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Rhizobacteria Treatment as Plant Growth Promotion for Growth and Yield of Soybean (*Glycine max* L.)

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Abstract: *This study aims to determine the effect of rhizobacteria treatment of plant growth promoters and soybean plant varieties on the growth and yield of soybean plants. This research was conducted at the Seed and Science Laboratory and Experimental Garden Faculty of Agriculture, Syiah Kuala University. The research will take place from September 2018 to March 2019. Experimental Rhizobacteria treatment as Plant Growth Promotion on the growth and yield of soybean plants using a randomized block design factorial pattern. Factors studied were 10 rhizobacterial isolates and 2 soybean plant varieties. The experiment was repeated three times. The parameters observed were plant height, number of leaves and stem diameter at 15, 30 and 45 days after planting, and yield potential. While the analysis of the physiological characteristics rhizobacteria (IAA production, Siderophore and phosphate solubility) did not use an experimental design. The results showed of the evaluation of the ability of rhizobacterial treatment as plant growth promotion were 2 isolates that were able to produce high IAA growth hormone compared to other rhizobacteria isolates, namely Bacillus megaterium and Bacillus laterophorus, and there were 5 isolates which had the ability to dissolve phosphate, namely Pseudomonas capacia, Pseudomonas dimuta, Bacillus larvae, Bacillus firmus and Bacillus polymixa. While in the ability of rhizobacteria to produce siderophore there are 5 isolates which have the ability to produce siderophore, they are Pseudomonas capacia isolates, Bacillus megaterium, Bacillus laterophorus, Bacillus lichiniformis and Bacillus stearothermophillus, the rest are not able to produce siderophore. Based on the results of the study showed that the treatment of rhizobacteria significantly affected plant height benchmarks 15, 30, 45 days after planting. The type of rhizobacteria at the height of plants aged 15 and 45 days after planting was highest in the type of rhizobacteria Pseudomonas capacia ie at the age of 15 days after planting (17.27 cm) and age 45 days after planting (72 cm). The best rhizobacteria treatment at plant height 30 days after planting was found in the treatment without rhizobacteria that is 44.48 cm. In the treatment of varieties, Anjasmoro varieties showed the best value based on the value of the measurement of plant height growth at the age of 15 days after planting (17.45 cm), 30 days after planting (45.27 cm) and 45 days after planting (70.03 cm) , number of leaves at 15 days after planting (4.69 strands), stem diameter (2.71 cm).*

Keywords: *Bacillus megaterium, isolates, production, Pseudomonas capacia, varieties*

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I. Introduction

Soybean is one of the few high-value food crop commodities in Indonesia. Soybean seeds are used as a source of vegetable protein which is generally used by Indonesian people as raw material for food products such as tofu and tempeh, soybean demand continues to increase in line with an increase in population (Zainal *et al*., 2014).

Soybean is also one of the leading food commodities after rice and corn. The average domestic production over the past five years is 982.47 thousand tons of dry beans, while the need for soybeans is 2.3 million tons of dry beans, this amount is only able to meet around 47% of the national soybean needs. The lack of soybean production causes the government to import soybeans from other countries such as the United States (Indonesian Central Statistics Agency, 2017).

National soybean production from 2013 to 2017 decreased by an average of 6.37% per year. A significant decrease occurred in 2017 of 36.90%, from production in 2016 amounting to 859.65 thousand tons to 542.45 thousand tons in 2017. The decline in production was the impact of reduced soybean harvest area in 2017 by 38.13%, from 2016 amounting to 576.99 thousand hectares to 356.98 thousand hectares in 2017 (Ministry of Agriculture, 2017). Aceh is one of the centers of soybean production in Indonesia, soybean production in Aceh in 2015 amounted to 54,078 tons, the value decreased when compared to production in 2014 which amounted to 63,352. The center of soybean production in Aceh is East Aceh District (Aceh Central Statistics Agency, 2015).

