Formula application of N fixation and P solubilizing isolate from two soil type of paddy field on the growth and yield of rice (Oryza sativa Linn.)

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Abstract. The formula application of biological nitrogen and phosphate solubilizing bacteria (NPSB) were suitable and possible potential for plant growth and yield of rice (Oryza sativa Linn.). This study aimed to investigate the formula application effect of NPSB on plant growth and yield components responses at different type soil paddy fields. The experiment was conducted at the greenhouse of the Center for Research and Development of Agricultural Biotechnology and Genetic Resources, Bogor District, West Java Province, and arranged in a factorial randomized block design with two factor and three replications. Biometrical observations found significantly highest in formula application at vegetative and generative stage. The maximum number of tillers was observed on 107 at alluvial type soil which was 11.0, followed by 105 µmol/ml at latosol type soil which was 10.3. The effectiveness of tiller after 63 DAT was observed on all formulate at alluvial type soil. The linear relationship between the number of tillers per plant and filled grain number per plant as influenced by the application of formulated isolate at alluvial and latosol soil type had only 32.38% (r = 0.569). The highest filled grain was on 105 µmol/ml formula isolated at latosol soil type which was 826 grain per plant at latosol soil type. The weight of grain per plant had a 96.78% contribution to the total filled grain per plant of rice(r = 0.984) indicates a very strong positive correlation between the weight grain and the number of filled grains per plant.

Keywords: formulation, NPSB, soil type, isolate.

1. Introduction
Beneficial microorganisms use as alternatives to replace synthetic fertilizers in agricultural production. Plant nutrient efficiency and enhance plant growth and improve yield are well-known by solubilization and mineralization of nutrient components particularly, N-fixation [1] and mineral P [2]. Application of beneficial microorganisms as a nitrogen (N2) fixation and phosphate solubilizing bacteria into the soil is an efficient and enhance mechanism for well-positioned to colonize seedling roots to respond at plant growth and yield. Microorganisms also have an important role in recycling nutrients, storing temporary nutrients, and releasing nutrients for use by plants. The sustainability of rice production can be increased by biofertilizer supplementary as a nutrient source [3]. The capability of NFB and PSB to solubilize organic and inorganic phosphorus and nitrogen-fixing respectively from insoluble compounds helps the
growth and development of plants [4], and advantage for environmentally of the intensive agricultural production system [5]. Nitrogen is a part of amino acids, nucleic acids, and chlorophyll very important element for plant health [6]. Soil organic matter degradation and biological nitrogen fixation and supply most nitrogen to plants [7]. Nitrogen is converted to ammonia to use the atmospheric nitrogen and be readily assimilated by plants via the biological Nitrogen fixation process (BNF) [8]. The global contribution estimate of biological nitrogen fixation is 180 x 10⁶ metric tons per year [9]. The interactions strains of microorganisms and plants applied through of seed or soil accelerate microbial processes uptake of nutrients and augment the extent of availability of nutrients in a form easily assimilated by plants [10].

The plant as host of growth-promoting bacteria due to their mutualism relationship for growth through nutrient availability [11]. The efficient microbial community of inoculants can improve soil quality and health, including plant growth, yield, and quality [12].

The various factors (soil physical and chemical properties, soil organic matter content, cultural practices, and plant growth stage) at the paddy ecosystem are influence microbial-mediated processes. [13]. The biofertilizers applied at seed or soil inoculants multiply and participate in nutrient cycling and benefit crop productivity [14]. In the soil, the biofertilizers by fixing atmospheric nitrogen and solubilizing insoluble phosphates improve soil fertility [15]. The biofertilizers use effective proven in crop plants promoting growth such as rice, pulses, millets, cotton, sugarcane, and vegetable crops [16].

Hence, the present study was conducted to investigate the effect of application formulate of biological nitrogen and phosphate solubilizing bacteria on plant growth and yield components responses at the different types of soil paddy fields.

2. Materials and Methods

2.1. Experimental site

The experiment was conducted at the greenhouse of the Center for Research and Development of Agricultural Biotechnology and Genetic Resources, Bogor Regency, West Java Province, Indonesia, in 2020. It was located at 247.0 m above sea level and coordinates: 6°34’27” E and 106°47’4” N latitude. The mean temperature were 24.2 °C (min) and 31.0 °C (max) in the morning. The mean temperature was 24.6 °C (min) and 40.2 °C (max) in the afternoon. The pots were arranged on a bench in the wire-netting of the greenhouse.

