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THE EFFECT OF BAMBOO'S ROOT PGPR CONCENTRATION AND ROW SPACING ON GROWTH AND YIELD OF KIDNEY BEAN (Phaseolus vulgaris)

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Abstract

The experiment aims to know and learn an interaction of bamboo's root concentration and row spacing on growth and yield of kidney bean (Phaseolus vulgaris). This experiment was carried out at Gunungmanik Village, in the sub district Tanjungsari Sumedang from May until July 2016. The altitude is about 800 meters above sea level, soil order andisol with pH 6,41 and types of rainfall is C (dampy). Design was used as Randomized Block Design (RBD) composed of two factor treatments with two replications. First factor was concentration of PGPR (Plant Growth Promoting Rhizobacteria) bamboo's root with four level of treatment, namely is p_0 *= 0 ml* L^{-1} *solution,* p_1 *= 5 ml* L^{-1} *solution,* p_2 *= 10 ml* L^{-1} *solution, and* p_3 *= 15 ml* L^{-1} *solution and row spacing with four level of treatments, namely is :* j_1 *= 20 cm x 20 cm,* j_2 *= 30 cm x 20 cm,* j_3 *= 40 cm x 20 cm, dan* j_4 *= 50 cm x 20 cm. The result of the experiment showed there are interaction between concentration of PGPR bamboo's root and row spacing to plant height age 35 DAP. The result observation of growth shows the highest of plant height on giving concentration of PGPR bamboo's root 15 ml* L^{-1} *solution accompanied row spacing 40 cm x 20 cm (*p_3j_3*) that is 74,1 cm, while on observation result shows wet weight of the seeds on giving concentration PGPR bamboo's root 5 ml* L^{-1} *solution that is 3259,27 g and the use of row spacing 20 cm x 20 cm that is 4222,69 g. The effects bamboo's root PGPR concentration and row spacing to plant height, number of leaves, numbers of pod per plot, numbers of seed per plot, wet weight of the seeds (pods), dry weight of the seeds (pods), wet weight of the seeds (without pods), dry weight of the seeds (without pods), and weight of 100 grains*.

Keywords: bamboo's root, kidney bean

Introduction

Kidney beans (*Phaseolus vulgaris* L.) is one of the vegetables are quite popular and widely cultivated and can be used as an alternative to meet the needs of vegetable world population continues to increase in line with population growth. Nuts have long been known as a protein source that is complementary with grains, such as rice and wheat. Commodities also turns potential as a source of other nutrients, namely minerals, B vitamins, complex carbohydrates and dietary fiber. Due to the high fiber content, the nuts also can be used as a source of fiber [1]. Red bean is one of many vegetables is favored because it feels good, tasty and rich in vitamin A, vitamin B, and vitamin C, especially in the seeds.

Red bean cultivation in Indonesia has expanded to various areas. In Indonesia, especially in West Java, the area under cultivation of beans decreased from 2005 to 2009, as in 2005 from 11,901 ha to 10,618 ha in 2009 [2]. According to data from the Central Statistics Agency [3], the production of red beans fluctuates from year to year, which is thought to be caused by several factors including the age and cultivar, soil fertility, high place of investment, climate (growing season), genetic trait, pests and diseases and how cultivation (fertilization yet precise and spacing). To increase crop yields per unit area of red beans must consider the level of soil fertility, especially organic matter content in the soil.

According to Effi Ismawati Musnamar [4], the number of productive agricultural land is already diminishing, the fertility of agricultural land is also declining so that a marginal land, to resolve the issue use organic fertilizers so that fertility can be maintained. Therefore, one way to increase the production of red bean plant is environmentally friendly fertilization as a biological fertilizer and organic fertilizer. Biological fertilizer and organic fertilizer with a variety of processes that support each other in soil fertility and also conserve and nourish the soil ecosystem and prevent possible environmental pollution [5].

