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Journal of Applied Agricultural Science and Technology E-ISSN: 2621-2528 4 (2): 155-169 (2020) ISSN: 2621-4709 Received 20 Maret 2020; Received in revised form 26 July 2020; Accepted 26 August 2020 https://doi.org/10.32530/jaast.v4i2.162 155 THE EFFECT OF BIOORGANIC DOSAGE WITH N, P FERTILIZER ON RICE PRODUCTION OF SRI METHODS AND INCREASED NUTRIENT CONTENT OF PADDY SOIL INTENSIFICATION Nelson Elita*, Rita Erlinda, Agustamar Department of Food Crop Cultivation, Politeknik Pertanian Negeri Payakumbuh, Kabupaten 50 Kota, Indonesia *Corresponding author Email: nelsonelita@yahoo.com Abstract. The System of Rice Intensification (SRI) operates under aerobic conditions so that helpful microbes are active and abundant.

Effective N-fixing rhizobacteria and indigenous phosphate solubilizers Azotobacter and Pseudomonas grow well in the organic compost Bioorganic because it resembles their natural habitat. The purpose of this research is to find out the right dose of Bioorganic fertilizer and the most N and P doses needed to optimize the SRI method of rice crop production.

This research uses a factorial randomized block design. The first factor is Bioorganic fertilizer dosage (1, 3, and 6) t ha-1. The second factor is the dose of N and P fertilizers to use (0, 25, 50, and 75)% of the recommended dosage. The results of this study inform you about Bioorganic fertilizers containing Azotobacter and Pseudomonas fluorescens indigenous.

Azotobacter bacteria produce the availability of nutrients N, which functions as Plant Growth Promoting Rhizobacteria (PGPR), these bacteria quickly colonize the root

system, regulate hormonal balance, nutrition, and encourage resistance to pathogens. Pseudomonas fluorescens bacteria acts as a provider of phosphorus and nutrients in the generative phase.

Both of these microbes have a role in SRI method of rice plant metabolism to increase vegetative and generative growth of rice plants with SRI method with production reaching production of 8.80 t ha-1 in B2 (3 t ha-1) and N2P2 (50%) with the production of 9.21 t ha-1, so the use of inorganic fertilizers is more efficient. Rice soil nutrient status increased pH from slightly acidic to neutral, C-organic increased from 1.27% (low) to 9.30-10.68% (high), N total from 0.13% (low) to 0.45- 0.58% (high), P- available from 13.0 ppm reaching 18.0-20.0

ppm (moderate), the Bioorganic application has not been able to increase the C: N, CEC value and base saturation. Nutrient uptake of N and P on the leaves of rice plants is better at dose B2. Bioorganic applications increase the nutrient content of paddy soils planted with the SRI method compared to initial soil nutrient analysis.

Keywords: azotobacter; pseudomonas fluorescens; bioorganic; SRI I. Introduction The SRI (The System of Rice Intensification) method requires increased use of input ingredients: water, inorganic fertilizers, and agrochemicals. Research conducted in India and Indonesia on changes made to plants and water can increase the expression of the genetic potential of rice plants, thus creating a more productive and strong, which is currently carried out with various combinations of production technology (Uphoff et al., 2015).

SRI requires a different allocation of inputs from traditional methods; especially with regard to water, seeds, fertilizer and labor (Berkhout et al., 2015). It reduces water demand during the vegetative phase, thereby increasing rice production to 15 t ha-1 (Gathorne-Hardy et al., 2016). Dry conditions allow beneficial microorganisms to thrive abundantly.

Elita, Erlinda, and Agustamar JAAST 4(2):155–169 (2020) 156 The problem of element N in wetlands is that it is short, easily dissolved in water, carried by percolation, surface runoff and volatile. The efficiency of N (Urea) fertilizer uptake by lowland rice plants is relatively low at around 30-50% which adds to the production costs borne by farmers (Flores et al., 2015). Intensive long-term use of chemical fertilizers causes a decrease in soil organic content, damaged soil structure and environmental pollution.

