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RESEARCH OF WHILE BBV INFECTED AND DOSAGE OF RICE CHAFF ON THE INCREASING OF PATHOGEN STEM ROT RESILIENCE OF VANILLA (BBV) WHICH INDUCED OF RHIZOCTONIA BINUCLEATE (BNR) AND THE EFFECT ON THE INCREASING OF ORGANIC MATTERS AND SOIL PHOSPHORUS

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Abstract

The using of healthy vanilla seedlings can increases productivity, quality, and plant's production life, however seeing the fact that inoculum *F. oxysporum* f.sp.*vanillae* (Stem Rot of Vanilla or BBV) scattered on the land then the utilization of microbial antagonism as a control agents which can decreasing level of the attacks. The effectivity of *Rhizoctonia* Binucleate (BNR) on plants affected by while BBV infected and dosage of chaff on plants. Before the treatment of every sample vanilla plants were inoculated with 15 grams of *Rhizoctonia* Binucleate and 9 grams of phosporus. This research consisted of two treatment which first treatment is when inoculation of BBV with a level without inoculation of BBV, consists of (while doing planting, after fifteen days and after thirty days) or (H_1, H_2, H_3), the second treatment is dosage of rice chaff consists of (0, 5, 10, 15) grams/plant or (S_0, S_1, S_2, S_3), soil type is Alfisol. With those variables on research units which organized around broad substantive research topics. Every research units consists of planted ten vanilla seeds in polybag which contain of 500 grams medium soil. Whereas sampling units consists of overall individual research units. The result of research shows that the interaction when inoculation of BBV and dosage of chaff truely different with the level of organic material, phosporus and percentage of seedling death. Higher result of organic matter observation's parameter on the treatment H_3S_3 was 4.10%, phosporus on the treatment H_3S_3 was 12.14%.

Key words: *Rhizoctonia binucleate, rice chaff, organic matter, phosporus, vanilla*

Introduction

Vanilla plant (*Vanilla planifolia* Andrew) is one of industry plants which has economic values (Hadisutrisno, 2005). Vanilla can be augmented generatively with seeds and vegetative by cuttings. Because of augmentation with seeds takes time and blooming slower, then vanilla augmentation for commercial did by cuttings way. Farmer usually uses vanilla plants substance in the form of long cuttings (50-60 cm), at least consist of five joint as an augmentation substance. Vanilla seed or cutting needs every year around sixteen million of seeds, then needed a comprehensive main garden. Until now, adding seeds is still an obstacle factor in areas expansion, so need to think about adding cheap and efficient vanilla seeds from the best varieties (Sukarman, 2011). The main disease of vanilla plants in Indonesia is foul stem of vanilla (BBV), which caused by fungus *Fusarium oxysporum* f.sp *vanilla.* This disease can causing a great damage which makes 50% to 100% plants death (Hadisutrisno, 2004). Every controlling effort of foul stem of vanilla which had been done, there are utilization of soil microorganism such as fungus rizosfer which profitable and has an antagonism characteristics on soil borne pathogen (Sukarman, 2011; Haryuni *et al.,* 2014a; Haryuni & Tyas, 2014b).

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Fusarium is an uncontrollable fungi (Singh *et al*., 1999), lives as saprofit in soil for two until four years, the infection is so fast by the sparks of soil water, water flow, insects, soil and plants cutting substance (Hadisutrisno, 2005). Fungus *Fusarium* sppin plants tissue creates polypeptide which has a role as a toxin and creat fusarat acid as pectolytic enzyme which is *pektinmetilesterase* (PME) and *depolimerase* (DP) which have roles to split the pectin in the cell wall of xylem and create colloidal mass as non-pectin which clogging the xylem until change into brown (Semangun, 2000; Semangun, 2001; Mukarlina *et al*., 2010). Infection of fungus *F. oxysporum* through by lateral roots tip or the main of roots tip in parenchyma intercellularly and intracellulary, after that the infection is hamperring roots growth. This fungi survives in saprofit condition which shaped as chlamydospora on period of time up to five years (Sukamto &Tombe, 1995; Sudantha & Abadi, 20011).