Rhizobakteri boosters grow crops or more popularly known as Plant Growth Promoting Rhizobacteria (PGPR) are the beneficial bacteria that are actively colonize the rhizosphere live and thrive in soil that is rich in organic matter [6]. These bacteria are known to actively colonize plant roots in the area and has three main roles for plants [7], namely:

1. As biofertilizer, PGPR is able to accelerate the process of plant growth by accelerating the absorption of nutrients,

2. As biostimulan, PGPR can stimulate plant growth through production fitohormon consisting of IAA (Indole Acetid Acid), cytokinins and gibberellins,
3. As bioprotektan, PGPR may serve to suppress and inhibit the development of plant pests and diseases and protect plants from pathogens.

According to Sri Setyati Harjadi [8] spacing that is set on a plot of land plant layout to reduce the competition for nutrients, sunlight and other factors. Spacing is important, because it determines the amount of the population that is planted which will further affect the crop production. Spacing is one package of cultivation technology useful in suppressing the growth of weeds, reduces erosion of soil and cut the life cycle of pests and diseases. The denser the weed plants are not given the opportunity to grow. The meeting these plants can also reduce soil erosion, because rainwater does not immediately fall to the ground but first detained by the crowns of plants. Based on the above background, the research on the effect of the concentration of PGPR (Plant Growth Promoting Rhizobacteria) bamboo root and plant spacing on growth and yield of kidney bean (Phaseolus vulgaris L.) is necessary as part of efforts to increase crop yields red beans. The purpose of this research was to study the effect of the interaction between PGPR concentration bamboo root and plant spacing on growth and yield of red beans are expected to deliver growth and yield the best red beans in order to increase production of red beans in Indonesia can be achieved.

Experimental

This experiment was conducted in the village of Gunungmanik, Tanjungsari, Sumedang district, at an altitude of 800 meters above sea level, the order Andisol soil and precipitation type is C (rather wet) according to the classification of Schmidt and Ferguson [9] in Ance Gunarsih Kartasapoetra [10]. This experiment was conducted in May through July 2016. The material to be used in this experiment is the land as growing media, seeds of red beans, PGPR Roots Bamboo (bamboo root, sugar, shrimp paste, fine bran, water, flavor/MSG), sheep manure, fertilizer NPK Phonska, insecticides Curacron 500 EC and fungicide Dithane M-45 80 WP. Tools that will be used is the hoe, scales, thermometer, stationery, bucket, bailer, basins, plastic drum, clear plastic, camera, measuring cups, hand sprayer, aerator, newsprint, nameplate trial, and the length measuring tools.

The experiment was conducted in field trials and using a Randomized Block Design (RBD) factorial pattern with two factors, namely treatment of PGPR concentration bamboo root treatment consists of 4 levels and spacing consists of 4 levels of treatment. Combination treatment of as many as 16 in combination with two replications. The design of the treatment is as follows:

Factor 1: PGPR bamboo's root concentration (P) with 4 levels of treatment, namely: p_0 = 0 ml L^{-1} solution, p_1 = 5 ml L^{-1} solution, p_2 = 10 ml L^{-1} solution, and p_3 = 15 ml L^{-1} solution

Factor 2: Spacing (J) with 4 levels of treatment, namely: j_1 = 20 cm x 20 cm, j_2 = 30 cm x 20 cm, j_3 = 40 cm x 20 cm, and j_4 = 50 cm x 20 cm

The main observation is the observation that the data were statistically tested, using a sample of each treatment plant. The main observations include: high plant, number of leaves per plant, number of pods per plot, number of seeds per plot, wet weight of seed (with pods) per plot, weight of dry beans (with pods) per plot, weight wet beans (without pods) per plot, weight of dry beans (without pods) per plot, and weight of 100 grains. Testing continued with two different test average of treatments, using Duncan Multiple Range Test (Duncan's Multiple Range Test) at the 5% significance level.

Result and Discussion

Plant Height.

The results of the analysis in Table 6 shows the bamboo's root PGPR treatment gives a significantly different effect on plant height than the control at each age observations.