2.2. Experimental design

The experiment was laid out on a factorial randomized block design with two factors and three replications. The first factor was two types of paddy soil (T) consisted, i.e., T1: alluvial and T2: latosol. The second factor was formula dosage of nitrogen fixation and phosphate solubilizing bacteria consortia from alluvial and latosol paddy fields (F), consisting of F1=10⁵ µmol/ml, F2=10⁶ µmol/ml, F3=10⁷ µmol/ml. One treatment unit consisted of one pot with three replications. So the total treatment units were eighteen pots. The formula dosage of bacteria isolated was collected from a paddy field in Pusakanagara located at -6°25’42”, 107°8’99”, 23.1 m above sea level (asl) (alluvial soil) and Muara, located at -6°36’54” 106°47’29”, 291.0 m asl, 90° (latosol soil). The isolate proposed, namely Latosol 3.1 and Alluvial 1.2, had the potential for nitrogen fixation ability, while the other two isolates were Latosol 4.2 and Alluvial 7.1. The consortia bacteria proposed to have great qualitative nitrogenase activity for about 1.1E + 09, 1.7E + 09, and 1.3E + 09 (µmol/ml)/hours and could dissolve 14.398 mg l-1, 12.648 mg l-1 and 12.145 mg l-1 of phosphate, respectively.

Inpari 32 was chosen for the experiment as a new plant-type rice variety with high production potential. All seeds were soaked for 24 hours and brooded for about 12-24 hours until the coleoptile arose. All were soaked again in each formula dosage of nitrogen fixation and phosphate solubilizing bacteria consortia liquid culture for 15-20 minutes. Then, seed treatments were sowed in alluvial soil and latosol soil. The seedlings were planted 28 days after sowing. Parameters observed were divided into three different stages consisting of traits: at seedling stage (seedling height, leaf number, leaf area, root fresh length, root fresh weight, leaf fresh weight, root dry weight, and leaf dry weight), vegetative
stage (plant height and tiller number), and traits on generative stage (panicle number per plant, panicle length, filled grain number per plant, unfilled grain number per plant, filled grain weight, the weight of grain).

2.3. Statistical Analysis
The growth and yield component parameters data were collected analysis by SAS software program ver. 9.1.3 variance (ANOVA) according to experimental design. If there was a significant difference, Duncan’s Multiple Range Test test was performed at the level of 5% significance.

3. Results and Discussion
3.1. Chemical soil properties before treatment
The characteristics of soil alluvial and latosol paddy fields in this experiment were classified as clay loam. Soil texture alluvial soil was dominated by fractions of clay (72%), dust (26%), sand (2 %) and clay (65%), dust (29%), sand (6%) to latosol soil. The N total was 0.14% in alluvial soil and 0.18% in latosol soil. The P content extracted with HCL solvent in alluvial and latosol was 83 mg 100 g⁻¹ and 190 mg 100 g⁻¹, respectively. The actual pH (pH H₂O) of alluvial (pH H₂O = 6.2) was higher than latosol (pH H₂O = 5.6). The organic C content of two observed soil was categorized low (alluvial organic C content = 1.37% and latosol organic C content = 1.85%) due to below 2%.

3.2. Response in seedling stage
Analysis of variance showed that soil type effects were significant for seedling height (cm) and stem length (cm). Formula dosage of isolates was significant effects for seedling height (cm), leaf number, stem length (cm), fresh root length (g), fresh root weight (g), dry root weight (g), fresh leaf weight (g), and dry leaf weight (g). The interaction of soil type (T) and formulation dosage of isolate (F) effects were significant for seedling height (cm), fresh root length, and dry leaf weight (Table 1). At 105 µmol/ml formula dosage of isolate at alluvial type soil was the highest value on seedling height (46.63 cm), fresh root length (19.2 g), and fresh root weight (0.79 g). Isolate Formula dosage on 107 µmol/ml at latosol soil was highest value on seedling height (46.20 cm), leaf number (10.33), root dry weight (0.13 g), and leaf dry weight (0.38 g). Isolate formula dosage on 109 µmol/ml at latosol soil was minimum on seedling height (38.40 cm), stem length (11.37 cm), fresh root length (11.1 g), dry root weight (0.060 g), and dry leaf weight (0.24 g) per plant.