Effective solutions include the use of indigenous rhizobacteria, whose existence is influenced by biotic and abiotic factors. This type of rhizobacteria increases the availability of special nutrients N is rhizobacteria with local N-fixing (indigenous). Rhizobacteria can function as Plant Growth Promoting Rhizobacteria (PGPR) (Kumar et al., 2018).

Rhizobacteria rapidly and aggressively colonize the root system, increase plant growth and yield by promoting plant growth and controlling various plant pathogens (Gouda et al., 2018). PGPR mechanism includes regulating hormonal balance and nutrition, encourage resistance to plant pathogens, and solubilizing nutrients for easy absorption by plants (Gurikar et al., 2016). Flores et al.,

(2015) found that inoculating rice plants with an isolated nitrogen-fixing bacteria can increase biomass of both stems and roots. According to Rai et al., (2017) the increase in vegetative growth of plants inoculated with Azotobacter may be due to the synthesis of several growth hormones that are affected by application of Azotobacter. (Uphoff et al.,

2015) stated that aerobic conditions in the SRI method support soil microbes and their abundant diversity in the ground through root inoculation. The use of Trichoderma harzianum and Pseudomonas fluorescens which are present in Bioorganic Plus compost as microbial inoculants for rice plants grown using SRI method results in a higher availability of nutrients and nutrient uptake than in conventional systems, and has been shown to increase rice production up to 229% (Erlinda et al., 2019). Application of microbial inoculants containing Arbuscular Mycorrhizal Fungi (AMF) has also increased SRI rice production to 13.86 t ha -1 (Elita et al., 2018a). The availability of P in the soil and absorption of P from root to leaf increases significantly as a result of microbial inoculation.

The N and P content of the resulting rice seeds has also been found to be higher (Prasanna et al., 2015). The use of phosphate fertilizers (P-fertilizer) for plants is very important to provide phosphorus as a nutrient especially for the generative phase of fruit or seed formation so that plant growth becomes healthy (Pinto et al., 2013).

The P fertilizer problem is that most of the phosphorus derived from inorganic fertilizer is maintained in the solid phase of the soil as a precipitate with aluminum, iron, calcium, and organic matter or adsorbed on the surface of soil particles only, which makes it unavailable for plant absorption. Phosphate chemical fertilizers are difficult to dissolve and can cause eutrophication (Gurikar et al., 2016).

The use of phosphate Elita, Erlinda, and Agustamar JAAST 4(2):155–169 (2020) 157 from natural sources is very limited due to the low ion exchange capacity of acid tropical soils (Edwards et al., 2016). Overcoming the problem of the use of P fertilizers in organic with the application of phosphate solvent microbes, including Pseudomonas fluorescens bacteria.

Phosphate-solubilizing bacteria (PSB) could play an important role in supplying phosphate to plants in an eco-friendly and sustainable way (Gomes et al., 2014). Pseudomonas fluorescens bacteria can thrive in extreme environmental conditions though it is affected by soil pH, phosphorus content, soil aeration and water content (Gurikar et al., 2016).

The results of Elita (2012, 2018b) have found Pseudomonas fluorescens, Azotobacter indigenous bacteria from rice plants rhizosphere SRI method and applied to rice cultivation SRI method. The consortium of indigenous Pseudomonas fluorescens and Azotobacter bacteria in bioorganic is expected to have a significant influence on the vegetative and generative growth of rice plants in the SRI method.

Therefore, application research has been carried out from indigenous Pseudomonas fluorescens and Azotobacter bacteria which are made into bioorganic fertilizer with compost media in SRI method of rice cultivation. The objectives of the study were (1) obtaining appropriate Bioorganic doses to increase SRI method of rice production, (2) obtaining appropriate N and P fertilizer doses to increase SRI method of rice production, (3) increasing intensification of nutrient content of paddy soil. 2. Methods 2.1.