Table 1. Effect of Bamboo's Root PGPR Concentration and Row Spacing to Plant Height of Red Beans at age 14 DAP, 21 DAP and 28 DAP

Treatments	The Average of Plant Height (cm)		
	14 DAP	**21 DAP**	**28 DAP**
PGPR Concentration			
p_0 (0 ml L^{-1} solution)	23,99 a	38,89 a	48,65 a
p_1 (5 ml L^{-1} solution)	29,73 b	44,17 b	56,06 b
p_2 (10 ml L^{-1} solution)	29,38 b	43,71 b	55,11 b
p_3 (15 ml L^{-1} solution)	29,42 b	44,07 b	56,24 b
Row Spacing			
j_1 (20 cm x 20 cm)	28,71 a	43,05 a	54,89 a
j_2 (30 cm x 20 cm)	28,77 a	42,76 a	54,84 a
j_3 (40 cm x 20 cm)	27,67 a	43,07 a	53,90 a
j_4 (50 cm x 20 cm)	27,37 a	41,95 a	52,43 a

Description: The average number of treatments that are marked with the same letter in the same column showed no significant based on Duncan's Multiple Range Test at the 5% significance level

Table 2. Effect of Bamboo's Root PGPR Concentration and Row Spacing to Plant Height of Red Beans at age 35 DAP

PGPR Concentration	Row Spacing			
	j_1 (20 cm x 20 cm)	**j_2 (30 cm x 20 cm)**	**j_3 (40 cm x 20 cm)**	**j_4 (50 cm x 20 cm)**
p_0 (0 ml L^{-1} solution)	61,94 a A	59,99 a A	60,14 a A	57,44 a A
p_1 (5 ml L^{-1} solution)	70,82 b AB	73,43 c B	65,73 b A	68,44 b AB
p_2 (10 ml L^{-1} solution)	65,73 b B	69,2 bc B	67,48 b AB	63,84 b A
p_3 (15 ml L^{-1} solution)	69,15 b AB	67,26 b A	74,10 c B	68,89 b AB

Description: The average number of treatments that are marked with small letters (the vertical direction) in the same column and capital letters (the horizontal direction) on the same line showed no significant based on Duncan's Multiple Range Test at the 5% significance level

Based on Table 1 showed that there is no interaction between bamboo's root PGPR concentration and row spacing to average plant height at each observation period. Independent effects bamboo's root PGPR treatment showed significant among treatment at 14 DAP, 21 DAP and 28 DAP. Independent effects a spacing showed that in all the different treatment is not real. The influence real difference to the observation of plant height at each period of observation showed that the concentration of PGPR bamboo's root can provide a good influence on the growth of plants, because in PGPR bamboo's root, there are elements of macro and micro nutrients required by plants is also the presence of bacteria beneficial for plants, one of which is *Rhizobium* sp. (5.05 x 107 CFU/ml) in which the use of Rhizobium as a biological fertilizer has good prospects because it can increase the productivity of the soil, helps nutrient leaching process, and increase the carrying capacity of the soil as a result of low microbial activity, to the Rhizobium bacteria have a positive impact either directly or indirectly on the physical and chemical properties of the soil, thus increasing soil fertility.

Based on Table 2 showed that the interaction between PGPR concentration bamboo's root and row spacing on the plant height at age 35 HST. The results showed the level of treatment p_0 has no significant effect on the level of treatment j_1, j_2, j_3, and j_4. The level of treatment p_1 has no significant effect on the level of treatment j_3, and j_4 but has significant effect on the level of treatment j_1 and j_2. The level of treatment p_2 influential not evident the level of treatment j_3, and j_4 but has significant effect on the level of treatment j_1 and j_2 and the level of treatment p_3 has not significant effect on the level

of treatment j_1, j_2 and j_4 but has significant effect on the level of treatment j_3.

The treatment j_1 has not significant effect on the level of treatment p_0 but has significant effect on the level of treatment p_1, p_2, and p_3. The level of treatment j_2 has not significant effect on the level of treatment p_0 but has significant effect on the level of treatment p_1, p_2, and p_3. The level of treatment j_3 has not significant effect on the level of treatment p_0 but significant effect on the level of treatment p_1, p_2, and p_3, and standard treatment j_4 has not significant on the level of treatment p_0 but has significant effect on the level of treatment p_1, p_2, and p_3.