The suitable formulation of isolate 107 µmol/ml treatment had the highest and significant value on seedling height (cm), leaf number, stem length (cm), dry-root weight (g), and dry-leaf weight (g) at alluvial and latosol soil. However, formulation isolate 107 µmol/ml treatment had a higher value compared and significant value on ), dry-root weight (g) and dry-leaf weight (g) at latosol soil than alluvial soil. This finding showed that the effect of suitable formulation of isolate and soil type generally were significant on seedling stage traits. It is due to many factors such as isolate type or formulation dosage of isolates treatment. The number and length of root & shoots and dry weight inoculation of rice seedlings significantly increased by plant growth-promoting rhizobacteria (PGPR) [17].

3.3. Plant height and number of tillers response
The combined application of soil type and isolate formulation on plant height is showed a not significant effect on plant height except at 7 DAT. (Tabel 4). At 63 DAT, maximum plant height was observed on 10³ at alluvial type soil was 107.83 cm, followed by 10² at latosol type soil which was 104.50 cm, and 10³ formulate at alluvial type soil, which was 101.17 cm, respectively (Table 2). The plant height and isolate formulation at alluvial showed a good response on plant height than latosol soil. [18] reported that plants, seed weight, early flowering, grains, fodder, and fruit yields germination percentage, seedling vigor, emergence, plant stand, root and shoot growth, total biomass can increase by PGPR treatments. Applied nitrogen fertilizer to the soil cannot all utilize by plants [19]. Availability of biologically fixed nitrogen at the tillering phase might be due at tillering one [20].
### Table 1. Mean square from analysis of variance and effect of soil type and formulation of isolate on seedling stage traits.

| Treatments (µmol/ml) | Seedling height (cm) | Leaf number | Stem length (cm) | Root fresh length (g) | Root fresh weight (g) | Root dry weight (g) | Leaf fresh Weight (g) | Leaf dry weight (g) |
|----------------------|----------------------|-------------|------------------|-----------------------|-----------------------|---------------------|----------------------|---------------------|
| **Alluvial soil**    |                      |             |                  |                       |                       |                     |                      |                     |
| 10<sup>5</sup>       | 46.63<sup>a</sup>    | 9.00<sup>ab</sup> | 13.43<sup>ab</sup> | 19.2<sup>a</sup>     | 0.79<sup>a</sup>      | 0.092<sup>ab</sup>  | 1.87<sup>a</sup>      | 0.29<sup>bc</sup>   |
| 10<sup>7</sup>       | 47.77<sup>a</sup>    | 9.00<sup>ab</sup> | 15.53<sup>a</sup> | 12.5bc                | 0.56<sup>ab</sup>     | 0.073<sup>b</sup>   | 1.62<sup>a</sup>      | 0.32<sup>b</sup>    |
| 10<sup>9</sup>       | 43.13<sup>ab</sup>   | 7.00<sup>b</sup> | 11.57<sup>b</sup> | 16.1<sup>ab</sup>    | 0.45<sup>b</sup>      | 0.065<sup>b</sup>   | 1.75<sup>a</sup>      | 0.31<sup>b</sup>    |
| **Latosol soil**     |                      |             |                  |                       |                       |                     |                      |                     |
| 10<sup>5</sup>       | 39.67<sup>b</sup>    | 6.67<sup>b</sup> | 11.70<sup>b</sup> | 12.5<sup>b</sup>     | 0.58<sup>ab</sup>     | 0.091<sup>ab</sup>  | 1.44<sup>a</sup>      | 0.25<sup>c</sup>    |
| 10<sup>7</sup>       | 46.33<sup>a</sup>    | 10.33<sup>a</sup> | 13.47<sup>a</sup> | 12.7<sup>c</sup>     | 0.74<sup>ab</sup>     | 0.13<sup>a</sup>    | 1.96<sup>a</sup>      | 0.38<sup>a</sup>    |
| 10<sup>9</sup>       | 38.40<sup>b</sup>    | 7.67<sup>b</sup> | 11.37<sup>b</sup> | 11.1<sup>c</sup>     | 0.52<sup>ab</sup>     | 0.060<sup>b</sup>   | 1.65<sup>a</sup>      | 0.24<sup>c</sup>    |
| **Soil type (T)**    | 88.00 **             | 0.055 ns    | 8.00*            | 0.0005 ns             | 0.0005 ns             | 0.0008 ns          | 0.0006ns            | 0.001 ns           |
| **Formula (F)**      | 59.02 **             | 9.055 **    | 14.15 **         | 0.067 *               | 0.066 ns              | 0.0030 *           | 0.29 *              | 0.011 **           |
| **T x F**            | 11.04**              | 5.722 ns    | 1.48 ns          | 0.063 *               | 0.062 ns              | 0.0015 ns          | 0.10 ns             | 0.006 **           |
| **CV (%)**           | 7.66                 | 17.87       | 11.94            | 23.89                 | 26.09                 | 29.04              | 13.46               | 10.21              |

Noted: CV: Coeff Var, DAT: Days after plantation. values with different letters in a column are significantly different according to Duncan’s Multiple Range Test (P ≤ 0.05).