The decline in soybean production in Indonesia is caused by the use of low-quality seeds, the number of pests and diseases and the lack of fertile land resources due to inorganic fertilizer resistance continuously. One of the efforts that can be done to increase the growth and yield of soybean plants is by utilizing rhizobacteria that stimulate plant growth or Plant Growth Promoting Rhizobacteria (PGPR). Syamsuddin (2010) states that rhizobacteria have been widely used as a plant growth promotion and biocontrol agent, this is in line with the increasing human awareness of health and environmental damage due to the use of synthetic chemicals. Aceh Agricultural Technology Assessment Center (2015), recommends two soybean varieties suitable for development in Aceh, namely Anjasmoro and Kipas Merah Bireuen.

Plant growth promoting rhizobacteria or popularly called plant growth promoting rhizobacteria (PGPR) a group beneficial bacteria that colonize rhizosphere (thin soil layers between 1-2 mm around the root zone). Rhizobacterial activity of plant growth promoters benefits plant growth and is able to suppress pathogenic activity by producing various compounds or metabolites such as antibiotics and siderophore (Kloepper *et al*., 1991; Kloepper, 1993; Glick, 1995).

Seed treatment using rhizobacteria has a positive effect on plant growth, i.e. (i) it can prevent the proliferation of pathogens; (ii) providing plant hormones such as auxins and cytokines; (iii) assisting plants in obtaining nutrients such as nitrogen, phosphorus and iron (Glick *et al*., 2007). Some rizobacteric strains that promote plant growth are able to synthesize IAA from precursors (basic ingredients) found in root exudates and from organic matter (plant and animal residues). Indole acetic acid compound is an active form of the auxin hormone found in plants and plays a role in increasing growth and yields (Arshad and Frankenberger, 1993).

Many species and specific strains of rhizobacteria have been studied as plant growth promoting rhizobacteria (PGPR) in plants in several different regions. The role of rhizobacteria as a plant growth promoter includes the genus *Pseudomonas* spp., *Bacillus* spp., *Serratia* spp., *Azotobacter* spp., *Azospirillum* spp., *Acetobacter* spp., *Burkholderia* spp., and several genera *Enterobacteriaceae* known to function as PGPR (Thuar *et al*., 2004; Raj *et al*., 2005). Among the rhizobacterial genus, rhizobacteria of the group *Pseudomonas* spp., and rhizobacteria of *Bacillus* spp. the most widely reported as a driver of plant growth (Adesemoye *et al*., 2008).

Research results Ratnawati (2018) showed that in vitro there were 4 rhizobacterial isolates that had very high inhibitory power (> 75%), namely isolates *Azotobacter* sp., *B. megaterium*, *B. laterophorus*, and *B. coagulans* which could inhibit the growth of pathogenic *Phytium* sp. colonies in chili plants. Pre-planting seed treatment with plant growth promotion rhizobacteria can also improve viability and vigor of better seed growth power until the seedling growth phase.

The results of research conducted by Mardiah (2015) also showed that seed treatment using rhizobacteria can increase the growth of red chilli seedlings. Mardiah *et al*, (2016) stated that several types of rhizobacterial isolates such as *Bacillus lichiniformis*, *Necercia* sp., *Bacillus larvae*, and *Pseudomonas capacia* were effective in increasing the weight of fruit per plant on chili plants. In line with the results of research Harahap (2018) which showed that rhizobacterial treatment can increase the growth and yield parameters of soybean plants such as the number of pods, number of seeds per plant and yield potential.

Ilicic *et al*. (2017) also mentioned that the treatment of several types of bacterial isolates that promote plant growth can increase the growth and yield of soybean plants, all treatments of bacterial isolates showed a positive effect on increasing the number of pods and number of seeds per plant. Ardianto *et al*. (2017) states that the administration of rhizobacteria can also increase plant height and the number of soybean leaves.