Award PGPR concentration bamboo's root 15 ml L^{-1} solution that accompanied the use of a spacing of 40 cm x 20 cm (p_3j_3) give better effect to the plant height. This is due to the growth of plants is influenced by several factors, including growing space, sunlight and nutrients. PGPR concentration on providing high bamboo root (15 ml L^{-1} solution) gives a high yield of crops is 74.1 cm, it is suspected the ability PGPR bamboo roots make plants produce phytohormones add surface area of fine roots and increase the availability of nutrients in the soil. Masnilah research results [11] indicate that treatment of PGPR can increase root growth of soybean plants compared with controls. This causes the absorption of nutrients and water can be done so that the health of the plant is also getting better. PGPR can improve plant growth directly through growth hormones produced as Giberelin (Gac) and indole 3-Acetid Acid (IAA).

The Number of Leaves per Plant.

The results of the analysis in Table 3 shows that treatment PGPR bamboo roots provide no significant effect at 14 DAP, 21 DAP and 28 DAP except at age 35 DAP. While the spacing of treatments provide similar effects at age 21 DAP, 28 DAP and 35 DAP except at the age of 14 DAP.

Based on Table 3 shows no interaction between PGPR concentration bamboo root and ros spacing on the average number of leaves per plant in each period of observation. Effects standalone treatment PGPR bamboo roots in the observations of 14 DAP, 21 DAP and 28 DAP showed different effects are not noticeable, whereas the observation of 35 DAP, treatment p_1 significantly different from p_0, p_2, and p_3 but between p_0, p_2, and p_3 are not significant. The number of leaves is highest at treatment concentrations PGPR bamboo roots p_1 (5 ml L^{-1} solution). This is due to the increased concentration of bamboo root PGPR applied, also increased nutrients and microorganisms contained in soil that can be absorbed by plants thereby increasing the formation of leaves for photosynthesis increases with the availability of nutrients. Sufficient availability of nutrients allows optimum photosynthesis and assimilates produced can be used as a backup food for plant growth and development, because the food reserves in the network more it will allow the formation of leaves much anyway.

Table 3. Effect of Bamboo's Root PGPR Concentration and Row Spacing to the Number of Leaves per Plant of Red Beans at Age 14 DAP, 21 DAP, 28 DAP, and 35 DAP

Treatments	The Average of The number of Leaves per Plant			
	14 DAP	**21 DAP**	**28 DAP**	**35 DAP**
PGPR Concentration				
p_0 (0 ml L^{-1} solution)	0,38 a	2,10 a	4,43 a	7,43 a
p_1 (5 ml L^{-1} solution)	0,60 a	2,45 a	5,20 a	10,48 b
p_2 (10 ml L^{-1} solution)	0,58 a	2,60 a	5,20 a	9,03 a
p_3 (15 ml L^{-1} solution)	0,60 a	2,55 a	5,15 a	9,28 a
Row Spacing				
j_1 (20 cm x 20 cm)	0,55 b	2,38 a	5,00 a	8,88 a
j_2 (30 cm x 20 cm)	0,68 b	2,60 a	5,30 a	9,75 a
j_3 (40 cm x 20 cm)	0,55 b	2,43 a	5,08 a	8,78 a
j_4 (50 cm x 20 cm)	0,38 a	2,30 a	4,60 a	8,80 a

Description: The average number of treatments that are marked with the same letter in the same column showed no significant based on Duncan's Multiple Range Test at the 5% significance level

Table 4. Effect of Bamboo's Root PGPR Concentration and Row Spacing to the Number of Pods and Seeds per Plot