Experimental Design The study was conducted in the field on wet rice fields in the area of Taram, Harau District, Lima Puluh Kota Regency, Indonesia. Experimental design using factorial randomized block design (RBD) with two treatment factors namely Bioorganic and N (Urea), P (SP-36) fertilizer. The first factor was the Bioorganic dose (B1 = 1 t ha -1, B2 = 3 t ha-1 and B3 = 6 t ha-1).

Bioorganics doses were given according to treatment (1, 3, and 6) t ha-1 or (0.4, 1.2, and 2.4) kg/plot. Time of application one week before planting. Bioorganics were distributed by distributing evenly above the soil surface of the experimental plot. The second factor was the dose of N and P fertilizers, namely (N0P0 = 0%, N1P1 = 25%, N2P2 = 50% and N3P3 = 75%.

Urea and SP-36 fertilizers were applied according to treatment: (1). N0P0 = without Urea and SP-36 fertilizer, (2). N1P1 = 25% recommended dosage (30 and 20) gr/plot. (3). N2P2 = 50% recommended dosage (60 and 40) gr/plot. (4). N3P3 = 75% recommended dosage (80 and 60) gr/plot. Elita, Erlinda, and Agustamar JAAST 4(2):155–169 (2020) 158 Urea fertilizer was applied two times, the first one-third at two wap (weeks after planting) and the second two-third at eight wap. SP-36 fertilizer is given all age doses of rice plants two wap.

Urea and SP-36 fertilizers are given by means of rows beside the planting rows. Experiments were performed in triplicate with the 12 treatment combinations. To test the significance of the observed response to each treatment analysis of variance was performed using the Statistical Analysis System (SAS) program, the Duncan Multiple Range Test (DMRT) was then used to determine the difference between treatments at the 5% significance level. 2.2.

Bioorganic Fertilizer Rice straw added with cow dung was inoculated with Trichoderma harzianum to help decomposition was incubated to produce compost. Compost which contains colonies of the bacteria Azotobacter and Pseudomonas fluorescens has beeb labeled Bioorganic (Elita et al., 2019). Bioorganics supplemented with molasses, sunstitusi as a source of the nutrients microbial Molasses can be utilized immediately by microbes for their growth and development, so that microbial populations develop rapidly.

Microbial population in culture media is largely determined by the available nutritional sources (Uthayasooriyan et al., 2016). 2.3. Nursery The seedbed nursery was made in plastic tub a size 20 cm x 30 cm placed in plastic house. Seedbed containing 5 cm of equal quantities of soil and cow manure. Seeds that had been soaked overnight then left to sprout over 24 hours were sown at the rate of approximately 300-350 seeds per tub.

After 12 days or after 2 leaves had appeared seedlings were transplanted into the field. 2.4. Land Management Rice field preparation included cultivation of plowed land and then soaking with water, then the soil is harrowed. Soil treatment was carried out three weeks before planting. Experimental maps were made of thirty six plots with a size of 2.1 m x 2.1

m which have separate irrigation and drainage channels. 2.5. Soil Sampling and Soil Analysis Soil sampling was conducted at five points, namely four point at each corner of plot and one point in the middle of the plot with 0-20 cm deep. Soil samples were air dried and filtered through a 2 mm sieve for initial soil fertility analysis based on PPT (1995).

The results are presented in Table 1. 2.6. Planting Seedlings from the nursery were planted individually at each planting point spaced 30 cmx30 cm apart fortynine plants per plot. Elita, Erlinda, and Agustamar JAAST 4(2):155–169 (2020) 159 Table 1.

Initial soil analysis results before the application of Bioorganic fertilizers Parameter Analysis Method Results Criteria pH 1:1 H2O 6.05 Slightly acid C/N 9.77 Low C-Organic (%) Walkley & Black 1.27 Low N-Total (%) Kjeldahl 0.13 Low P (ppm) Bray 1 13.0 Low CEC (meq.100 g-1) NH4OAc pH 7.0 11.25 Low Base Saturation (%) 5.16 Very low 2.7. Maintenance Weeding was done 4 times at 2, 4, 6, and 8 weeks after planting (wap) using a rotary weeder so that the ground air system is better. 2.8.