In connection with the role of rhizobacteria that can increase growth and yields as a driver of plant growth in soybean there is no information, so it is necessary to conduct in-depth research to determine the effect of rhizobacteria treatment of plant growth promoters on the growth and yield of soybean plants. The purpose of this study was to determine the effect of rhizobacteria treatment of plant growth promoters and soybean plant varieties on the growth and yield of soybean plants.

II. Research Methods

This research was conducted at the Science and Technology Laboratory of Seed and Experimental Gardens at the Faculty of Agriculture, Syiah Kuala University. The study took place in September 2018 to March 2019. This research used factorial randomized block design, namely the treatment of soybean varieties consisting of two varieties, namely Kipas Merah Bireun and Anjasmoro. Rhizobacteria treatment consisted of ten isolates and one control treatment. Research data were analyzed using analysis of variance (ANOVA). If the F test shows a significant effect, then proceed with the Duncan New Multiple Range Test (DNMRT) level of 5%.

Preparation Rhizobacteria Isolates for Rhizobacteria Treatment as Plant Growth Promotion

Rhizobacteria isolates used in this experiment were bacterial isolates from the collection of Seed and Science Laboratory of Syiah Kuala University, type of isolate and the name of the bacteria: 1. *Acitinobacillus Suis*, 2. *Psedomonas capacia*, 3. *Bacillus megaterium*, 4. *Psedomonas dimuta,* 5. *Bacillus laterophorus* , 6.

Bacillus larvae, 7. *Bacillus firmus* 8. *Bacillus polymixa*, 9. *Bacilluslichiniformis*, 10. *Bacillus stearo chermopillus*. The rhizobacterial isolate is an isolate resulting isolation from the roots of healthy red chili plants in the farmers' chilli area of Cipayung District, Bogor Regency, West Java Province.

Seed Treatment with Rhizobacteria as Plant Growth Promotion

Rhizobacterial isolates were grown in solid TSA (*Bacillus* sp.) or King's B (*Pseudomonas* sp.) Medium and incubated for 48 hours. Growing bacterial colonies were suspended in sterile distilled water to reach a population density of 10^9 cfu/ml or equivalent to reading absorbance values OD_{600}=0.164 mm (*Bacillus* sp.) and OD_{600}=0.192 (*Pseudomonas* sp.) using a spectrophotometer.

Observation

1. Plant height is measured at 15, 30, 45 days after planting. Plant height is measured from the base of the stem to the end of the growing point, expressed in units of centimeters (cm).
2. The number of leaves per plant was observed at 15, 30, 45 days after planting. The number of leaves is counted on all leaves that have been fully opened in each plant sample expressed in units of strands.
3. Stem diameter was observed at 15, 30, 45 days after planting. Measurement of stem diameter of soybean plants is done by measuring the diameter in the middle of the stem using calipers, expressed in units of centimeters (cm).
4. Potential yields are observed by weighing the seeds per plant after harvesting at each treatment. Yield per hectare is calculated by converting these values to hectares using the equation:

$$\text{Potential yields } (ton\ ha^{-1}) = \frac{land\ volume\ 1\ ha}{planting\ distance}\ x\ seed\ weigh\ per\ plant$$

III. Result and Discussion

Evaluation of Rhizobacteria Treatment as Plant Growth Promotion

The results of the rhizobacteria treatment test of plant growth promoters show different abilities. Based analysis of the F test showed that the ability of the rhizobacteria isolates tested produced IAA with different contents depending on the type of isolate. All rhizobacterial isolates turned out to have the ability to produce IAA growth hormones in the range of 3.16 μ/ml filtrate to 13.08 μ/ml filtrate (Table 1). There are 2 isolates which are able to produce high IAA growth hormone compared to other rhizobacterial isolates, they are *Bacillus megaterium* and *Bacillus laterophorus* isolates. While other isolates produce IAA with amounts less than 6.63 μ/ml filtrate.

