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Effect of Bioameliorant and Biofertilizers to Improve Resistance of Paddy Againts Disease

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Introduction

The major rice diseases in Indonesia are paddy blast, bacterial leaf blight, and brown spot (IRRI, 2002). Blast disease reduced plant growth, number of tillers and grain yield (losses up to 50%) and if infection at tillering stage can lead to total losses. The locally available of organic ameliorant (straw compost) can be used to remediate the soil health, increase the fertilizers efficiency and crop paddy productivity. Tthe application of augmented straw`compost will boost the biodiversity of beneficial microbes in rhizospehere and promote the induced systemic resistancen (ISR). Induced systemic resistance (ISR) emerged as an important mechanism by which selected plant growth–promoting bacteria and fungi in the rhizosphere prime the whole plant body for enhanced defense against a broad range of pathogens and insect herbivores. The induced resistance in plants triggered by biological or chemical inducers, which protects nonexposed plant parts against future attack by pathogenic microbes and herbivorous insects (Ku, 1982; Kloepper et al., 2004).

Biofertilizer can be defined as natural fertilizers which is containing a large population of specific or a group of beneficial microorganisms for enhancing the productivity of soil either by fixing atmospheric nitrogen or by solubilizing soil phosphorus or by stimulating plant growth through synthesis of growth promoting substances or latent cells that activate the biological process render to form a fertilizer compound or make the unavailable form of elements to be available or to facilitate nutrients availability for plants (Singh and Purohit, 2011; Bhattacharjee, R and U. Dey. 2014). Its application under proper condition increases the yield of various crops by about 25 % and reduce the application inorganic fertilizers until 25–50 % for nitrogen and about 25 % for phosphor nutrient (Simarmata, 2013). The application of composted straw and consortia of biofertlizers are expected to be used (1) to improve the soil health, (2) reduce the

intensity of major paddy diseases (paddy blast, bacterial leaf blight, brown spot and other diseases) by promoting the induced systemic resistance, (3) incrrease the fertilizers efficiency and paddy grain yield..

Material and Methods

The selected superior of decomposer and bacterial of biofertilizers containing the isolate of *Azotobacter sp, Azospirilum sp, Pseudomonas sp, Bacillus* sp. Acinetobacter and *Trichoderma* were obtained from the culture collection of soil Microbiology Laboratory of Agriculture Faculty of Padjadjaran University Bandung. The composted straw (0, 2.5, 5.0 and 7.5 ton ha^{-1}) were deployed one weeks on soil surface of plots (4 m x 5 m) homogeneously before the land cultivation or preparation (incorporating). The 400 g of biofertilizers inoculant consortia (CB) or 400 g of biocontrol agent (*Trichoderma sp*) inoculant was mixed with 40 kg of compost and distributed evenly on the paddy plots shortly before the transplanting of paddy seedling. Two single young seedlings (15 days) was planted with plant spacing about 30 cm x 35 cm in line about 5 cm distance from each others at point of planting cross section (Simarmata *et al*., 2011). The seedling was planted by slipping in sideways rather than plunging it into the soil vertically makes the shape of the transplanted seedling more like an L than like a J. With an L shape, it is easier for the tip of the root to resume its growth downward into the soil (Simarmata *et al*., 2011). The inorganic fertilizers were applied, as follows: (1) fertlizers consisted of 25kg urea, 50 kg SP-36 and 25 kg KCl shortly before transplanting, (2) 100 kg of Urea applied at 21 days after transplanting or after weeding, (3) finally,50 kg urea and 50 kg KCl per hectare are applied at 42 days after transplanting. The water saving technology is adopted by using the water level indicator for watering the paddy field (Antralina, *et al*., 2015). Weeding and pest managements were done during the planting season. The paddy was harvested at 100 DAT. The intensity of paddy diseases was observed at 7 weeks after transplanting (WAT) using 0-9 scale of the standard evaluation system for paddy (IRRI, 2002). Leaf blight intensity data is used to calculate the Area Under Disease Progress Curve (AUDPC) with the formula (Campbell and Madden, 1990)

Results and Discussion

Application of composted straw combined with biofertlizers consortia or biofertilizers and gave a significant effect on reducing the intensity of brown spot disease (BS), blast disease and Sheat blight disease. The highest percentage of inhibition (51.38%, 58.33% and 47.95%) was obtained by the application 400 g ha-1 of CB + 5 ton ha-1 CS) with (Tabel 1.). Applications combination of straw, a consortium of bacteria and *Trichoderma sp.* provide a significant effect. Emphasis blast disease in paddy is the highest (80.12%) present in the first treatment (400 g ha-1 of CB-T).

Application Consortium (*Azotobacter sp., Azospirillum sp, Pseudomonas sp, Bacillus sp. Acinetobacter and Trichoderma sp*.) in a biological fertilizer known to have a role as an inducer agent. In addition, the application of augmented straw`compost will boost the biodiversity of beneficial microbes in rhizospehere and promote the induced systemic resistancen (ISR). Induced systemic resistance (ISR) emerged as an important mechanism by which selected plant growth–promoting bacteria and fungi in the rhizosphere prime the whole plant body for enhanced defense against a broad range of pathogens and insect herbivores. Table 2 shows the orange leaf blight suppressor highest (40.36%) in the treatment G (00 g ha-1 of CB + 5 ton ha-1 CS). Suppresion BLB disease in paddy plants amounted to 53.05%, 59.09% and 63.8% found in the treatment of G, C and K.

