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The Biofertilizer (Nitrogen-Fixing, Phosphorus Solvent Bacteria, and Mycorrhiza) Impact for Peanut (*Arachis hypogaea* L) Growth on Various Locations

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ABSTRACT

Nitrogen-Fixing, Phosphorus Solvent Bacteria, and Mycorrhiza were microorganism which supported plant growth. They potentially played as biofertilizer. This research conducted to obtain the impacts of granting nitrogen-fixing, phosphorus solvent bacteria and mychorriza toward *Arachis hypogaea* L. growth at various planting media locations. Completely random sampling through factorial pathway with various microorganism concentrations and soil from different area applied at this research. There were 8 isolates various concentrations. Different soil collected separately from Blitar, Tulungagung, Trenggalek and Pacitan district. General linear model utilized to analyze data and followed by Tukey test. Biofertilizer combination interacted with the location of soil taken informed by research result. It gave impacts for leaves wide, high of plants, stem diameter and total dry weight of peanut. The largest leaves wide was gain from V0sL1 and V1L2 treatments, whereas for the highest plant length got from V3L4, V3L3 for the largest stem diameter and total of dry weight produced by V6L4.
KEYWORDS— *Arachis hypogaea* L., Nitrogen-Fixing, Phosphorus Solvent Bacteria, Mycorrhiza, various location, biofertilizer

INTRODUCTION

Peanut production increased linearly over the population number. Whereas infertile land kept occur as a kind of problems. Lime area at southern East Java province got that categorize, began from Pacitan to southern Malang district [1]. Fertilizing farmland might increase it fertility [2]. Even chemical fertilizer granting potentially polluted the soil due to unable absorbed entirely by plant [3]. It was quickly hardened, poor save water and became acid where plant productivity declined eventually [4]. Biofertilizer advised to used as a solution which it composed by microorganism that supported plant growth [5].

Biofertilizer got required to fill plant nutrient demand such as nitrogen and phosphoric [6]. Nitrogen contributed in vegetative plant growth phase [7]. Phosphorus helped at root development and various metabolisms [8]. Nitrogen-fixing bacteria provided available nitrogen through nitrogenase enzyme. Phosphatase enzyme served phosphorus through chelation mechanism by phosphorus solvent bacteria and mychorriza. This research was aim to understand the influences of granting nitrogen-fixing and phosphorus bacteria also mycorrhiza toward peanut (*A. hypogaea* L.) at cropping media from different location of soil [9].

MATERIALS AND METHODS

Collecting for cropping medium

Soil taken from 4 different locations which were 1) Popoh- Selopuro Blitar district, 2) Pinggirsari-Ngantru Tulungagung district, 3) Durenan-Durenan Trenggalek district, 4)Nanggungan-Pacitan, Pacitan, district East Java province. They got from randomly sampling [10].

Subculture for bacteria isolates and mycorrhizal propagule

Sterile NA (nutrient agar) medium made under 121°C as long as 15 minutes with 1.5 atm pressure [11]. Nitrogen fastened by *Azotobacter* sp. and *Bacillus* sp isolate [12]. They recultivated at NA medium and incubated at 37°C for

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24 hours [13]. Mycorrhizal propagule reproduced using *Zea mays* as host plant at sterile soil [14].

Biofertilizer

Sawdust placed as carrier-medium for nitrogen-fixing and manure for phosphorus solvent bacteria [15]. Amount 2 kg carrier-medium sterilized using autoclave [16]. It watered and humidified by molasses and distilled water (1 molasses : 6 distilled water) [11]. Azotobacter sp. and Bacillus sp. which aged 24 hours inoculated at carrier-medium [17].

Cultivation and observation parameter

Biofertilizer cultivated at 1 cm depth in 1 kg of soil within plastic bags [18] based on Table 1. Seeds of peanut had grown at 5 cm depth as long as 25 days in every medium with three times repetition for each treatment [19]. Vegetative growth (leaves area measured using gravimetric method [19]-[20]), high, and dry weight of peanut plant were the observation object

Research design and data analysis

Random sampling with two kinds of factorial (eight biofertilizer composition and land collection location) applied as research design. Combination of both of them conducted to be observed. Data observation tested by general linear model at 95% (α = 0.05%) confidence level. It conducted to observe any influences toward planting media retrieval location and biofertilizer concentrations for peanut growth.

Tukey test applied when P values not more then 0.05 (Hypothesis; H0 gave none and H1 any impacts)

RESULTS AND DISCUSSION

Treatment impacted to leaves wide for peanut

GLM statistical analysis obtained P= 0.000. It had proven that there was any interaction for leaves wide of peanut plant (*A. hypogaea* L.) between biofertilizer combinations to soil location that had taken (Table 1).