Table 1. Ability to Produce IAA in Media containing Triptophan Amino Acid, Phosphate Dissolving, Producing Siderophore

Rhizobacteria Type	Capability Parameters of Various Rhizobacteria Isolates		
	IAA Content (μ/ml filtrate)**	phosphate solvents *	Producing Siderophore (Abs λ 550 nm)
A. suis (R_1)	5,98	-	0.000
P. capacia (R_2)	5,31	+	0.136
B. megaterium (R_3)	13,64	-	0.137
P. dimuta (R_4)	3,20	+	0.000
B. laterophorus (R_5)	13,08	-	0.119
B. larvae (R_6)	6,63	+	0.000
B. firmus (R_7)	3,45	+	0.000
B. pilymixa (R_8)	5,84	+	0.000
B. lichiniformis (R_9)	4,76	-	0.015
B.stearothermophillus (R_{10})	3,16	-	0.027
DNMRT 0,05			

Description : * for the activity of phosphate solvents: + positive reaction, in the form of halo, - negative reaction, not in the form of halo. ** Figures in columns with the same letter are not significantly different based on the DNMRT test at α = 0.05

From Table 1 it can also be seen that the ability of rhizobacterial isolates to dissolve phosphate, apparently from 10 isolates analyzed, 5 isolates have the ability to dissolve phosphates, namely *Pseudomonas capacia*, *Pseudomonas dimuta*, *Bacillus larvae*, *Bacillus firmus* and *Bacillus polymixa*. While the ability of rhizobacteria to produce siderophore there are 5 isolates which have the ability to produce siderophore, namely isolates *Pseudomonas capacia*, *Bacillus megaterium*, *Bacillus laterophorus*, *Bacillus lichiniformis* and *Bacillus stearothermophillus*, the rest are not able to produce siderophore.

Based on the results of the study it can be seen that the ability of several types of rhizobacterial isolates used in the treatment of seeds before planting to increase the value of growth variables and soybean yields of the Kipas Merah Bireun and Anjasmoro varieties are related to the ability of these isolates to act as rhizobacteria that stimulate plant growth. This can be seen in the results of physiological character analysis of the rhizobacterial isolates such as the ability to produce IAA, dissolve phosphate and produce siderophore compounds. All rhizobacteria isolates tested showed their ability to produce IAA, although in varying amounts. Based on several studies it has been proven that IAA is able to control various plant growth and development processes by stimulating lateral root formation, reducing the length of primary roots, and increasing hair root formation (Perig *et al*., 2007).

An important characteristic possessed by rhizobacteria in spurring plant growth besides being able to produce IAA is its ability to dissolve phosphate. Based on the results of research isolates *Bacillus* sp. and *Pseudomonas* sp. showed a higher ability to dissolve phosphate compared to other isolates. This is consistent with the results of research Sharma *et al*. (2007) who reported that rhizobacteria from the *Bacillus* sp. and *Pseudomonas* sp. has a better ability to dissolve phosphate compared to other groups of bacteria. All of these rhizobacterial isolates have a stable ability to dissolve phosphates that are not available in the soil, this is because the bacterial group *Bacillus* sp. and *Pseudomonas* sp. can release organic acids such as formic, acetic and lactic acids which are soluble phosphates into forms available to plants (Mehrab *et al*., 2010).

Effect Rhizobacteria Type as Plant Growth Promotion for Soybean Growth and Yields Plant Height

F test results on the analysis of variance showed that the treatment of rhizobacteria significantly affected plant height 15, 30 and 45 days after planting.