Irrigation After the young seedlings were planted in the plot the rice field was flooded to a depth of 1 cm and left to evaporate for about 5 days until dry, then it was watered again in the afternoon until the soil was saturated and left to dry repeatedly until the rice plants entered the initial flowering period. From then on the water level was maintained at 3 cm above the ground surface until the flower set period.

From then on until physiological maturity, the water level was maintained at 5 cm. Ten days before harvest the soil was left to dry. 2.9. Harvest and Post Harvest Plants were harvested with a sickle when mature at 110 days. Post-harvest activities included threshing and drying in the sun, so that the grain moisture content was reduced to 14%. 2.10.

Observations Observations made for this study on rice plants were : (1). Plant height (cm), (2) Number of tillers. (3) Number of panicles/clump (panicle), (4) Number of grains/panicle (grains), (5) Weight of 1000 seeds (g), (6) Dry unhulled rice production t ha-1. (7) Analysis of initial soil were pH, C/N, C-Organic, N-Total, P-available, Cation Exchange Capacity, Base Saturation, nutrient uptake of N, P and K in leaves and soil nutrient content 42 days after planting. 3. Results and Discussion 3.1.

Growth of Rice Plants The results of the field experiments after statistical analysis showed no interaction between Bioorganic doses with the dose of N and P fertilizers. There were because the function of Bioorganic fertilizers and N and P fertilizers is the same, namely providing nutrients for vegetative and generative plant growth rice so that it can increase the yield of rice plants. This condition is characterized by the higher organic C content by giving Bioorganics.

The higher organic C-content Elita, Erlinda, and Agustamar JAAST 4(2):155–169 (2020) 160 indicates the level of soil fertility. This is in line with the results of research Priambodo et al., (2019) the interaction between the application of biological fertilizers and inorganic fertilizers (N and K) is not significantly different, due to the function of biological fertilizers and inorganic fertilizers (N and K) in line which has an important role in providing nutrients to increase plant growth.

Statistical analysis of vegetative growth results are obtained as presented in Table 2. Table 2. Bioorganic dose and N and P dose fertilizer on vegetative growth of rice plants using SRI method Main Factor I Bioorganic Dose Plant Height (cm) Number of tillers B1 (1 t ha-1) 117.20 B 23.56 B B2 (3 t ha-1) 119.71A 25.31 A B3 (6 t ha-1) 118.98 A 24.19 A Key Factors II: N and P Dose N0P0 (0 %) 116.07 b 19.74 c N1P1 (25%) 117.33 b 21.00 c N2P2 (50 %) 120.95 a 32.04 a N3P3 (75%) 120.15 a 24.63 b The figures in the column followed by the same capital letter are not significantly different at the 5% level according to DNMRT.

In Table 2 it can be seen that the influence of Bioorganic doses on plant height and the highest number of tillers contained in the B2 treatment and not significantly different from the B3 treatment, but significantly different from the B1 treatment. This shows that the dosage of Bioorganic B2 and B3 has been able to increase plant height growth and number of tillers.

Bioorganics in B2 and B3 contain enough nutrients for growth in plant height and number of tillers. The role of Azotobacter bacteria in Bioorganics gives a boost to the growth of plant height and number of tillers. Azotobacter bacteria as PGPR can colonize the rhizosphere, increase plant growth and suppress plant pathogens carried by the soil on the root surface (Kumar et al.,

2016). The application of inorganic fertilizer significantly affected plant height and number of tillers compared with N0P0. The highest plant height and highest number of tillers were obtained at N2P2. N2P2 was not significantly different from N3P3 for plant height, but significantly different from N1P1 and N0P0.