### Table 2. Mean Square and treatment response on plant height, as influenced by the application different formulation isolate at alluvial and latosol type soil, West Java .2020.

| Treatments | Plant height (cm) |
|------------|-------------------|
|            | 7 DAT | 21 DAT | 35 DAT | 49 DAT | 63 DAT |
| **Alluvial soil** |      |        |        |        |        |
| 10<sup>5</sup>       | 55.17<sup>a</sup> | 76.50<sup>a</sup> | 91.7<sup>a</sup> | 100.17<sup>a</sup> | 101.17<sup>a</sup> |
| 10<sup>7</sup>       | 64.50<sup>a</sup> | 78.17<sup>a</sup> | 89.7<sup>a</sup> | 99.17<sup>a</sup> | 100.33<sup>a</sup> |
| 10<sup>9</sup>       | 58.00<sup>a</sup> | 78.50<sup>a</sup> | 98.5<sup>a</sup> | 105.50<sup>a</sup> | 107.83<sup>a</sup> |
| **Latosol soil**     |      |        |        |        |        |
| 10<sup>5</sup>       | 56.33<sup>a</sup> | 75.33<sup>a</sup> | 92.3<sup>a</sup> | 101.50<sup>a</sup> | 104.50<sup>a</sup> |
| 10<sup>7</sup>       | 60.67<sup>a</sup> | 76.67<sup>a</sup> | 92.8<sup>a</sup> | 99.17<sup>a</sup> | 100.17<sup>a</sup> |
| 10<sup>9</sup>       | 57.33<sup>a</sup> | 73.67<sup>a</sup> | 90.5<sup>a</sup> | 98.83<sup>a</sup> | 100.67<sup>a</sup> |
| **Mean**             | 58.11 | 75.22  | 93.28  | 101.61 | 103.11 |
| **CV (%)**           | 7.54  | 8.83   | 6.87   | 5.65   | 5.55   |

Noted: CV: Coeff Var, DAT: Days after plantation. values with different letters in a column are significantly different according to Duncan’s Multiple Range Test (P ≤ 0.05).
The soil type and isolate formulation interaction had a significant effect on the number of tillers. The formula application showed a good response at 10⁷ formulate at alluvial type soil at 35 DAT, 49 DAT, and 63 DAT (Tabel 3). At 63 DAT, maximum number of tillers was observed on 10⁷ at alluvial type soil, followed by 10⁵ at latosol type soil. Isolate formula dosage on 10⁹ µmol/ml at latosol soil was seen minimum on tiller number at all stages per plant. The highest tiller mortality was observed after 63 DAT was observed on 10⁷ formulate at alluvial type soil (11.62%). The lowest tiller mortality (0%) was observed on 10⁹ formulate at latosol type soil. All application treatments at 63 DAT were a significantly higher number of tillers on 10⁹ formulate at latosol type soil (6.7 number of tiller/plant) but not significantly on 10⁹ formulate at alluvial type soil.

Table 3. Mean Square and treatment response on the number of tillers as influenced by the application of different formulation isolate at alluvial and latosol soil type, West Java, 2020.