Table 2. Average Plant Height (cm) Soybeans Age 15, 30 and 45 Days After Planting Due to Rhizobacterial Treatment

Rhizobacteria Type	Plant Height (cm)		
	15 days after planting	30 days after planting	45 days after planting
Control (R_0)	17,11 cd	44,88 c	70,27 bc
Acitinobacillus suis (R_1)	14,38 ab	37,27 a	61,11 a
Pseudomonas capacia (R_2)	17,27 d	41,27 abc	72,00 c
Bacillus megaterium (R_3)	16,27 bcd	37,33 a	68,44 abc
Pseudomonas dimuta (R_4)	14,22 a	37,38 a	63,16 ab
Bacillus laterophorus (R_5)	16,22 bcd	39,27 ab	64,61 abc
Bacillus larvae (R_6)	15,05 abc	39,44 abc	62,88 ab
Bacillus firmus (R_7)	15,16 abc	38,00 ab	63,05 ab
Bacillus polymixa (R_8)	17,05 cd	41,55 abc	64,77 abc
Bacillus lichiniformis (R_9)	15,38 a-d	42,94 bc	69,44 bc
Bacillus stearothermophillus (R_{10})	16,50 cd	41,05 abc	60,83 a

Description : Numbers followed by the same letters on the same line are not significantly different at the 5% level (DNMRT 0.05)

The results showed that the growth of soybean height due to the treatment of some types of rhizobacteria at the age of 15 and 45 days after planting was highest in the type of rhizobacteria *Pseudomonas capacia*, at the age of 15 days after planting by 17.27 cm and age 45 days after planting by 72 cm which significantly different from the treatment of *Acitinobacillus suis*, *Pseudomonas dimuta*, *Bacillus larvae*, *Bacillus firmus* and at 45 days after planting *stearothermophillus* rhizobacteria were significantly different, but not significantly different from without rhizobacteri, *Bacillus megaterium*, *Bacillus laterophorus*, *Bacillus polymixa*, *Bacillus lichiniformis* and 15 days after planting *Bacillus stearothermophillus* was not significantly different.

While the treatment of some types of rhizobacteria at the age of 30 days after planting the best types of rhizobacteria are without rhizobacteria that is equal to 44.48 cm which is significantly different from *Acitinobacillus suis*, *Bacillus megaterium*, *Pseudomonas dimuta*, *Bacillus laterophorus* and *Bacillus firmus*.

Number of Leaves

F test results on the analysis of variance showed that the treatment of rhizobacteria did not significantly affect the increase in the number of leaves of soybean plants at the age of 15, 30 and 45 days after planting.

Table 3. Average Number of Leaves (Strands) of Soybean Plants at Age 15, 30 and 45 Days After Planting

Rhizobacteria Type	Number of Leaves (strands)		
	15 days after planting	30 days after planting	45 days after planting
Control (R_0)	4,56	11,89	27,06
Acitinobacillus suis (R_1)	4,61	11,94	29,78
Pseudomonas capacia (R_2)	4,50	11,44	32,33
Bacillus megaterium (R_3)	4,44	11,39	29,56
Pseudomonas dimuta (R_4)	4,44	12,22	29,89
Bacillus laterophorus (R_5)	4,44	11,67	31,11
Bacillus larvae (R_6)	4,67	12,06	34,94
Bacillus firmus (R_7)	4,56	11,83	30,06
Bacillus polymixa (R_8)	4,67	12,78	30,56
Bacillus lichiniformis (R_9)	4,83	12,11	29,06
Bacillus stearothermophillus (R_{10})	4,61	11,44	28,44

Table 3 shows that the treatment of rhizobacteria did not have a statistically significant effect, but the number of leaves that tended to be more at the age of 15 days after planting was found in the treatment of rhizobacteria of *Bacillus lichiniformis* type, which was 4.83 strands, the number of leaves at 30 days after planting there were 12,78 rhizobacteria of *Bacillus polymixa* treatment and at 45 days after planting found 34,94 strands of *Bacillus larvae*.

Stem Diameter

F test results in the analysis of variance showed that the treatment of rhizobacteria did not significantly affect the stem diameter of soybean plants at the age of 15, 30 and 45 days after planting.