The function of organic matter are to change nutrient uptake of soil to unravel, 90% lost very fast because decomposition process around 5% only which have a form as mineral. Those lost in the soil are affected by temperature, oxygen, and humidity, even with too much soil processing (Funderburg, 2001). Organic matter *Gliricidie sepium*, haulm and animal manure which are organic matter that worth to be used for farmer, it is because those have high quality, availability and high potential as well (Minardi *et al*., 2011).

Phosphat is essential nutrition which as plants needs for its growth and progress. There are huge of phosphat in the soil, but around 95% to 99% phosphat which unavailable, so it can't be used by plants (Sanjotha, *et al*., 2011). Efficiency of phosphorus fertilization usually around 15% to 20%, the last is lost because of abstersion and adsorbed by soil colloids (Moljono *cit* Soeminaboedy & Tejowulan, 2012).

BNR has a role as mikoryza (Haryuni, 2012), mikoryza fungi is fixing chemistry, physics and biology of soil characteristics because hyphae external of mikoryza fungi is able to penetrate the soil pore space, both micro or macro. Hyphae external and root existence is very important becauce it can absorbs and keep soil moisture (Dhillion & Friese, 1997; Nelson & Safir *cit.* Harahap, 2009). The existance of BNR and phosphorus before been inoculated with BBV is increasing plant resilience.

There is no final result of research about the effect of BNR and rice chaff on vanilla resiliences progress on pathogen of BBV, so we need to do testing, the aim of this research is to getting know while infection of BBV and rice chaff dosages happens, then increasing plant tissues resilience and its effect of the increasing of organic substance and soil phosphorus.

Methods

Give 9 grams phosphorus/plants and 15 grams fungus *Rhizoctonia* binucleate in every treatment, first treatment is inoculated by BBV with a giving variation by inoculated when planting, inoculated on fifteen days after planting and the second treatment's parameter rice chaff with a dosage without rice chaff, 5 grams/plant, 10 grams/plant, 15 grams/plant which the soil type is Alfisol. With those variables above research units use organized around broad substantive research topics project. Every research units consist of ten vanilla seeds which been planted in polybag which contain of 500 grams medium soil. Whereas the sampling unit consist of the whole of individu in research units.

Analysis

Soil analysis: example is soil that has been dried until the weight is constant, crushed or mashed, be strained with sieve size 2 mm, then put into plastic bowl. Soil characteristics that being observed in laboratory involve soil organic matter and phosphorus of soil with Bray II methods. Determination of organic material started with determination of C-organic

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substances (COT) with Walkley and Black methods (1934). Soil C-organic substances which next is being synchronized with soil organic substances (BOT) with the formula BOT = 1.724 x % COT (Sabaruddin *et al*., 2009).
Analysis of variance was conducted to test soil organic matter content and available soil phosphorus based on organized around broad substantive research topics project and continue with BNT test on the 5% of totally different standard.

Result and Discussion

1. Soil Organic matter

Soil organic matter is one of material forming soil aggregates which has a role as adhesive material between the soil particles to unite into soil aggregates, so then organic matter is important in forming soil structure (Suntoro, 2003). Soil degradation and land happens because of the contamination of agrochemistry materials, erosion, and improper land management resulting decrease in the carrying capacity of the physical, chemical and biological soil. Organic matter is one of the most effective ways to control the occurrence of degradation of land.

