, And Future Prospects. Applied and Envimrental Microbiology 72 (9): 4951-4959.

[7] Kusumadewi. 2011. Selection of Plant Growth Promoting Rhizobacteria for Control. http://repository.ipb.ac.id. Downloaded December 6, 2019.

[8] Dw, N., S. and Sudiarso 2018. Application of Chicken Cage Fertilizer and PGPR (Plant Growth Promoting Rhizobacteria) on the Growth and Yield of Soybean (Glycine max (L.) Merril).

[9] Yuda, P, P., Setyono, Y T., Nunun, B. 2017. The Effect of Plant Growth Promoting Rhizobacteria (PGPR) and Chicken Manure on Growth and Yield of Beans ( Phaseolus vulgaris L.). Faculty of Agriculture, Universitas Brawijaya. 5 (11): 1087-1815

[10] Mustofa, A. 2007. Changes in the Physical, Chemical and Biological Characteristics of Soil in Natural Forests which are Transformed into Agricultural Land in the Gunung Leuser National Park. (Thesis). Bogor. Faculty of Forestry, Bogor Agricultural University.

[11] Wedhasstri S. 2002. Isolation and Selection of Azotobacter spp. Producing Growth Factors and Nitrogen Fixing from Acidic Soils. Journal of Soil Science and an Environmental n. III (1).

[12] Purba, JH , Sasmita, N., Komara, LL, & Nesi mmasi, N. (2019). Comparison of seed dormancy breaking of Eusideroxylon zwageri from Bali and Kalimantan soaked with sodium nitrophenolate growth regulator. Nusantara Bioscience, 11 (2), 146–152. https://doi.org/10.13057 / nusbiosci / n 110206

[13] Silalahi M. J , A. Rumambi, Malcky. M . Telleng, WB Kaunang . 2018. The Effect of Chicken Coop Fertilizer on the Growth of Sorghum as Feed. Sam Ratulangi University Manado , 38 (2 ) : 286 - 295

[14] Aris, M. 2005. The Effect of Organic Fertilizer from Municipal Waste on the Growth and Yield of Shallots. Thesis. Faculty of Agriculture. Tadulako University. Hammer

[15] Siti Aisyah, Hapsoh, Erlida Ariani. 2018. The Effect of Several Types of Manure and NPK on the Growth and Yield of Shallots ( Allium ascalionicum L.) Department of Agrotechnology, Faculty of Agriculture, Riau University.

[16] Vacheron, J., G. Desbrosses, ML Bouffauid, B. Touraine. 2013. Plant Growth Promoting Rhizobacteria and Root System Functioning. University of de Lyon. France.Journal Frontie rs in Plant Science 4 (356): 1-4.

[17] Iswati, R. 2012. The Effect of Dose Formula PGP R from Bamboo Roots on the Growth
of Tomato Plants (Solanum lycopersicum syn). Journal of Agrotechnology, State University of Gorontalo 1 (1): 9–12.

[18] Son, IA and H. Hanum. 2018. Study of Antagonism of K, Ca and Mg in Inceptisol Soil Applied with Manure, Dolomite and KCl Fertilizer on the Growth of Sweet Corn (Zea mays saccharata L.). Journal of Islamic Science and Technology. 4 (1): 23-44.

[19] Sumarni N, Rosliani R and Suwandi. 2012. Optimization of Plant Distance and Dosage of NPK Fertilizer for Onion Production from Mini Bulbs in the Highlands. Vegetable Crops Research Institute. Bandung. Journal of Horticulture 22 (2): 148-155.

[20] Imam, S. N., Dadi, N. Atak, T. 2018. The Influence of Various Concentrations of Biological Agent Solutions on the Attack of Purple Spot (Alternaria porri), Growth and Yield of Shallots (Allium ascalonicum L.) Faculty of Agriculture, University of Garut. 3 (1): 2548-7752.