Table 1. Treatment variation on the average growth of the leaves size for peanut plants (*A. hypogaea* L.)

Biofertilizer comparison	Location			
	L1	L2	L3	L4
$V0_s$	$4,5^{a}$	$2,1^{de}$	$2,1^{de}$	$2,5^{cde}$
V0	$2,5^{cde}$	$2,9^{bcde}$	$2,5^{cde}$	$2,5^{cde}$
V1	$2,5^{cde}$	$4,5^{a}$	$2,5^{cde}$	$2,5^{cde}$
V2	$2,5^{cde}$	$3,3^{abcd}$	$2,5^{cde}$	$2,9^{bcde}$
V3	$2,5^{cde}$	$2,9^{bcde}$	$2,9^{bcde}$	$2,5^{cde}$
V4	$4,1^{ab}$	$4,1^{ab}$	$2,5^{cde}$	$0,4^{f}$
V5	$4,1^{ab}$	$3,7^{abc}$	$2,9^{bcde}$	$2,5^{cde}$
V6	$3,3^{abcd}$	$2,5^{cde}$	$2,5^{cde}$	$1,6^{ef}$

Description: Number which followed by the same letter at of the same column figured no significant differ based on Tukey test at 95% (α=0,05%) of confidence level.

$V0_s$: 0 g nitrogen-fixing bacteria : 0 g phosphorus solvent bacteria : 0 g mychorrizal (control) at sterile soil medium

V0 : 0 g nitrogen-fixing bacteria : 0 g phosphorus solvent bacteria : 0 g mychorrizal (control) at not sterile soil medium

V1 : 1 g nitrogen-fixing bacteria : 1 g phosphorus solvent bacteria : 1 g mychorrizal (control) at not sterile soil medium

V2 : 2 g nitrogen-fixing bacteria : 2 g phosphorus solvent bacteria : 2 g mychorrizal (control) at not sterile soil medium

V3 : 3 g nitrogen-fixing bacteria : 3 g phosphorus solvent bacteria : 3 g mychorrizal (control) at not sterile soil medium

V4 : 0 g nitrogen-fixing bacteria : 1 g phosphorus solvent bacteria : 2 g mychorrizal (control) at not sterile soil medium

V5 : 0 g nitrogen-fixing bacteria : 2 g phosphorus solvent bacteria : 1 g mychorrizal (control) at not sterile soil medium

V6 : 2 g nitrogen-fixing bacteria : 1 g phosphorus solvent bacteria : 0 g mychorrizal (control) at not sterile soil medium

L1 : soil taken from Popoh-Selopuro, Blitar district
L2 : soil taken from Pinggirsari- Ngantru, Tulungagung district
L3 : soil taken from Durenan- Durenan, Trenggalek district
L4 : soil taken from Nanggungan-Pacitan, Pacitan district

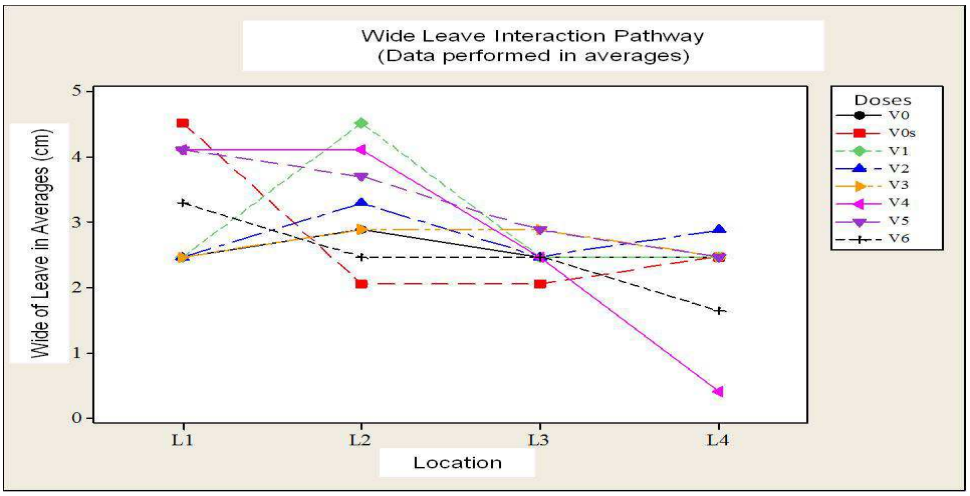

Figure 1. Treatment imapcts toward leaves wide of penaut plant (*A. hypogaea* L.)