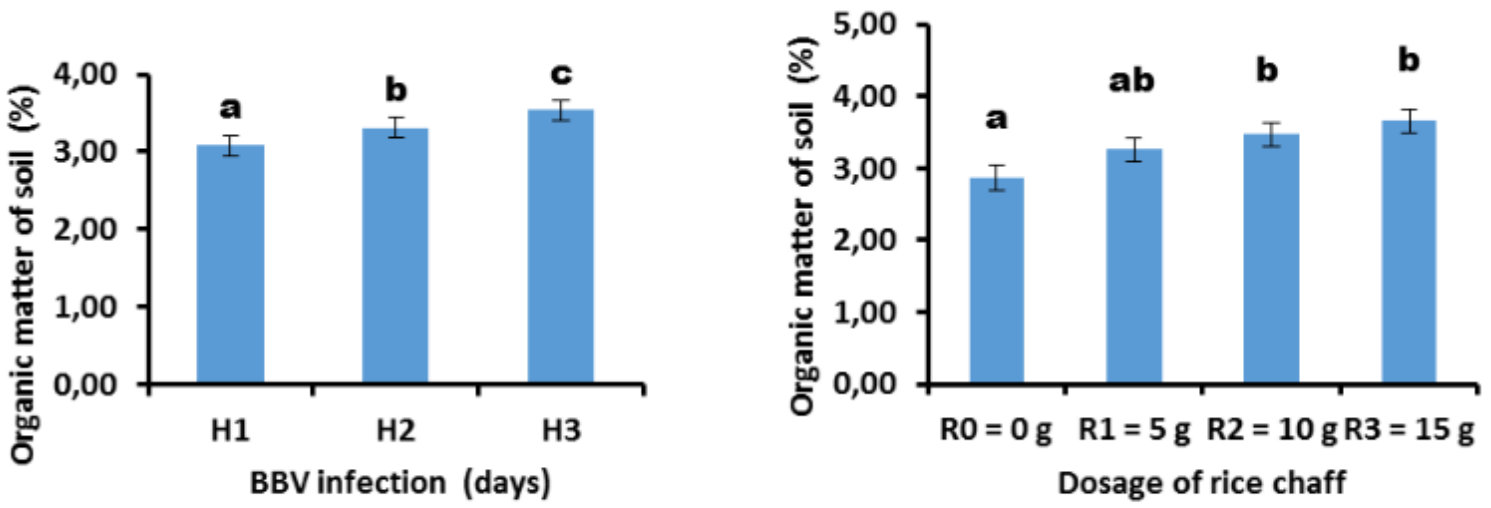

Figure 1. Soil of organic matter

Figure 1. shows that vanilla seeds which infected by BBV a month after planting (H_3) shows truely different with seeds that has been infected by BBV while were planting (H_1) whereas (H_1) and (H_2) was 3.09% and 3.31%. It caused by phosphorus (P) that has been given before planting could change P to available with hyphae help which formed from BNR, BNR existence has function as affected organic matter even by directly through mineralisation process or indirectly by helps the release of P which has been fixed (Suntoro, 2003). Soil organic matter serves as a reservoir of nutrients for crops, provides soil aggregation, increases nutrient exchange, retains moisture, reduces compaction, reduces surface crusting, and increases water infiltration into soil. Components vary in proportion and have many intermediate stages.
The treatment of giving dosage of 15 grams rice chaff is 3.65 grams shows truly different and tend to increase soil organic matter while the amount of (R_0), (R_1), and (R_2) are 2.86%, 3.26%, and 3.47% (Picture 1). 15 grams of rice chaff together with BNR and P for a month give a room and time to decompose organic matter. Suwahyono (2011) thought that the content of humic acid on organic matter is an important substance from humus molecule which has a role to recondition soil as medium planting, help to loosen the soil, and help to uptake the nutrient, also increasing retention of water content, and spur the growth of microbes in the soil. Everyday humic acid is called humus and these compounds contribute to the physical and chemical quality of the soil. Support by Funderburg (2001) benefits of

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organic matter are 1) nutrient supply, 2) water holding capacity, 3) soil structure aggregation, 4) erosion prevention.