N2P2 is significantly different from N3P3, N1P1 and N0P0 for the number of tillers. It is recommended to use N2P2 to be more efficient According to Oldfield et al., (2018) a mixture of compost and biochar increases availability of nutrients for plants that can increase growth as well as chemical fertilizers. The advantages of compost and biochar mixture have a lower environmental impact. Compost has more benefits by choosing the right raw materials.

Elita, Erlinda, and Agustamar JAAST 4(2):155–169 (2020) 161 Statistical analysis on the generative growth of rice plants including number of panicles/clumps, number of grains/panicles, weight of 1000 seeds and production ha-1 obtained results as presented in Table 3. Table 3. Bioorganic dose and N and P dose fertilizers on the generative growth of rice plants using the SRI method Main Factor I Bioorganic Dose Number of panicles / clump (panicle) Number of Grains / panicle (grains) Weight of 1000 seeds (grams) Production (t ha-1) B1 (1 t ha-1) 17.33C 204.25 A 20.05A 6.33C B2 (3 t ha-1) 22.08A 209.00 A 21.51A 8.80A B3 (6 t ha-1) 20.06B 206.19 A 20.33A 7.48B Key Factors II: N and P Dose N0P0 (0 %) 16.30 d 188.33 c 18.26 b 5.62 c N1P1 (25%) 19.15 c 203.85 b 20.07 b 7.26 b N2P2 (50 %) 23.07 a 225.04 a 22.70 a 9.21 a N3P3 (75%) 20.78 b 208.70 b 21.50 a 8.06 b The figures in the column followed by the same capital letter are not significantly different at the 5% level according to DNMRT.

In Table 3 it can be seen that the effect of Bioorganic doses on the number of panicles/plants obtained was highest in the B2 which was significantly different from the B3 and B1. The percentage of tillers (Table 4) becoming panicles/plants was 87.24%, 82.91% and 73.56% in B2, B3, B1, the highest yield in B2 These results indicate that not all tillers produce panicles because they were influenced by nutrient availability and nutrient uptake.

In B2 the activity and effectiveness of the Azotobacter and Pseudomonas fluorescens bacteria in Bioorganics were very good so that the availability of nutrients was sufficient for panicle growth. According to Thakur et al., (2018) root growth of rice plants in SRI method cultivation was influenced by soil nutrient availability. The level of xylem exudation in nutrient uptake at the seed filling stage was not the same as the response of each tillers in a single family of rice plants.

This condition affects puppies to produce panicles, so there are puppies that do not produce panicles The application of N and P fertilizer to panicle was highest in N2P2 and significantly different from other treatments. The percentage of tillers (Table 4) becoming panicles/plants was obtained 91.19%, 84.36, 82.57%, and 72.00% at N1P1, N3P3, N0P0, N2P2 respectively. This shows that N and P fertilizers in the vegetative phase are available for rice plant growth.

When filling the seeds of nutrients are not met the needs of plants. Inorganic fertilizers are readily available, dissolve easily and are easily lost due to surface runoff. . The amount of grain per panicle was not significantly influenced by Bioorganic dose.

Each panicle fills as a result of photosynthesis so that the same amount of grain is released. The Elita, Erlinda, and Agustamar JAAST 4(2):155–169 (2020) 162 application of N and P inorganic fertilizer to N2P2 is significantly different from N0P0, N1P1 and N3P3, so it can be recommended to use N2P2 to be more efficient. According to Kurniawan et al.,

(2017) in SRI method of rice cultivation changes in physiological processes that is increasing the ability of roots, sugar content dissolved, non-protein nitrogen, proline and dry matter in vegetative organs, the percentage of assimilate partition that is stored, the percentage of effective leaf area, the percentage of tillers productive and amount of grains/panicle. The weight of 1000 seeds influences the Bioorganic dose not significantly different.

The weight of 1000 seeds illustrates the quality and size of grain. Bioorganic fertilizers containing Azotobacter and Pseudomonas fluorescens have been able to provide the same nutrient availability and photosynthesis results. Application of N and P fertilizer obtained weight of 1000 seeds high in N2P2 and N3P3 were not significantly different but significantly different from the N1P1 treatment and N0P0, N1P1 treatments were not significantly different from N0P0 The highest production per hectare was obtained by B2 treatment which was 8.80 t ha-1 with an average number of productive tillers 19.82 tillers from the influence of Bioorganic doses and significantly different from B1 and B3.