Based on Table 1 and Figure 1 the most wide leaves reached by $V0_sL1$ and V1L2 treatment, whereas V4L4 as the lowest. Interaction test had performed significant different from both $V0_sL1$ and V1L2 treatment to V4L4. L1 and L2 had dusty clays texture that appropriate for cropping. Soil sampling organic carbon (C), total nitrogen and potassium analysis result informed that L1 the highest composition than others. Thus even it not got sterilized and infected by microorganism yet, plant might utilize nutrient content within it [21]. Inoculation of biofertilizer (nitrogen-fixing, phosphorus solvent bacteria and mychorrizal) at V1L2 treatment served more nitrogen and phosphorus availability that required by plant for better growth. Leaves expansion rate related to both leave number and nitrogen supply [21]-[22]. Limited phosphorus flows decreased to number, wide and leave elongation [22] [23] [24]. The absent of Nitrogen-fixing bacteria biofertilizer at V4L4 treatment made nitrogen supply disputes for plant [23].

Treatment impacted to peanut plant high

GLM statistical analysis obtained P= 0.0001. It had proven that there was any interaction for length of peanut plant (*A. hypogaea* L.) between biofertilizer combinations to soil location that had taken (Table 2).

Table 2. Treatment variation on the average growth of the length for peanut plants (*A. hypogaea* L.)

Biofertilizer comparison	Location			
	L1	L2	L3	L4
$V0_s$	26,3[a]	30,8[a]	26,7[a]	33,7[a]
V0	26,0[a]	30,0[a]	26,7[a]	30,2[a]
V1	28,3[a]	28,3[a]	26,2[a]	33,0[a]
V2	29,0[a]	31,2[a]	33,3[a]	30,8[a]
V3	29,0[a]	26,3[a]	33,0[a]	34,5[a]
V4	26,0[a]	30,2[a]	28,0[a]	8,8[b]
V5	29,8[a]	29,3[a]	30,7[a]	28,5[a]
V6	28,7[a]	32,0[a]	25,5[a]	28,5[a]

Description: Number which followed by the same letter at of the same column figured no significant differ based on Tukey test at 95% (α=0,05%) of confidence level.

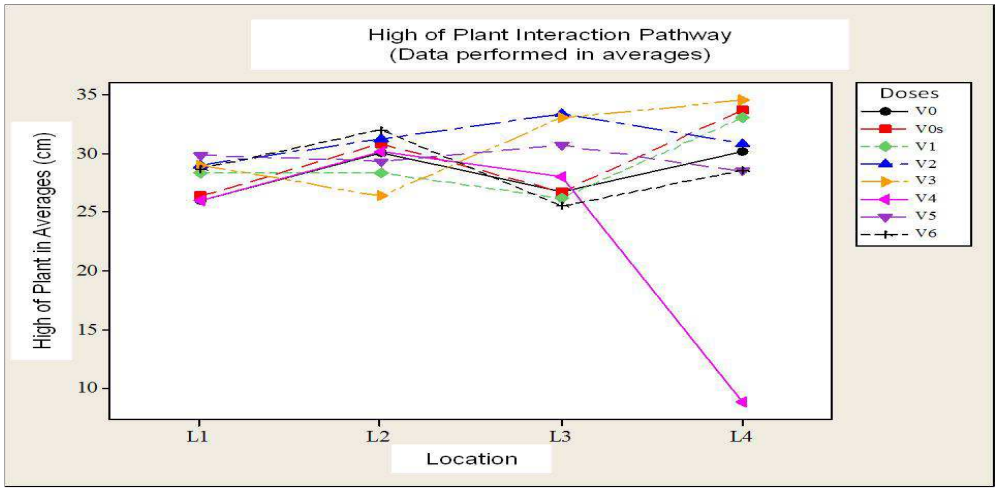

Figure 2. Treatment impacts toward length of penaut plant (*A. hypogaea* L.)

Tukey test gave significant different from treatment granting, Table 2 and Figure 2, V3L4 reached the highest plant length, where the opposite V4L4 got the lowest. L4 also had dusty clays texture that appropriate for cropping. V3 treatment succeed provide nitrogen demand by nitrogen-fixing bacteria within treatment composition. Nitrogen rolled importantly at leave to synthesize chlorophyll and amino acid for autotrophic organism in sink-source relations. It increased both photosynthate production and translocation to other plant sections [25], so that plant length increased by nitrogen additional enhancement [26]. Either phosphorus solvent bacteria or mychorizzal produced phosphate by chelation and phosphatase enzyme [27]. Phosphorus increasing gave more growth due to cell cleavage and meristematic tissue development rapidly that contributed to length of plant [28]-[29]. At the opposite occurred nitrogen flows hampered due to the absent of nitrogen-fixing bacteria at V4L4 treatment.