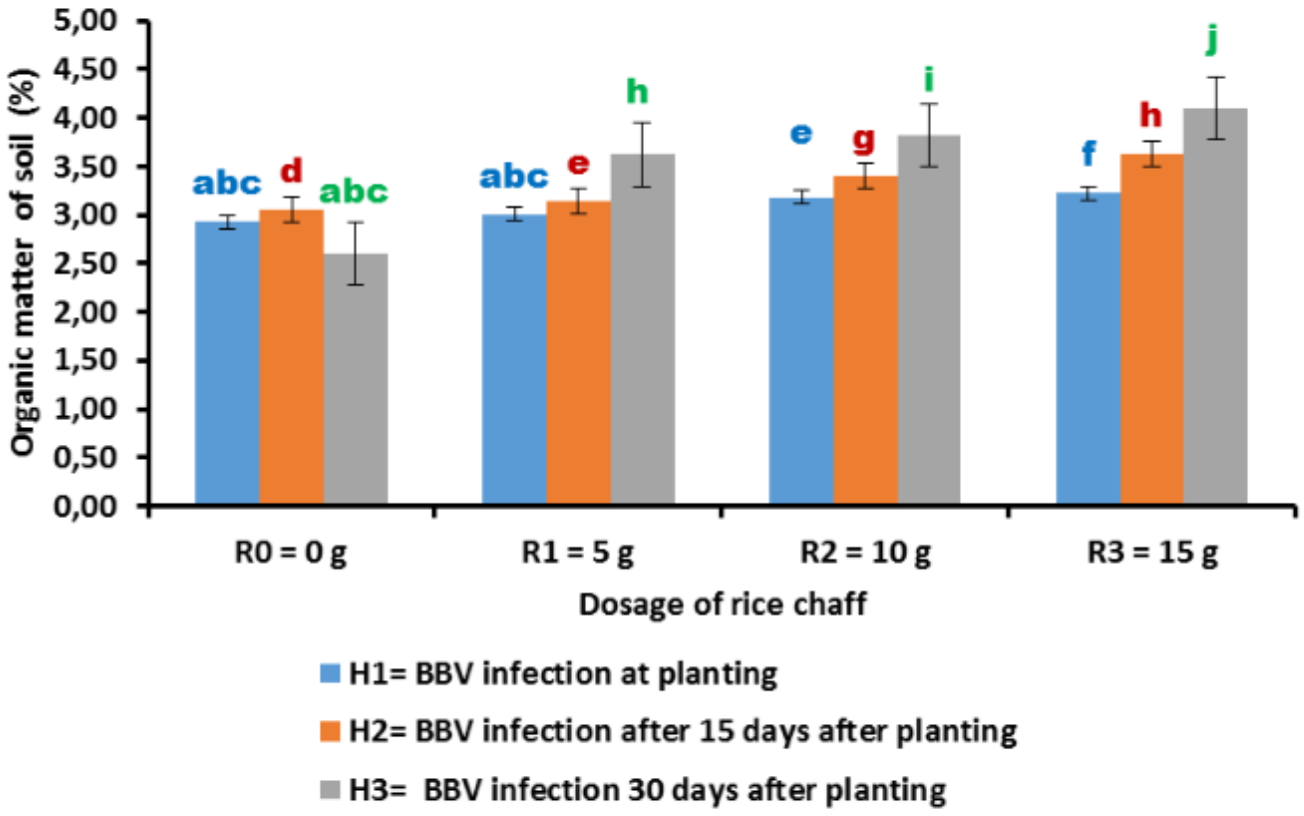

Figure 2. Effect of interaction of variation of BBV infected and dosage of rice chaff to soil of organic matter

