
EFFECT OF PLANT GROWTH PROMOTING RHIZOBACTERIA (PGPR) AND LIQUID ORGANIC FERTILIZER ON GROWTH OF SPINACH (*AMARANTHUS SPP.*) AND CHILI (*CAPSICUM ANNUUM*) ON VEGETATIVE PHASE

Masluki¹, Mutmainnah², Muhammad Naim³, Nining Triani Thamrin⁴

Agrotechnology Department, Agriculture Faculty of Cokroaminoto Palopo University
(lukimas886@gmail.com)¹, (mutmainnah08@ymail.com)²

Abstract

Plant Growth Promoting Rhizobacteria (PGPR) and liquid organic fertilizer is one of alternative replacement for synthetic fertilizer in improving plant growth. This research were aimed to determine the influence of PGPR and liquid organic fertilizer on growth of spinach and chili on vegetative phase. The research were done in Maros Sulawesi Selatan. Data of number of leaf, leaf area and plant height were collected. Data were analyzed by using analysis of variance according to Randomized Block Design when there was difference among the treatment, it was continued with Least Significant Difference ($p \leq 0.05$) (BNT) signification level. This research with 4 treatments, P1= PGPR 500cc/10 liters and liquid organic fertilizer 500 cc/10 liters, P2= PGPR 500cc/10 liters, P3= liquid organic fertilizer 500 cc/10 liters and P4= without treatment. Observation at 7 HST, 14 HST and 21 HST. The result showed P1 (PGPR 500cc/10 liters and liquid organic fertilizer 500 cc/10 liters) was the treatment to plant height, number of leaf and leaf area on spinach. On chili P2 (PGPR 500cc/10 liters) was the best treatment.

Keywords: PGPR, liquid organic fertilizer, *Amaranthus spp.*, *Capsicum annuum*

Background

Background agricultural sector is extraction of biological resources who performed by human beings to produce foodstuffs , raw materials industry , or source of energy , and to manage the environment his life .Extraction of biological resources included in agricultural ordinary understood as the cultivation of plants or farming , although their scope can also of the use of PGPR (plant growth promoting rhizobacteria and poc (organic liquis fertilizers) in cultivation products horticulture chili and spinach so as to produce products a defenseless the results of high , healthy and environmentally friendly.

PGPR (Plant Growth Promoting Rhizobacteria) is bacteria that live and developed in the area around rooting plants .Rhizobacteria can serve as pacemaker of the growth of plants and as agens antagonistic to pathogenic in rooting plants chili and spinach. Advantage of the use of rhizobacteria and fertilizer liquid organic that is they did not have danger or side effects so danger environmental pollution can be avoided .Several species rhizobacteria who are able to raise the growth of plants among others genus-genus rhizobium , azotobacter , azospirillum , bacillus , arthrobacter , bacterium , mycobacterium , and pseudomonas (Biswas et al., 2000).

The results of research conducted by Maunuksela in 2004 and Thakuria in 2004 reported that some groups rhizobacteria is as agens biological have the ability spur the growth of plants .This rhizobacteria come from the *Bacillus* spp., *Pseudomonas fluorescens* and *Serratia* spp . Which has reported capable of producing hormone growing such as an acid indol acetic (IAA) .The result of this research in line with research conducted by taufik et al .(2005 and the year 2010 that application pgpr able to increase the growth of plants chili and spinach. Inoculation agens biological *Bacillus* formis through treatment on seeds before planting can increase the growth of plants. Hence research objectives is test the role of PGPR and fertilizer liquid organic to increase the growth of plants chili and spinach.

Method

Research Design

This research using Randomized Block design with 4 treatment and 3 replications.

P1 = PGPR 500 cc / 10L and POC 500 cc / 10L

P2 = PGPR500 cc / 10L

P3 = POC 500 cc / 10L

P4 = without treatment

The Research Phase

a. Making Plant Growth Promoting Rhizobacteria (PGPR)

250 gram roots bamboo steeped in water that has been cooked in the cold state for 3 night , strain and grab the water as source og PGPR. Mix together 1 kg bran , 20 gram terasi, 1 gram of water whiting and 400 gram sugar. Strain and interfering with 1 liters of PGPR in a bucket and the meeting. Let sit 1-2 weeks and solution ready.

b. Making Liquid Organic Fertilizer

Green leaves , the skin cocoa , the top squash , eggshell , water rice , coconut water , sugar and EM-4 mixed and put into a bucket who has filled with water. Stir in every day and let sit for 2 weeks until produce of smellfermentation.

c. Planting chili and spinach

Uncultivated land and made with gap between took them 25 cm with into 5-7 cm to plant the plant spinach while for chili plants made holes cropping 5 centimeters and gap between cropping 80 cm . Above took them and the hole cropping sprinkled compost.Then sown the seed of row took them in the chili while seeds we grow in holes which it has already been prepared and next closed back with compost .

d. Application of PGPR and POC

PGPR applied for 2 times of 10 DAP and 20 DAP while the POC is applied once every 7 days.

e. Parameter observations

Observations plant height, leaf width, and number of leaves is done for 3 times, namely 7 DAP, 14 DAP, and 21 DAP.