The highest yield of N and P fertilizer on N2P2 was 9.21 t ha-1 with an average number of productive tillers of 19. 83 tillers, significantly different from N3P3, N1P1 and N0P0. This result is high because the amount of grains/panicle is higher. According to Gbenou et al., (2016) the SRI method of rice cultivation with compost yields 8,1163 t ha-1 with an average of 51 tillers while the conventional compost system yields 5,2417 t ha-1 with an average of 34 tillers. According to Li et al., (2016) the response of rice plants to N and P nutrients is balanced in the root zone.

The presence of microbial phosfate miners that are static and anchored to clay lattices is beneficial for the roots to absorb nutrients. This situation is beneficial for rice metabolism because it can accelerate the rate of photosynthesis in the reproductive period which increases yield. 3.2. Rice Field Nutrient Content After Bioorganic Application Bioorganic fertilizer dosage test with the dose of N and P fertilizer uptake in the field on the analysis of 42 days old rice field age of pH and C:N compared to initial soil nutrient content in Table1 is presented in Figure 1.

Figure 1 shows that Bioorganic application raised the soil pH value to pH 6.05 as presented in Table.1 for all treatments from 6.49 to 6.99. The increase in pH of the soil was caused by the conversion of organic acids into CO_2 so that the amount of organic acid in the soil decreased. This is confirmed by the C:N ratio which reduced slightly from the initial soil condition and is balanced Elita, Erlinda, and Agustamar JAAST 4(2):155–169 (2020) 163 according to the rate of plant growth. Microorganisms need carbon and nitrogen for their metabolism.

When the C:N ratio is high, the biological activity of microbes is reduced, as it takes several cycles of microorganisms to degrade organic matter which takes time. Figure 1.

pH and C/N ratio of 6 wap of paddy soil after bioorganic application The results of the analysis of nutrient content of C-organic, N-total, P-available, CEC and Base Saturation are presented in Table 4. Table 4. Analysis of the age of rice field nutrient for 6 wap. 3.3.

C-organic (%) The initial C-organic content of the soil is 1.27% which is classified as low (Table 1). After the application of Bioorganic there was an increase in C-organic from 2.30% to 3.68% with moderate to high classification. High C-organic content indicates high organic material production in the soil. Organic matter is one of the criteria for evaluating soil fertility.

The value of C-organic in the research soil is low because the position of the land is lower than the surrounding rice fields. This condition causes the paddy fields to be often submerged by rain water, resulting in erosion that drifts the surface flow. 3.4. N-total (%) The average N-total value of initial rice field soil of 0.13% is low (Table 1), after Bioorganic application this increased to from 0.45% to 0.58% which is high. This is due to the nitrogen fixing 6.05 6.49 6.51 6.56 6.57 6.58 6.88 6.99 6.78 6.59 6.62 6.74 6.55 9.77 9 8.63 8.44 8.89 8.67 8.71 9.33 9.17 8.53 8.33 9.17 9.53 0.00 2.00 4.00 6.00 8.00 10.00 12.00 B0N0P0 B1N0P0 B1N1P1 B1N2P2 B1N3P3 B2N0P0 B2N1P1 B2N2P2 B2N3P3 B3N0P0 B3N1P1 B3N2P2 B3N3P3 ph dan c/N ratsio Treatment pH C/N ratio No Soil Chemical Characteristics Treatment (M, NP) B1 B2 B3 N0P0 N1P1 N2P2 N3P3 N0P0 N1P1 N2P2 N3P3 N0P0 N1P1 N2P2 N3P3 1 C-organic (%) 2.35 2.38 2.52 2.60 2.30 2.88 3.68 2.65 2.45 2.50 2.65 2.62 2 N-total (%) 0.45 0.46 0.48 0.48 0.45 0.47 0.58 0.48 0.47 0.48 0.48 0.47 3 P- available (ppm) 19.0 20.0 19.0 19.0 18.0 18.0 19.0 19.0 18.0 18.0 17.0 18.0