Figure 2 shows that variant interaction while BBV infection and dosage of rice chaff effected it and tend to increase soil organic material content. The increasing of rice chaff and increasing while BBV infections on plants give real effect (Haryuni, 2012) by 4.1%. Whereas the lowest organic material content on treatment (R_0H_1) is 2.93%. It is because of increasing of dosage of rice chaff from (0, 5,10) grams to 15 grams causing in increasing organic material contents. Based on forming process, rice chaff doesn't bring microorganism pathogen because it was passing through burning process, then it is relative sterile. Its role in the soil increasing soil porosity then the soil becomes flabby also increasing soils ability to absorb water. The content of carbon is high, wherein the carbon element is indispensable in the composting process. Research result from Gawansyah *cit*. Tamtomo *et al*., (2015) shows that rice chaff charcoal serves as the organic material can increase the productivity of soil and fertilizer efficiency as well as reducing the need for fertilizers. Organic matter is an energy source of macro and microbiology of soil so then increasing activity and microbiology population which has relation with decomposition activity and mineralisation of organic matter (Stevenson, 2007). Supported by result of analysis data Tamtomo *et al.,* (2015) that the content of rice chaffs charcoal are 0.2107% phosphorus, 0.3979% Calium, 0.4758% Calsium, 0.0868% Magnesium and 3.2816% neutralization power. Rice chaff charcoal contains a lot of nutrient which have a role in increasing soil organic matter through decomposition process which give effect to the resistance and growth of plants. Sympatric microorganisms that influence microenvironment, such as water balance, nutrient content and substrate quality (Rasmussen *et al*., 2015).

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2. Soil Phosphorus

Nutrient which can be absorbed by plants with mycorrhizal fungi helps and roots are phosphorus, this element is required in relatively high amounts of plant (Marschner, 1986). Phosphorus which has been absorbed by hyphae external that resulting from BNR and modified root into polyphosphate compound. Hyphae is the important part of mycorrhizal fungi that are outside and inside the roots and serves to absorb the phosphorus in the soil (Dhillion & Friese, 1997; Brundrett, 2000; Krishna, 2005). Bolan (1991) thought that roots which been inoculated with mycorrhizal fungi, phosphorus levels higher than the roots do not bermikoriza. Supported by research of Haryuni (2012) dan Haryuni & Tyas (2015) BNR hyphae external increasing soil phosphorus levels. Support by Cameron *et al*., (2007) *Goodyera repens* can obtain significant amounts of P from its mycorrhizal partner. These results provide further support for the view that mycorrhizal associations in some adult green orchids are mutualistic.