| Treatments  | Number of tillers | 7 DAT | 21 DAT | 35 DAT | 49 DAT | 63 DAT |
|-------------|-------------------|-------|--------|--------|--------|--------|
| **Alluvial soil** |                   |       |        |        |        |        |
| 10⁴         |                   | 2.3   | 3.7    | 9.0    | 9.3    | 9.3    |
| 10⁵         |                   | 3.0   | 6.3    | 10.7   | 11.0   | 11.0   |
| 10⁶         |                   | 2.0   | 4.3    | 8.3    | 8.7    | 8.7    |
| Mean        |                   | 2.4   | 4.8    | 9.3    | 9.7    | 9.7    |
| **Latosol soil** |                   |       |        |        |        |        |
| 10⁴         |                   | 2.7   | 6.0    | 10.3   | 10.3   | 10.3   |
| 10⁵         |                   | 3.3   | 7.0    | 9.0    | 9.3    | 9.3    |
| 10⁶         |                   | 2.0   | 4.3    | 6.0    | 6.7    | 6.7    |
| Mean        |                   | 2.7   | 5.8    | 8.4    | 8.8    | 8.8    |
| Soil type (T) |                   | 0.22  | 4.50   | 3.56   | 3.56   | 3.56   |
| Formula (F) |                   | 2.06* | 9.06*  | 13.39* | 11.06* | 4.06*  |
| T x F       |                   | 0.16  | 2.17   | 5.72   | 4.06   | 4.06   |
| CV (%)      |                   | 17.01 | 29.08  | 18.10  | 14.23  | 14.23  |

Note: Treatment means separated by DMRT and columns represented with the same letter (s) are not significant at 5% level of significance.

The linear relationship between the number of tillers per plant and filled grain number per plant as influenced by the application of formulated isolate at alluvial and latosol soil type had only 32.38% contribution to the total filled grain number of rice and the remaining contribution was due to other factors. The coefficient of correlation (r = 0.569) indicates a moderate positive correlation between the number of tillers and filled grain number per plant as the number of tillers per plant increases (Figure 1).
3.4. Yield component parameters

Analysis of variance showed that at alluvial and latosol soil type has a significant on unfilled grain number per plant, unfilled grain weight, sterility, and weight of wet straw (Table 6). The highest mean value was observed, which was 273.67 unfilled grain number per plant, 18.00 unfilled grain weight per plant, and 25.90 % sterility at alluvial soil type. At alluvial type soil, the mean value of all parameters is highest than latosol type soil except panicle length, wet strawweight (g) per plant, and dry strawweight (g) per plant. This result showed that alluvial soil had different characteristics based on soil analysis before treatment.

The formulation effects were not significant for all parameters. The highest filled grain number per plant was observed on $10^5$ formulate which is 826.00 at latosol soil type. The highest grain per plant on $10^5$ formulate isolate at alluvial soil (1081.67 grain), but it was highest on unfilled grain number per plant which was 287.00 grain per plant. Interaction of soil type and formulation isolate effects showed a significant response for unfilled grain weight and sterility (%) per plant. The highest unfilled grain weight per plant was observed on $10^6$ formulate which is 20.2 at latosol soil type. The highest sterility (%) per plant was observed on $10^5$ formulate which is 27.30 at alluvial soil type.

There is a linear relationship between weight gain and the number of tillers/plant. The weight of filled grains per plant was observed to be significantly higher on alluvial soil than latosol type soil. The weight of grain per plant had a 96.78% contribution to the total filled grain per rice plant, and the remaining 3.22% contributed was due to another factor. The coefficient of $r = 0.984$ indicated the strongest positive correlation between the weight of grain and the number of filled one per plant (Figure 2).

![Figure 1](image)

**Figure 1.** Relationship between the number of tillers/plant and filled grain number/plant as influenced by the application of formulated isolate at alluvial and latosol soil type. West Java 2020.

**Table 4.** Mean square from analysis variance treatment response on yield component as influenced by the application different formulation isolate at alluvial and latosol type soil, West Java 2020.

| Parameters                       | Panicle number per plant | Panicle length (cm) | Filled Grain number per plant | Unfilled Grain number per plant | unfilled grain weight (g) | Grain number per plant | sterility (%) | Wet straw weight (g) per plant | Dry straw weight (g) per plant |
|----------------------------------|--------------------------|---------------------|-------------------------------|---------------------------------|---------------------------|------------------------|---------------|--------------------------------|-------------------------------|
| Alluvial soil                    |                          |                     |                               |                                 |                           |                        |               |                                |                                |
| $10^0$                           | 9.33$^{a}$               | 21.08$^{a}$         | 780.00$^{a}$                  | 264.67$^{b}$                    | 18.3$^{a}$                | 1044.67$^{a}$         | 23.63$^{ab}$  | 32.90$^{b}$                       | 11.40$^{ab}$                   |
| $10^1$                           | 9.67$^{a}$               | 20.29$^{a}$         | 794.67$^{a}$                  | 287.00$^{a}$                    | 18.9$^{a}$                | 1081.67$^{a}$         | 26.77$^{a}$   | 33.77$^{b}$                       | 11.23$^{ab}$                   |
| $10^2$                           | 8.08$^{a}$               | 21.51$^{a}$         | 711.67$^{a}$                  | 269.33$^{a}$                    | 16.8$^{a}$                | 981.00$^{a}$          | 27.30$^{a}$   | 25.80$^{b}$                       | 10.13$^{ab}$                   |
| Mean                             | 9.00                     | 20.96               | 762.11                        | 273.67                          | 18.00                     | 1035.78                | 25.90         | 30.82                           | 10.92                          |
Table 4. Mean square from analysis variance treatment response on yield component as influenced by the application different formulation isolate at alluvial and latosol type soil, West Java 2020 (Continued).