In general, straw compost application plays an important role in inhibiting diseases in paddy plants. This can be seen in Table 1 in all applications straw compost emphasis diseases in paddy plants. Straw compost contain K and Si element that can increase plant resistance to disease. Elements K and Si may strengthen the plant tissue and cell walls thicken the epidermis so as to increase plant resistance to pathogen attack mechanically.

Table 1. Effect of composted straw, Consoria of biofertilizes and combined with *Trichoderma sp* on area under disease progress curve (AUDP) of brwon spot (*Helminthosporium oryzae*), Blast disease (*Pyricularia oryzae*), andSheath paddy blight (*Rhizoctonia solani*

Treatments Dosage (ha^{-1})	Brown spot disease		Blast disease		Sheat blight disease	
	AUDPC	Inhibition (%)	AUDPC	Inhibition (%)	AUDPC	Inhibition (%)
A=Control	340,6 g	0	84,0 a	0	170,3 a	0
B=2.5 ton CS	228,6 abcd	32,88	53,7 a	36.07	163,3 a	4,17
C=5 ton CS	322,0 fg	5,46	83,3 a	0.83	137,7a	19,19
D=7.5 ton CS	252,0 bcde	26,01	35,0 a	58.33	156,3 a	8,27
E=400 g of CB	298,6 efg	12,33	18,6 a	77.86	151,67 a	10,99
F=400 g CB + 2.5 ton CS	280,0 cdefg	17,79	46,7 a	44.40	137,7 a	19,19
G=400 g CB + 5 ton CS	165,6 a	51,38	35,0 a	58.33	88,7 a	47,95
H=400 g CB + 7.5 ton CS	224,0 abc	34,23	74,7 a	11.07	165,7a	2,76
I=400 g f CB-T	326,6 g	4,09	16,7 a	80.12	151,7 a	10,97
J=400 g CB-T+ 2.5 ton CS	261,3 bcdef	23,28	56,0 a	33.33	158,7 a	6,87
K=400 g CB-T+ 5 ton CS	193,6ab	43,16	51,33 a	38.89	163,3	4,17
L=400 g CB-T+ 7.5 ton CS	294,0 defg	13,68	63,0 a	25.00	133 a	21,95

Note: WAT (weeks after transplanting) and the value within column followed by the same letter are not different significantly ($p = <0.05$). Composted Straw (CS) and Consortia of biofertilizes (CB), T (*Trichoderma* sp.)

Conclusions and Outlook

1. Application of composted straw (bioameliorant) combined with biofertilizer consortia and *Trichioderma sp*. had enhanced the induced systemic resistance to against brown spot disease, blast disease and sheath blight disease.

2. Economically, application of 2.5 ton ha^{-1} composted straw` combined with 400 g ha^{-1} of biofertilizer consortia and 400 g of biocontrol agent (inoculant of *Trichoderma sp*) can be recommended to reduce brwon spot, narrow brown spot, sheath paddy blight and bacterial leaf blight paddy in sustainable ways.

References

Antralina, M., Istina, I.I., Yuwariah, Y. and T. Simarmata. 2015. Effect of Difference Weed Control Methods to Yield of Lowland Paddy In The SOBARI. Procedia Food Science 3 (2015) 323 – 329

Bhattacharjee, R and U. Dey. 2014. Biofertilizers a way towards organic agriculture: A Review. African Jour. Micro. Res. Vol 8 (24): 2232-2342

Campbell, C. L. and L.V, Madden. 1990. Introduction to Plant Disease Epidemiology. John Wiley & Sons, New York. 532 p.

IRRI. 2002. Standard Evaluation System for Paddy. International Paddy Riseach Institute, Los Banos Phillipine

Kloepper, J.W., Ryu, C.M and S. Zang. 2004. Induced systemic resistance and Promoting of plant growth by Bacillus spp. Phytophatology 94:1259-1266

Ku´c J. 1982. Induced immunity to plant disease. *Bioscience* 32:854–60

Simarmata, T, Benny J. and T. Turmuktini. 2011**.** Water Saving and Organic Fertilizers Based Technology to Remediate the Health of Paddy Soils and to Increase Paddy Productivity in Indonesia. Tropentag 2011, University of Bonn, October 5-7, 2011. Proceeding (Online) www.tropentag.de

Simarmata, T. 2013. Tropical Bioresources to Support Biofertilizer Industry and Sustainable Agriculture In Indonesia. International Seminar on Tropical Bio-resources for Sustainable Bioindustry; from Basic Research to Industry, 30 – 31st October 2013 in ITB. Bandung. Indonesia. https://www.researchgate.net/profile/Tualar_Simarmata/ publications

Singh, T and S S. Purohit. 2011. Biofertilizers Technology. Agrobios (India).

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