Results and Discussion

a. Plant Height, Leaf Area and Number of Leaves of Chili (*Capsicum annuum*)

Plant height parameters indicate an increase in daily observations with different treatments. Treatment P2 (PGPR) showed a higher yield than the other treatments with an average height of 14.08 cm whereas the plant reaches P1, P3 and P0 show successive plant height 13.17 cm, 11.54 cm and 10.9 cm. Leaf area showed an increase in daily observations with different treatments. Treatment P2 (PGPR) showed a higher yield than the other treatments with an average leaf area reached 3.47 cm while the P0, P3 and P1 showed plant height respectively of 1.81 cm, 2.67 cm and 3.39 cm.

This is in accordance with Setiadi (1989) that required the association synergistic between bacteria with plants to create an environment for the survival of the bacteria phosphate solvent, so that the performance of the bacteria as perombak and solvent organic matter bound, it would be optimal particularly in synthesizing and releasing recover materials into organic materials that are available and can be used by plants to increase growth by way of saving dissolving phosphate source that can not be taken up by the root surface to limit the diffusion, microbial synergistic interaction should improve the availability of P in plants (Bareaet al.2005). According Thakuria et al. (2004), the

ability rizobakteri in dissolving the phosphate that is around rooting can help increase the supply of phosphate to be used for plant growth. Bacteria isolated phosphate solvent can increase rice production from 5.4 to 21.6%. In addition can improve the availability of phosphate, some bacteria can also increase the availability of some of the elements nitrogen and nutrients a plant, and can stimulate the plant to form lateral roots. Lateral roots is especially useful to expand the area of nutrient uptake by plants, so that nutritional needs are met more quickly and improve plant growth (Vasudevan et al.2002).

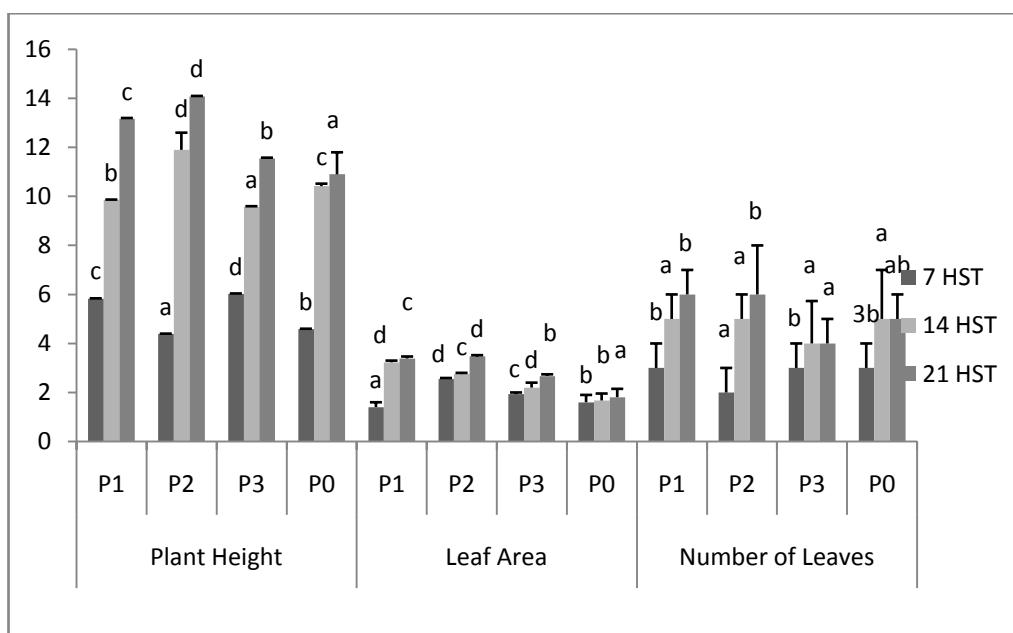


Figure 1. Effect of PGPR and liquid organic fertilizer on plant height, leaf area and numer of leaves of chili. Means of each parameter in the same time followed by same letter are not significantly different according to least significant difference ($p \leq 0.05$).