| Treatments | Parameters | Parameters | Wet straw weight (g) per plant | Dry straw weight (g) per plant |
|------------|------------|------------|-------------------------------|-------------------------------|
|            | Panicle number per plant | Panicle length (cm) | Filled Grain number per plant | Unfilled Grain number per plant | unfilled grain weight (g) | Grain number per plant | sterility % |            |            |
| Latosol soil |            |            |                               |                               |                             |                       |            |            |            |
| 10a        | 9.33        | 21.60ab    | 646.33a                       | 232.00           ab           | 16.5a                        | 878.33a                  | 26.53a       | 46.80ab     | 12.97ab     |
| 10b        | 9.06        | 20.69a     | 826.00a                       | 210.67           ab           | 20.2a                        | 1036.67a                 | 20.57a       | 60.37a      | 11.17ab     |
| 10c        | 6.67b       | 21.02a     | 600.00a                       | 103.33b          | 14.8b                        | 703.33a                  | 15.30b       | 30.87b      | 8.70b       |
| Mean       | 8.33        | 21.10      | 690.78                        | 182.00           17.17          | 872.78                      | 20.80        46.01      | 10.94       |            |            |
| Soil type (T) |            |            |                               |                               |                             |                       |            |            |            |
|            | 2.00ns      | 0.07 ns    | 22898.00 ns                   | 37812.50 *       0.78**        | 119560.50 ns                | 117.05*      1038.16* | 0.002ns     |            |            |
| Formulation (F) | 8.00 ns   | 1.35 ns    | 36598.72 ns                   | 7750.50 ns       0.090ns       | 70868.22 ns                | 21.92ns      535.65ns  | 11.80 ns    |            |            |
| T x F      | 0.67 ns     | 0.44 ns    | 12039.50 ns                   | 6931.17 ns       0.52*         | 20312.67 ns                | 84.62*       175.75ns  | 3.38ns      |            |            |
| CV (%)     | 18.49       | 3.70       | 21.60                         | 36.28            27.61          | 23.09                       | 19.20        35.79      | 19.13       |            |            |

Noted: values with different letters in a column are significantly different according to Duncan’s Multiple Range Test (P ≤ 0.05).

Figure 2. Relationship between the grain weight and the number of filled grain per plant as influenced by application of formulated isolate at alluvial and latosol soil type, West Java 2020.

There is a linear relationship between panicle number per plant and unfilled grain number per plant. The number of panicles per plant had 74.54% contribution to the total unfilled grain number per rice plant, and the remaining contributed was due to other factors. The coefficient of correlation (r = 0.866) indicated a strong positive correlation between the panicle number and unfilled grain number per plant (Figure 3).

The panicle number has a significant effect on the weight of grain per plant. There is a linear relationship between panicle number per plant and weight grain per plant. The number of panicles per plant had 69.33% contribution to the total weight grain per plant of rice and the remaining contribution was due to 30.67% other factors besides panicle number that affect grain weight. The coefficient of correlation (r = 0.8326) indicates a strong positive correlation between the panicle number and weight grain per plant (Figure 4).
**Figure 3.** Relationship between the panicle number per plant and unfilled grain number per plant as influenced by the application of formulated isolate at alluvial and latosol soil type, West Java 2020.

**Figure 4.** Relationship between the panicle number per plant and weight grain per plant as influenced by the application of formulated isolate at alluvial and latosol soil type, West Java 2020.

4. Conclusion
This study concludes that application of formula dosage isolate of N- fixation and P solubilizing from alluvial and latosol soil type can best be exploited in terms of seedling, plant height, number of tillers, effective tillers, panicle number, and grain yield by using them combined with a suitable soil amendment. Both of these applications can be enhancing on plant growth and yield of rice paddy fields.

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