4 CEC (meq.100 g-1) 8.52 9.32 10.45 10.08 8.55 9.49 10.23 10.07 8.98 9.74 10.25 11.16 5 Base Saturation (%) 5.54 5.78 6.05 6.15 5.64 5.98 6.24 6.14 5.84 6.04 6.25 6.36 Elita, Erlinda, and Agustamar JAAST 4(2):155–169 (2020) 164 Azotobacter bacteria (Toago et al., 2017). Organic material that contains Azotobacter bacteria allows these bacteria to multiply after being applied to the soil (Hindersah et al., 2018).

Azotobacter bacteria as Plant Growth Promoting Rhizobacteria (PGPR) can stimulate plant growth. PGPR promotes plant growth in two different ways, directly or indirectly. The direct promotion of plant growth by PGPR is through production, antibiotic synthesis, phytohormone production, and increased phosphate absorption by plant nitrogen fixation and enzyme synthesis that regulates plant ethylene content, providing nutrients.

Indirectly by opposing phytopathogen which is transmitted through the soil through secondary metabolites (Sivasakthi et al., 2017). 3.5. P-available The average initially available P in the soil of 13.0 ppm was classified as low (Table 1), after Bioorganic application there was an increase of available P to 18.0-20.0 ppm which can be classified as moderate.

This is due to Pseudomonas fluorescens, a source of P, in Bioorganics and the dose of P inorganic fertilizer. P contained in various compounds in the soil can be largely unavailable. Pseudomonas fluorescens including phosphate solvent bacteria also referred to as phosphobacteria, are found everywhere in the soil and the amount varies depending on the type of soil (Mohammadi, 2012).

Phosphate solubilizing bacteria can dissolve phosphorus from organic and inorganic sources through the action of organic acids and extracellular enzymes that are secreted into the soil (Park et al., 2011; Baliah et al., 2016). Pseudomonas fluorescens bacteria are decomposers that consume simple carbon compounds, such as root exudates and plant residues to produce organic acids and increase the availability of P in the soil (Suarjana et al., 2015). 3.6. CEC The initial soil CEC of 11.25meq.100 g-1 was classified as low (Table 1), after Bioorganic application there was a variation of CEC values ranging from 8.52 - 11.16meq.100 g-1 which was still relatively low.

This shows that the application of Bioorganic to the CEC values of paddy soil is more stable, although there are differences in the response of Bioorganic doses (B1, B2 and B3) as root absorption triggers (Fig.1). CEC is a soil chemical characteristic that is able to neutralize the balance of metals absorbed by plants. The impact of the stability of this CEC will provide the freedom of N and P nutrients to be absorbed by roots assisted by the microorganism Pseudomonas fluorescens.

This phenomenon has been analyzed by Tan (1996) that in long-soaked soils in the presence of padding (pan), the solubility of metals makes it easier to interact with soil micelles so that it is easier to achieve the stability of the CEC. Elita, Erlinda, and Agustamar JAAST 4(2):155–169 (2020) 165 3.7. Base Saturation The initial base saturation value of 5.16 is classified as very low (Table 1).

Bioorganic application had an increase in base saturation value of 5.54-6.36, although it was still classified as very low (Table 4). Base saturation is closely related to soil pH, low soil pH values have low base saturation. It can be seen from the results of analysis of saturation of paddy soils (Table 4) and pH of paddy soils (Fig. 1) in all treatments ranging from 6.49-6.99 with slightly acid -neutral category. Base saturation value indicates the availability of base cations for plant use in terms of soil nutrients.