Treatments	The Average of the number of Pods Per Plot	The Average of the Number of Seeds per Plot
PGPR Concentration		
p_0 (0 ml L^{-1} solution)	335,78 a	1148,55 a
p_1 (5 ml L^{-1} solution)	531,53 b	1988,63 b
p_2 (10 ml L^{-1} solution)	518,78 b	1937,40 b
p_3 (15 ml L^{-1} solution)	527,40 b	1919,25 b
Row Spacing		
j_1 (20 cm x 20 cm)	695,25 c	2558,25 c
j_2 (30 cm x 20 cm)	547,50 b	2008,50 b
j_3 (40 cm x 20 cm)	361,13 a	1326,38 a
j_4 (50 cm x 20 cm)	309,60 a	1100,70 a

Description: The average number of treatments that are marked with the same letter in the same column showed no significant based on Duncan's Multiple Range Test at the 5% significance level of root system

Table 5. Effect of Bamboo's Root PGPR Concentration and Row Spacing to Wet and Dry Weight Beans (with pods) per Plot

Treatments	The Average of Wet Weight Beans (with pods) per Plot (g)	The Average of Dry Weight of Beans (with pods) per Plot (g)
PGPR Concentration		
p_0 (0 ml L^{-1} solution)	2078,27 a	644,28 a
p_1 (5 ml L^{-1} solution)	3259,27 b	1058,60 b
p_2 (10 ml L^{-1} solution)	3147,70 b	1068,29 b
p_3 (15 ml L^{-1} solution)	3116,06 b	1038,54 b
Row Spacing		
j_1 (20 cm x 20 cm)	4222,69 c	1372,16 c
j_2 (30 cm x 20 cm)	3351,38 bc	1113,60 b
j_3 (40 cm x 20 cm)	2209,73 b	734,79 a
j_4 (50 cm x 20 cm)	1817,51 a	589,14 a

Description: The average number of treatments that are marked with the same letter in the same column showed no significant based on Duncan's Multiple Range Test at the 5% significance level

The Number of Pods and Seeds per Plot

The results of the analysis in Table 4 shows the bamboo's root PGPR treatment having the same effect on any treatment unless the treatment p_0, while the spacing of treatments have different effects on each treatment unless the treatment j_3 and j_4. Based on Table 4 showed that no interaction between PGPR concentration bamboo roots and row spacing of the number of pods and number of seeds per plot. Independent effects bamboo root PGPR treatments showed significantly different treatment to the treatment p_0, p_1, p_2, and p_3 but between treatment p_1, p_2, and p_3 showed no significant. The treatment p_1 (5 ml L^{-1} solution) shows the results of the average number of pods and number of seeds are best compared to the treatment p_0, p_2, and p_3. This suggests that the increase in the number of pods and number of seeds per plot line with increasing concentrations of PGPR bamboo roots are given, where the provision of the concentration of PGPR root of bamboo has increased the average number of leaves on the same treatment (5 ml L^{-1} solution) which would then be improve the process of photosynthesis. The rate of photosynthesis is high with the state of supportive environment will produce carbohydrates that are used for the formation of pods, therefore it can be said that the more carbohydrates are deposited inside the pod, the more number of pods formed.

Independent effects of row spacing of treatment j_3 and j_4 showed no significant but significantly different from j_1 and j_2 treatment, while the treatment j_1 and j_2 significantly different. In the row spacing is narrower (j_1 20 cm x 20 cm) showed the best results compared to the spacing of the others, it is because the level of competition of crops to nutrients, growing space is low so nutrient and water absorption by plants optimally fulfilled.

The Wet and Dry Weight Beans (with Pods) per Plot

The results of the analysis in Table 5 shows the bamboo's root PGPR treatment having the same effect on any treatment unless the treatment p_0, while the spacing of treatments have different effects on each treatment unless the treatment j_3 and j_4. Based on Table 5 showed no interaction between PGPR concentration bamboo roots and row spacing of the fresh weight and dry weight of seed (with pods) per plot. Independent effects bamboo root PGPR treatments showed significantly different treatment to the treatment p_0, p_1, p_2, and p_3 but between treatment p_1, p_2, and p_3 showed no significant. The treatment p_1 (5 ml L^{-1} solution) showed an average yield of fresh weight seeds (with pods) can be best compared to the treatment p_0, p_2, and p_3 is 3259.27 g and p_2 treatment (10 ml L^{-1} solution) shows results the average weight of dried beans (with pods) can be best compared to the treatment p_0, p_2, and p_3 is 1068.29 g.