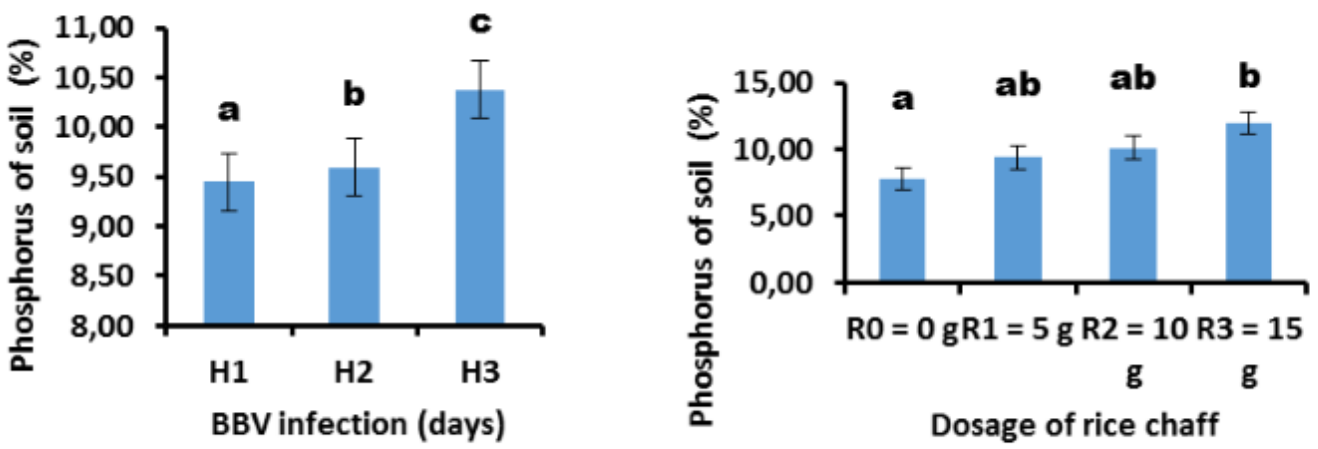

Figure 3. Soil of phosphorus

Time of BBV infected is truly different and increasing soil phosphorus levels, BBV infected while planting (H_1) is 9.45% but (H_2) and (H_3) increased to 9.60% and 10.38% (Figure 3). That is because BNR which has been inoculated before planting forming threads hyphae, then issued a phosphatase enzymes and organic acids, especially oxalate can help liberate phosphorus (Bolan, 1991; Sasli, 2004). Research on sorghum were inoculated with mycorrhizal fungi showed that phosphorus levels higher than those without inoculated mycorrhizal fungi. Menurut Sasli (2004), thought, plants that have been with mycorrhizal fungi can grow better because can uptake nutrient such as N, P, dan K more than in the infected soil and root mycorrhizal fungi can increase the absorption of nutrients. BNR inoculation forms hyphae then helps the roots absorb and store water.

The increasing of husk dosage gives real effect and tend to increase soil phosphorus levels ($R_{3)}$ is 11.95% whereas on dosage (R_0) (R_1) and (R_2) 7.77%, 9.41% and 10.1%. Increasing of phosphorus because husk contains of humic acid which is organic material components (Tamtomo *et al.,* 2015). Adding organic material can increase soil microorganism population even fungi or decomposers (Haryuni, 2012). The microorganisms that play a role here is BNR which grows forming threads hyphae thus improving nutrient absorption P. Supported by the research of Priyadharsini & Srane (2009) which states that rice husk ash improve the growth and yield of cowpea. BNR is microorganism which has ability to extract phosphate from insoluble form into a form available to plants through secretion of organic acids that

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produced for the release of the complex P sorption (Hanafiah *et al.*, 2009; Haryuni, 2012). Inoculation can be increased available soil P concentrations, so that inoculated roots mobilize more P and plants may have up taken more P from soil. Arbuscular mycorrhizal fungi inoculation can be used as a component of integrated nutrient management strategies (Cozzolino *et al*., 2013).

Figure 4 shows that variant interaction while infection BBV and rice shaff dosages gives different effect and tend to increasing soil phosphorus levels. On interaction (R_3H_1) the highest phosphorus levels is 13.03%, meanwhile (R_3H_2) and (R_3H_13) are 10,61% and 12,22%. That was because of BNR and chaff contains of chitinase activity or microbial kitinolik, then hydrolyze chitin BBV compounds that has a role as organizer of cell walls, so BBV weaks even death (Fakamizo *et al., cit*. Ferniah *et al*., 20011; Semangun, 2001; Haryuni *et al*., 2014a). BNR and chaff which degrade chitin BBV called as biopesticides and has a role as enzym producer and Plant Growth Promoting Fungi (PGPF) which produce metabolites growth regulators and provide nutrients for plants (Suryanto *et al*, 2010; Bustaman *cit*. Khaeruni & Rahman, 2012; Haryuni *et al*., 2014).