Table 4. Average Stem Diameter of Soybean Plants at Age 15, 30 and 45 Days After Planting

Rhizobacteria Type	Stem Diameter (cm)		
	15 days after planting	30 days after planting	45 days after planting
Control (R_0)	2,67	5,00	8,83
Acitinobacillus suis (R_1)	2,81	4,93	8,95
Pseudomonas capacia (R_2)	2,71	5,02	8,47
Bacillus megaterium (R_3)	2,70	4,85	8,93
Pseudomonas dimuta (R_4)	2,54	4,90	9,11
Bacillus laterophorus (R_5)	2,66	4,75	8,75
Bacillus larvae (R_6)	2,76	5,06	9,37
Bacillus firmus (R_7)	2,58	4,72	8,70
Bacillus polymixa (R_8)	2,66	4,69	8,90
Bacillus lichiniformis (R_9)	2,73	4,80	8,80
Bacillus stearothermophillus (R_{10})	2,60	4,72	8,02

Table 4 shows that the treatment of rhizobacteria did not have a statistically significant effect, but the diameter of the trunk which tended to be greater at the age of 15 days after planting was found in the treatment of *Acitinobacillus suis* by 2.81 cm, whereas at the ages of 30 and 45 days after planting 5.06 cm and 9.37 cm are found in the rhizobacteria of *Pseudomonas larvae*.

Potential Yield

F test results showed that the treatment of some types of rhizobacteria did not significantly affect the potential results. Rhizobacteria treatment did not have a statistically significant effect, but the highest yield potential was found in *Bacillus larvae*, which was 2.20 tons ha^{-1}.

Table 5. Average Potential Yield as a Result of Rhizobacteria Treatment

Rhizobacteria Type	Potential Yield (ton^{-1})
Control (R_0)	1,85
Acitinobacillus suis (R_1)	1,71
Pseudomonas capacia (R_2)	1,94
Bacillus megaterium (R_3)	1,90
Pseudomonas dimuta (R_4)	1,97
Bacillus laterophorus (R_5)	2,04
Bacillus larvae (R_6)	2,20
Bacillus firmus (R_7)	1,82
Bacillus polymixa (R_8)	1,76
Bacillus lichiniformis (R_9)	2,01
Bacillus stearothermophillus (R_{10})	1,55

Based results of the study showed that all treatments of rhizobacterial isolates applied to soybean plants had a significant effect in increasing the growth and yield of soybeans. In the vegetative phase, rhizobacterial isolates *Pseudomonas capacia*, *Bacillus megaterium*, *Pseudomonas dimuta* and *Bacillus larvae* are able to increase soybean growth better than other rhizobacterial isolates in terms of increasing plant height, number of leaves, and diameter soybean plant stems. Likewise in the generative phase, four rhizobacterial isolates were found that had better ability to increase yield potential compared to other isolate treatments, the four isolates were *Acitinobacillus suis*, *Pseudomonas capacia*, *Pseudomonas dimuta* and *Bacillus larvae*.

With the discovery of rhizobacterial isolates that have a better ability to increase the growth and yield of soybeans namely *Acitinobacillus suis*, *Pseudomonas capacia*, *Bacillus megaterium*, *Pseudomonas dimuta* and *Bacillus larvae* are suspected because of the five isolates able to adapt to the environment of soybean roots and symbiosis with soybean roots well so that it can help the needs of plants through rhizobacteria as Rhizobacteria Plant Growth Promotion that are bacteria that are able to colonize around plant roots and able to stimulate plant growth. This is in line with the results of research Egamberdiyeva (2005) which shows that seed inoculation with several types of rhizobacteria such as *Pseudomonas* sp. and *Bacillus* sp. can stimulate plant growth. The existence of this bacterium will be very good and beneficial for plant, this is suspected because the rhizobacteria group has the ability to produce IAA compounds, siderophore compounds, reduce manganese and phosphate dissolving (Syamsuddin, 2010).