Fresh weight and dry weight of seed (with pods) is not off to do with the number of pods and number of seeds per plot, it is indicated that the number of pods per plot, number of seeds per plot and wet weight of the seeds (with pods) per plot is affected by the treatment concentration PGPR bamboo root the same, namely p_1 (5 ml L^{-1} solutions) and p_2 (10 ml L^{-1} solution) to dry weight of seed (with pods) per plot, in which all elements of subsistence crops such as light, water, air and nutrients are met optimally so that the provision of PGPR concentration bamboo roots have improved the process of photosynthesis and carbohydrate accumulation is suspected that high during the formation of the seeds so fotosintat collected on each item of red beans will affect the weight per nut. The mechanism is directly conducted by PGPR bamboo root that is by synthesizing metabolites, for example compounds that stimulate the formation of such fitohormon acetid indole acid (IAA) or by increasing the capture plant nutrients.

Independent effects spacing of treatment j_3 and j_4 showed no significant but significantly different from j_1 and j_2 treatment, while the treatment j_1 and j_2 significantly different. Treatment j_1 (20 cm x 20 cm) showed an average yield of fresh weight seeds (with pods) can be best compared to the treatment j_2, j_3, and j_4 is 4222.69 g and treatment j_1 (20 cm x 20 cm) shows the mean results average seed dry weight (with pods) can be best compared to the treatment j_2, j_3, and j_4 is 1372.16 g. At a row narrower showed the best results, although the level of competition of crops to nutrients, sunlight and space to grow high, but the spacing is narrower (20 cm x 20 cm) a population of more than a spacing wide so that the number of pods and number of seeds produced more responses and the resulting weight was higher than others.

The Wet and Dry Weight Beans (without Pods) per Plot

The results of the analysis in Table 6 shows the bamboo's root PGPR treatment having the same effect on any treatment unless the treatment p_0, while the spacing of treatments have different effects on each treatment unless the treatment j_3 and j_4.

Table 6. Effect of Bamboo's Root PGPR Concentration and Ros Spacing to Wet and Dry Weight Beans (without pods) per Plot

Treatments	The Average of Wet Weight Beans (without pods) per Plot (g)	The Average of Dry Weight Beans (without pods) per Plot (g)
PGPR Concentration		
p_0 (0 ml L^{-1} solution)	1532,01 a	509,66 a
p_1 (5 ml L^{-1} solution)	2121,63 b	827,57 b
p_2 (10 ml L^{-1} solution)	2146,43 b	849,14 b
p_3 (15 ml L^{-1} solution)	2019,05 b	811,09 b
Row Spacing		
j_1 (20 cm x 20 cm)	2953,69 c	1087,31 c
j_2 (30 cm x 20 cm)	2090,78 bc	880,88 b
j_3 (40 cm x 20 cm)	1536,30 b	571,89 a
j_4 (50 cm x 20 cm)	1238,36 a	457,38 a

Description: The average number of treatments that are marked with the same letter in the same column showed no significant based on Duncan's Multiple Range Test at the 5% significance level

Table 7. Effect of Bamboo's Root PGPR Concentration and Ros Spacing to The Weight of 100 Grains

Treatments	The Average of the Weight of 100 Grains (g)
PGPR Concentration	
p_0 (0 ml L^{-1} solution)	47,90 a
p_1 (5 ml L^{-1} solution)	46,10 a
p_2 (10 ml L^{-1} solution)	48,93 a
p_3 (15 ml L^{-1} solution)	47,26 a
Row Spacing	
j_1 (20 cm x 20 cm)	46,49 a
j_2 (30 cm x 20 cm)	48,69 a
j_3 (40 cm x 20 cm)	49,08 a
j_4 (50 cm x 20 cm)	45,94 a

Description: The average number of treatments that are marked with the same letter in the same column showed no significant based on Duncan's Multiple Range Test at the 5% significance level