The maximum number of cations that can be absorbed by the soil indicates the value of the exchange capacity of the cation. According to Pinatih et al., (2015) base saturation value shows the complexity of ion exchange is dominated by base cations. The existing cationic feeds at the same time inform the nutrients provided are quite effective which can cause a neutral and stable pH. 3.8.

Analysis of rice leaf nutrient uptake The results of the analysis of leaf nutrient content of rice plants (4th leaf) at 42 days after planting (dap) are presented in Figure 2. Figure 2. Analysis of leaf nutrient uptake at 42 dap Figure 2 indicates that the B2 dosed Bioorganics resulted in a better ability than B1 and B3 to increase nutrient uptake of nitrogen (N) and phosphorus (P). Bioorganics B1 and B3 respond in a similar fashion with regard to N and P.

This absorption pattern is due to the work balance in the plant metabolism with the larger N and P doses in B3 which can increase the nutrient uptake balance in the leaves of rice plants. The nutrient content of soil N and P at 42 dap is illustrated by the excellent growth of rice plants in the field. The fact shows that Bioorganic (B1, B2 and B3) paddy soils have responded to 0.68 0.72 0.78 0.78 0.71 0.84 0.82 0.86 0.74 0.78 0.76 0.74 0.10 0.11 0.12 0.13 0.11 0.12 0.13 0.14 0.11 0.12 0.14 0.15 0.00 0.10 0.20 0.30 0.40 0.50 0.60 0.70 0.80 0.90 1.00 B1N0P0 B1N1P1 B1N2P2 B1N3P3 B2N0P0 B2N1P1 B2N2P2 B2N3P3 B3N0P0 B3N1P1 B3N2P2 b3N3P3 N and P (%) Treatment N P Elita, Erlinda, and Agustamar JAAST 4(2):155–169 (2020) 166 the pH, C-organic, N-total and P available in the soil are higher than the initial value (Table 1).

Increased soil nutrient levels indicate sources of soil nutrient providers, namely the microbial activity of Azotobacter and Pseudomonas fluorescens in Bioorganics, which functions to supply nutrients for the growth needs of rice plants. Overall the use of Bioorganics with doses of B1, B2 and B3 as a source of microbes increased nutrient uptake in the root zone, especially phosphorus (P) and followed by a balance of nitrogen (N) .

Increases the dose of N and P together correlated with increase in leaf nutrient uptake The last response affected the base saturation, the soil cation exchange capacity (CEC) was also more stable in B1, B2 and B3. Soil CEC is a chemical characteristic of soil that is able to neutralize the balance of metals absorbed by plants in response to the macro elements N, P and K.

This phenomenon has been analyzed by (Nam et al., 2017) on lowland soils which are subject to long soaking and have layers of compacted soil because of the solubility of the metals they easily interact in soil micelles resulting in stability of the soil CEC.

The impact of the stability of this CEC will provide a free macro-nutrient status N and P responded by the roots to the microbial activity of Azotobacter and Pseudomonas fluorescens in Bioorganics as a provider of soil nutrients so that the nutrient content of paddy soils increases 4. Conclusion A single factor dose of Bioorganic B2 increases plant height, number of tillers, number of panicles/clumps and gives the highest rice yield of 8.80 t ha-1.

A single factor of inorganic fertilizer N, P dose 50% can increase plant height, number of tillers, number of panicles/clump, number grains/panicle, weight of 1000 seeds and SRI method rice production reaches 9.21 t ha-1. Bioorganic applications increase the pH, C-organic, N-total and P available higher than the initial soil nutrient content, while the C:N, cation exchange capacity and the saturation of the base are relatively more stable. Nutrient uptake of N and P on the leaves of rice plants is better at dose B2.

Bioorganic applications can increase the nutrient content of paddy soils planted with SRI method compared to initial soil nutrient analysis. Acknowledgements Gratitude is expressed to the Ministry of Education and Culture of DIKTI for funding this research and P3M Payakumbuh State Agricultural Polytechnic who has supported this research activity. References Berkhout, E., Glover, D., & Kuyvenhoven, A. (2015).

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