Rhizobacterial isolates applied to soybean seeds can increase plant height because the rhizobacteria are able to tether N_2 from the air so that N is available and can be used by plants for growth. Nitrogen is an essential nutrient that is most needed by plants, which are generally needed for the formation or growth of vegetative parts of plants such as leaves, stems and roots. Plants that have a higher height, a large number of branches and leaves as well as high chlorophyll content will cause good plant growth so that the results of photosynthesis can be put to good use by plants in the vegetative phase and in the generative phase. Rhizobacteria that live in colonies at the root can increase the chlorophyll content which plays a role in the process of photosynthesis of plants by converting light energy into food in the form of glucose, and then stored into food reserves that are used to support plant growth (Raka, 1993). The rate of photosynthesis will increase with increasing chlorophyll content so that the higher the chlorophyll of the leaf, the more photosynthesis results, so that the dry weight of a plant both above and below the ground will be higher.

Apart from that rhizobacteria that stimulate plant growth can also release various kinds of organic acids such as formic acid, acetic acid, propionate, lactic glycolic, succinate and fumarate (Ahmad *et al*., 2005). These organic acids can form organic chelate (stable complex) with cation Al, Fe, or Ca bonds that bind P so that H_2PO_4 ions become free of their bonds and available to plants to be absorbed. According to Adesemoye *et al*. (2008) the role of the rhizobacteria is also beneficial because it can increase the efficiency and effectiveness of nutrient absorption, especially nitrogen and phosphate by plants.

The ability of bacteria to produce siderophores is an important component in Rhizobacteria Plant Growth Promotion, because the siderophore compound is able to bind iron (Fe^{3+}) into iron siderophore bonds that become available to plants. Siderophore produced by microorganisms is beneficial for plants because it can inhibit the growth of pathogens. It appears that Fe^{3+} deficiency is needed by pathogens because Fe^{3+} is already bound by siderophore (Sharma and Johri, 2003). In addition, iron is an important element in the development of disease, so that by binding to iron by siderophore the pathogen is less able to infect, thus inhibiting the development of the disease.

Effect of Varieties for Soybean Growth and Yields
Plant height

F test results in the analysis of variance showed that the treatment of varieties had a very significant effect on plant height at ages 15, 30 and 45 days after planting. Table 6 shows that the height of soybean plants aged 15, 30 and 45 days after planting was highest in the Anjasmoro variety that was significantly different from the Kipas Merah Bireun variety.

Based analysis of variance shows that the treatment of varieties has a very significant effect on the number of leaves aged 15 days after planting. The treatment of varieties did not have a significant effect on the age of 30 and 45 days after planting statistically, but the number of leaves which tended to be the highest was found in the treatment of varieties of Kipas Merah Bireun.

Table 6 shows that the highest number of leaves aged 15 days after planting was found in the Anjasmoro variety of soybean, which was 4.69 strands that were significantly different from the Kipas Merah Bireun variety. The average plant height and number of soybean leaves due to the treatment of varieties can be seen in Table 6.

Table 6. Average Plant Height and Number of Leaves Soybean Age 15, 30, 45 Days After Planting Due to Variety Type Treatment

Variety Type	Plant Height (cm)			Number of Leaves (strands)		
	15 days after planting	30 days after planting	45 days after planting	15 days after planting	30 days after planting	45 days after planting
Kipas Merah Bireun (V_1)	14,30 a	34,81 a	58,99 a	4,46 a	12,18	30,51
Anjasmoro (V_2)	17,45 b	45,27 b	72,03 b	4,69 b	11,60	30,00

Description : Numbers followed by the same letters on the same line are not significantly different at the 5% level (DNMRT 0.05)

Stem Diameter

F test results in the analysis of variance showed that the treatment of varieties had a very significant effect on stem diameters aged 15 and 45 days after planting, and did not have a statistically significant effect at age 30 days after planting but the stem diameter tended to be higher found in the treatment of Kipas Merah Bireun variety is 4.92 cm. Table 7 shows that the highest diameter of stem treatment 15 days after planting was found in the Anjasmoro variety, which was 2.71 cm, while the highest stem diameter 45 days after planting was found in the Kipas Merah Bireun variety which was 9.27 cm.