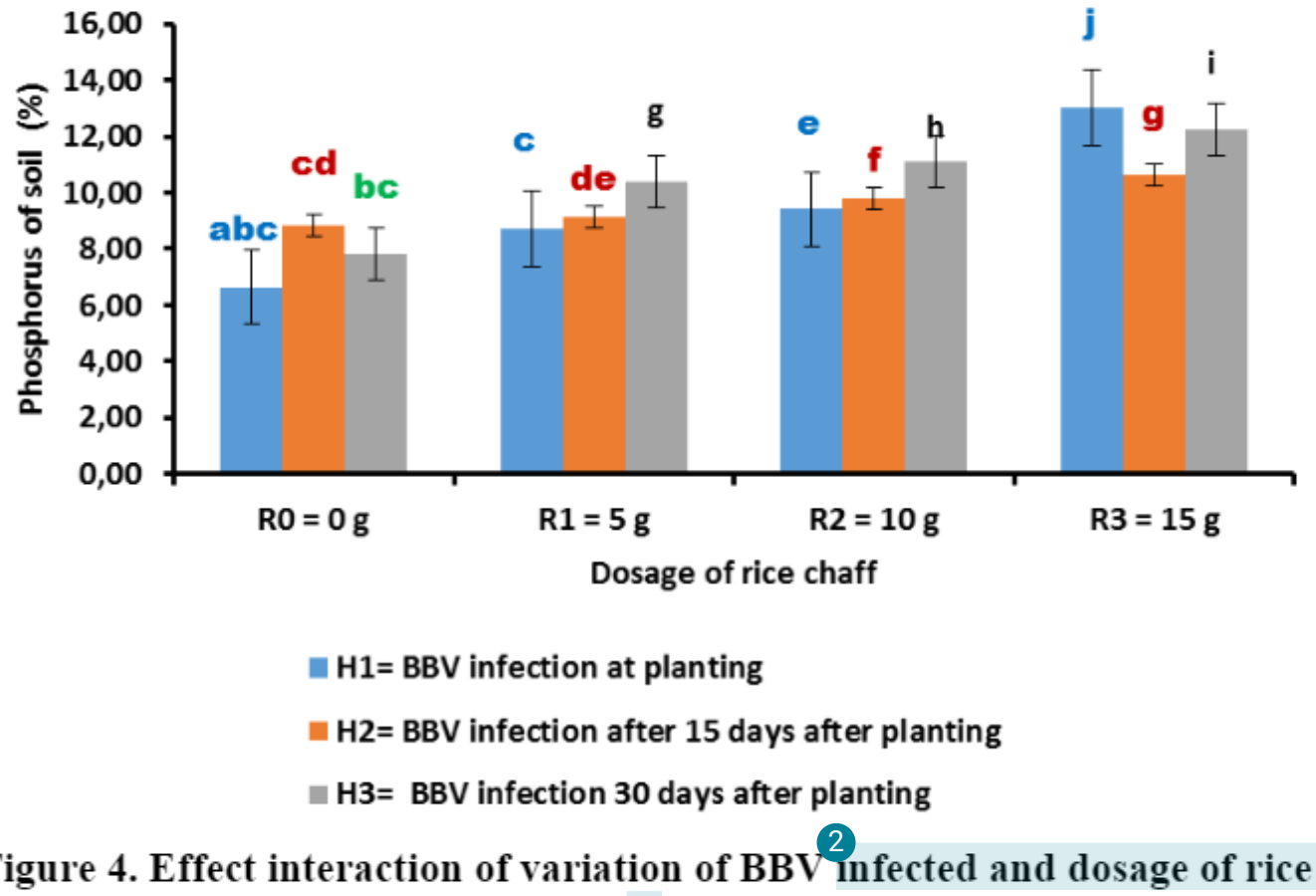

Figure 4. Effect interaction of variation of BBV infected and dosage of rice chaff to soil of phosphorus

BNR and rice chaff which degrades BBV has a role as microorganism that can release P bound so available shaped to plants. BNR as mycorrhizal can absorb P from mineral P sourches which soluble because produce organic acids and phosphatase enzyme, with the mechanism of infection of the root system of the host plant, produces interwoven hyphae intensively then mycorrhizal roots can increase nutrient absorption capacity (Iskandar, 2001; Haryuni, 2014). Wherein P in soil substances is increasing, then P absorbtions by plants will be increase as well (Mengel & Kirkby, 2007). Organic substances and mycorrhizal increase availability of P on corn crop (Sufardi *et al*., 2013). The higher of population of mycorrhizal increase the absorption of water and nutrients needed by plants (Sastrahidayat, 2011; Subhi *et al,* 2014). Microorganism existance is needed oc n P element because (1) the amount in soil

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is little, (2) unavailability of the original P, and (3) P fixation occurs in soils derived from fertilization (Buckman dan Brady, 1980).

Conclusion

Based on the analysis and the discussion above it can be concluded that while infection BBV, rice chaff dosages and its interaction really effecting on organic material levels and soil phosphorus and tend to increase. Infection BBV on the base of the trunk does not infect but degraded by BNR, contains of humic acid then decomposes into organic matter. Organic matter which has been formed is an energy source of BNR of hyphae external growth which has a role to absorb available P to plants.

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