Treatment impacted to dry weight of peanut plant

GLM statistical analysis obtained P= 0.0002. It had proven that there was any interaction for dry weight peanut plant (*A. hypogaea* L.) between biofertilizer combinations to soil location that had taken Table 3.

Table 3. Treatment variation on the average growth of dry weight for peanut plant (*A. hypogaea* L.)

Biofertilizer comparison	Location			
	L1	L2	L3	L4
$V0_s$	$0,3^{ab}$	$0,4^{a}$	$0,3^{a}$	$0,4^{a}$
V0	$0,3^{ab}$	$0,3^{a}$	$0,3^{a}$	$0,3^{a}$
V1	$0,3^{ab}$	$0,3^{a}$	$0,2^{ab}$	$0,3^{a}$
V2	$0,3^{a}$	$0,4^{a}$	$0,4^{a}$	$0,4^{a}$
V3	$0,3^{a}$	$0,3^{a}$	$0,3^{a}$	$0,3^{a}$
V4	$0,3^{a}$	$0,3^{a}$	$0,3^{ab}$	$0,1^{b}$
V5	$0,3^{a}$	$0,3^{a}$	$0,3^{a}$	$0,2^{ab}$
V6	$0,3^{a}$	$0,4^{a}$	$0,3^{a}$	$0,4^{a}$

Description: Number which followed by the same letter at of the same column figured no significant differ based on Tukey test at 95% (α=0,05%) of confidence level.

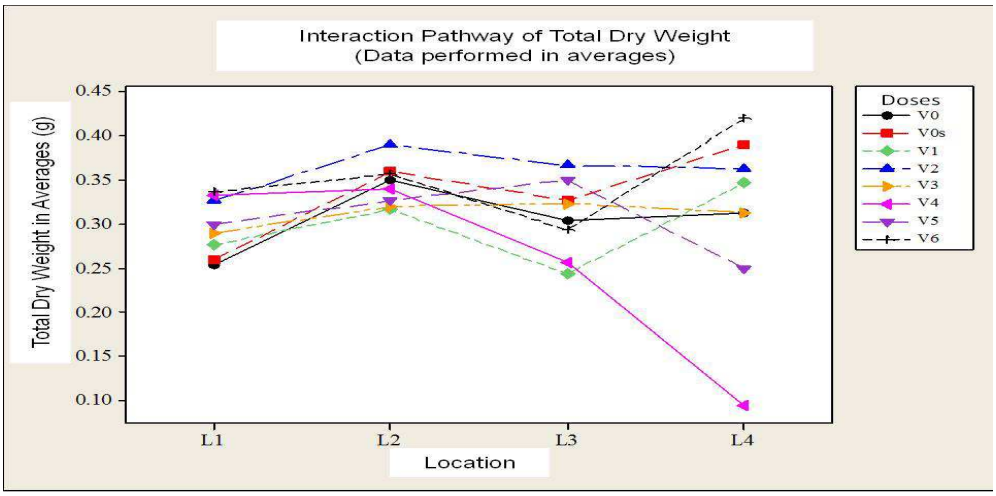

Figure 3. Treatment impacts toward dry wieght of penaut plant (*A. hypogaea* L.)

According to Table 3 and Figure 3, V6L4 treatment contributed as the highest dry weight and V4L4 as the lowest. Tukey test also gave significant different from treatment granting. The availability of nitrogen helped plant regulation due to nitrogen was part of enzymatic protein [30]. Hence nitrogen fertilizing affected on their crops and biomass [31]. The addition of phosphorus solvent bacteria increased phosphoric capacity number within the ground. Phosphorus (P) was essential macronutrient for plant growing and development biologically [32]. It demanded in a very large number at meristematic tissue, where cell rapidly cleaved and enlarged [33] then finally influenced the plant biomass. Mychorrizal position as plant phosphorus provider had replaced by phosphorus solvent bacteria. Even in mychorrizal absent v6 plant better in growth. Unfortunately for V4L4 treatment, without biofertilizer granting (none nitrogen-fixing bacteria) affected to nitrogen decreasing. The low nitrogen supply reduced photosynthate and metabolism process like what had provided in total dry weight that also decreased.

CONCLUSION

The research result proved that there was any interaction between biofertilizer combinations to soil location that had taken on leaves wide and total of dry weight produced by V6L4 (0.6 g).

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