While the parameters of an increase in the number of leaves each day of observation with different treatment. Treatment of P1 (PGPR + POC) and P2 (PGPR) showed a higher yield than the other treatments with an average leaf area reached 6 strands while P0 and P3 indicate the height of the plants in a row 5 strands and 4 strands (figure 1). The addition of plant height and number of leaves, chili is suspected estimated that the liquid organic fertilizer can cause or terpacunya and encouraged stem cell at the end to hold a division and cell enlargement, especially in areas meristematis. This is in accordance with the opinion of Bonner & Galston1951) who said that the division is anticinal and periklinal and magnification meristematis cells at the stem end, although the rate of speed is not the same. Liquid organic fertilizer that contains elements of N, P, K, Mg and Ca) will cause the dam terpacunya synthesis division is anticinal cell wall so that it will accelerate the accretion of plant height.

b. Plant Height, Leaf Area and Number of Leaves of Spinach (*Amaranthus spp.*)

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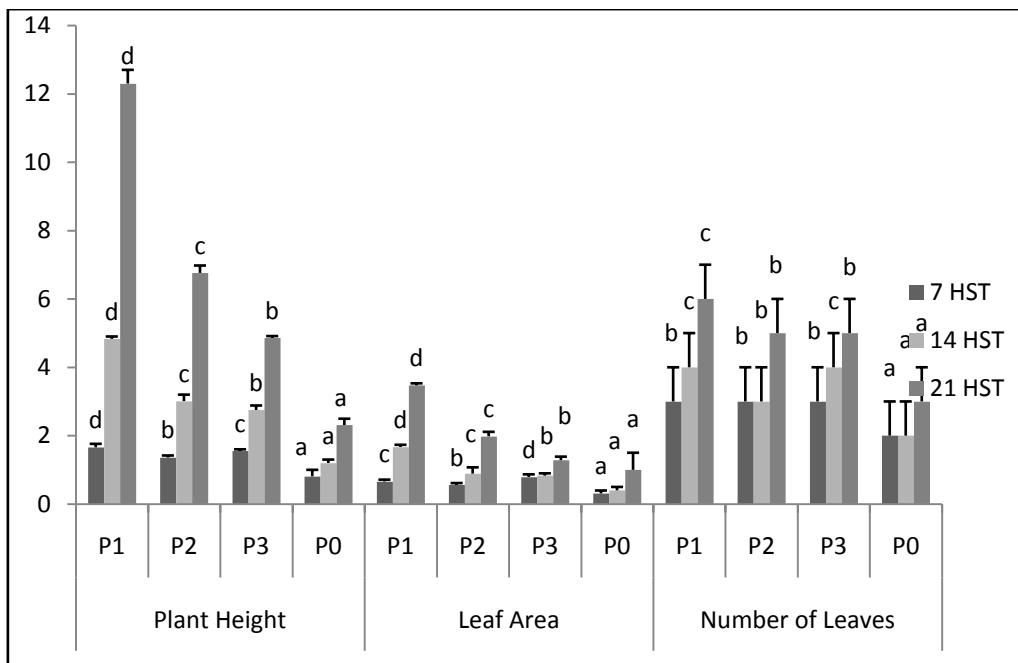


Figure 2. Effect of PGPR and liquid organic fertilizer on plant height, leaf area and number of leaves of spinach. Means of each parameter in the same time followed by same letter are not significantly different according to least significant difference ($p \leq 0.05$).

PGPR isolates as plant growth promoter is closely related to the hormones produced by rizobakteri. Hormon growth-hormones such as auxin, IAA, gibberellins, cytokinins and ethylene. In addition to these hormones, may also be associated with several important characters generated by rizobakteri in increasing the growth, such as the ability to fix N, dissolving phosphate, as well as the ability to degrade and use a large number of organic compounds and inorganic that will interact with the plant and associations in the rhizosphere.

According to Watanabe et al. (1987), *Pseudomonas fluorescens* as a producer group fitohormon in large numbers, especially in stimulating the growth of IAA was very influential in the formation of the characteristics of the root zone of plants. Tjondronegoro et al. (1989) also added that the IAA is the growth hormone group auxin useful to stimulate plant growth, which serves to enhance the growth of stem cells, inhibits the process of defoliation, stimulate fruit formation, stimulate the growth of cambium, and inhibits the growth of axillary buds.

This is presumably because a liquid organic fertilizer that is applied to contain macro and micro nutrients. Nutrients N function in accelerating the growth of plants in this case adding plant height, number of tillers, increasing the size of leaves and large grain and improve the quality of crops and grain, increase the protein content of rice, increasing the number of grains and the percentage of filled grain to provide food for the

microbes (microorganisms that work destroys the organic materials in the soil) (Dobermann and Fairhurst, 2000). P element plays a role in increasing the number of tillers of paddy, root development early flowering and ripening (especially where low temperatures). Potassium increase the number of grains per panicle, percentage of filled grain, and 1000 grain weight. K increases the tolerance of rice plants against adverse climatic conditions and pests and diseases (Dobermann and Fairhurst, 2000).

Conclusion

- a. P2 (PGPR500 cc / 10L) is the best treatment for Plant Height, Leaf Area and Number of Leaves of Chili (*Capsicum annum*)
- b. P1 ((PGPR500 cc / 10L + Organic liquid fertilizer 500cc/L) is the best treatment for Plant Height, Leaf Area and Number of Leaves of Spinach (*Amaranthus* spp.)

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