Table 7. Average Stem Diameter of Soybean Plants Age 15, 30 and 45 Days After Planting

Variety Type	Diameter Batang (cm)		
	15 days after planting	30 days after planting	45 days after planting
Kipas Merah Bireun (V_1)	2,62 a	4,92	9,27 b
Anjasmoro (V_2)	2,71 b	4,80	8,34 a

Description : Numbers followed by the same letters on the same line are not significantly different at the 5% level (DNMRT 0.05)

Potential Yield

F test results in the analysis of variance showed that the treatment of varieties had a very significant effect on the potential yield. Table 8 shows that the highest yield potential was found in the Kipas Merah Bireun variety which was significantly different from the Anjasmoro variety.

Table 8. Average Potential Yield of Soybean Plants

Variety Type	Potetial Yield (ton ha^{-1})
Kipas Merah Bireun (V_1)	2,26 b
Anjasmoro (V_2)	1,52 a

Description : Numbers followed by the same letters on the same line are not significantly different at the 5% level (DNMRT 0.05)

Based on the results of research in the vegetative phase showed that the best treatment varieties found in Anjasmoro varieties compared to the Kipas Merah Bireun variety, this can be seen in the plant height benchmarks 15, 30 and 45 days after planting, number of leaves 15 days after planting, stem diameter 15 days after planting. Some previous studies also prove that variations arising in plant populations planted under the same environmental conditions are variations or differences that originate from the genotypes of individual population members (Mangoendidjojo, 2003). Furthermore Jumin (2005) added, in adjusting, the plants will experience changes in physiology and morphology in the direction in accordance with their new environment. Different plant varieties will show different growth and yield even if planted in the same environmental conditions.

The increase in plant growth of the vegetative phase of soybeans on Anjasmoro variety is suspected because the variety is able to adapt well to the environmental conditions in which it grows so that it shows a good response in its growth phase. Anjasmoro variety is one of the superior varieties has several advantages when compared to local varieties. This variety has higher growth in terms of plant height, number of leaves, stem diameter, leaf area and root nodules, compared to the Kipas Merah Bireun variety. Genetic nature is very influential on plant growth and development, growth is a result of the interaction between various internal factors (genetic) and external factors (climate, soil and biological environment) (Dewi and Jumini, 2012).

The differences in the characters possessed by the two varieties are caused by the different genetic makeup of each variety so that it shows different responses to the environment and production factors. Stated that soybean yield is a quantitative character whose expression is determined jointly by genetic potential, growing environmental conditions, and cultivation management. Stated that the yield of a plant determined by genetic factors which include resistance to pests and pathogens and drought. Environmental factors include temperature, water availability, sunlight, and microorganisms.

IV. Conclusion

Based on the results of the study can be concluded as follows:

1. The results of the physiological character evaluation showed that Pseudomonas capacia isolates had the best ability as a plant growth promotion, which was able to produce IAA, siderophore and phosphate dissolving.
2. The treatment of rhizobacteria that promotes plant growth influences soybean yield. Rhizobacteria types of *Pseudomonas capacia*, *Pseudomonas dimuta* and *Bacillus larvae* can increase the growth and yield of soybean plants compared to control treatments based on the measurement of plant height, 15, 30 and 45 days after planting, number of flowers per plant, number of pods and seeds per plant, weights wet, dry stubborn and potential yield.
3. Varieties affect the growth and yield of soybean plants. Kipas Merah Bireun varieties can increase the growth and yield of soybean plants compared to Anjasmoro varieties based on the measurement of the number of leaves 30 and 45 days after planting and stem diameter 30 and 45 days after planting.

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