Based Table 6 showed no interaction between PGPR concentration bamboo roots and row spacing of the fresh weight and dry weight of beans (without pods) per plot. Independent effects bamboo root PGPR treatments showed significantly different treatment to the treatment p_0, p_1, p_2, and p_3 and between treatment p_1, p_2, and p_3 showed no significant. The treatment p_2 (10 ml L^{-1} solution) showed an average yield of fresh weight and dry weight of beans (without pods) are best compared to the treatment p_0, p_2, and p_3 are 2146,43 g and 849,14 g. Red bean plants using Rhizobium will produce nitrogen that play a role in the process of photosynthesis and nitrogen produced will increase if rainfall is heavy because soil bacteria will increase its activity in the form of nitrogen. Assimilates produced by photosynthesis will be used for pod filling and at this time also takes a long radiation. Rao (1994), stating the effective root nodules capable of fixing N from the air and converts N into amino acids to be donated to the red bean plants.

Independent effects spacing of treatment j_3 and j_4 showed no significant but significantly different from j_1 and j_2 treatment, while the treatment j_1 and j_2 significantly different. The treatment j_1 (20 cm x 20 cm) showed an average yield of fresh weight seeds (without pods) can be best compared to the treatment j_2, j_3, and j_4 is 4222.69 g and treatment j_1 (20 cm x 20 cm) shows the mean results average seed dry weight (without pods) can be best compared to the treatment j_2, j_3, and j_4 is 1372.16 g. At a spacing narrower showed the best results, although the level of competition of crops to nutrients, sunlight and space to grow high, but the row spacing is narrower (20 cm x 20 cm) a population of more than a spacing wider so that the number of pods and number of seeds produced more responses and the resulting weight was higher than others.

The Weight of 100 Grains

The results of the analysis in Table 7 shows the bamboo's root PGPR treatments do not provide any real effect on each treatment. Effect of self-treatment effect of PGPR concentration bamboo roots showed that the treatment had no significant p_0 with treatment p_1, p_2, and p_3. Based on Table 7 showed no interaction between PGPR concentration bamboo roots and row spacing of the weight of 100 grains per plot. Effects standalone treatment concentration PGPR bamboo root and plant spacing showed that all treatments had no significant, but treatment p_2 (10 ml L^{-1} solutions) and j_3 (40 cm x 20 cm) shows average yield weight of 100 grains are best compared to treatment p_0, p_1 and p_3 is 48.93 g and 49.08 g. This is because the number of fotosintat accumulated in seeds produced per plant more than the other treatments, this shows that the photosynthetic activity in the treatment more effective.

Generally, growth and yield of red beans at a distance tanama narrower give lower yields, it relates to competition in the plants get nutrients, water, light and air. However, from the results of experiments conducted apparently showing also the same circumstances, ie lower yields when row spacing is wider (50 cm x 20 cm) with results of 45.94 g. Allegedly this is not because the level of competition the plant in getting the necessities of life, but the chance of plants to pollinate smaller, and also it is technically the number of plant population less per unit area will produce more results than the number of the populations were relatively more.

Conclusion

Based on the results of experiments that have been done can be concluded. There was an interaction between PGPR konsentrsi bamboo root and plant spacing on the plant height at age 35 dAP. The observation of plant growth showed the highest height is the provision of PGPR concentration bamboo roots 15 ml L^{-1} solution that accompanied the use of a spacing of 40 cm x 20 cm (p_3j_3) is 74.1 cm, while on the observation results show the top results in the wet weight of the seeds PGPR concentration is on providing bamboo roots 5 ml L^{-1} solution of 3259.27 g and that the use of spacing of 20 cm x 20 cm is 4222.69 g. Effect bamboo root PGPR concentration independent and independent effects a spacing effect on plant height, number of leaves per plant, number of pods per plot, number of seeds per plot, weight of wet seeds (with pods) per plot, seed dry weight (with pods) per plot, the weight of wet beans (without pods) per plot, weight of dried beans (without pods) per plot and weight 100 grains.

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