DOSAGE TEST OF RHIZOBIUM AND MULTI-ORGANIC KOHEN FERTILIZER ON GROWTH AND PRODUCTION SOYBEAN (*Glycine max* L)

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ARTICLE INFO

Date received : 22 Oct 2022
Revision date : 19 Nov 2022
Date received : 26 Nov 2022

Keywords:
Multi-Organic,
Cohen,
Production,
Fertilizer,
Rhizobium

ABSTRACT

The study aimed to determine the dose of Rhizobium and Kohen multi-organic fertilizer on the Growth and Production of Soybean (Glycine max L). The research method used a factorial Randomized Block Design (RBD) consisting of 2 factors with 16 treatment combinations and 2 blocks. which is the first factor in the administration of rhizobium (R) doses consisting of 4 levels, namely R0 = No Treatment, R1 = 5 g/kg seeds, R2 = 10 g/kg seeds, and R3 = 15 g/kg seeds. The second factor was the multi-organic kohen (S) fertilizer treatment consisting of 4 levels, namely S0 = No Treatment, S1 = 0.5 kg/plot, S2 = 1,5 kg/plot, and S3 = 2,5 kg/plot. The research parameters were plant height, number of productive branches, number of pods per sample, dry weight of seeds per plot, and dry weight of grain per sample.The results showed that treatment with rhizobium dose affected the parameters of dry weight of seeds per plot, but did not affect the parameters of plant height, number of productive branches, number of filled pods, dry weight of seeds per sample.The multiorganic kohen fertilizer treatment had an effect on the dry weight of seeds per plot, and dry weight of seeds per sample, but had no effect on the parameters of plant height, number of productive branches.The interaction of the dose of rhizobium and multi-organic kohen fertilizer did not affect all the observed parameters.

INTRODUCTION

The Agricultural Research and Development Agency of the Ministry of Agriculture stated that the demand for soybean production in Indonesia in 2020 reached 2.3 million tons per year, while soybean production only reached 900 thousand tons per year, where the shortage of soybean production was 1.4 million tons per year.The need will continue to increase from year to year, while production has not been able to achieve the existing needs. In 2016, soybean demand in Indonesia was estimated at 2,720,496 tons while production in the same year was only 943,862 tons (Nuryati et al., 2016). Soybean has many varieties, in 2016 removed 86 soybeans were. These varieties have various advantages and characteristics, both morphological and agronomic characteristics. The superior soybean variety is the Anjasmoro variety.Anjasmoro is one of the superior soybean varieties that can adapt to the ecosystem of rice fields, dry land, lowland swamp land, and tidal swamp land. Some of the advantages possessed by the Anjasmoro variety are high production, resistance to fall, moderate to leaf disease, large seeds, pods that are not easily broken, and especially for making tempeh(Jumakir dan Endrizal, 2014).

One way to increasecrop productivityis the provision of biological fertilizers (rhizobium sp) which can beexpected to meet nitrogen nutrients whichwill help reduce production costs, as well as increase the efficiency of usingin organic fertilizers despite the scarcity of fertilizers due to the recent pandemic.In soybean plants, there are severalwaysthat can bedone to increasesoy bean production, in addition to providing air, one of whichis the application of organic fertilizer. This isbecause fertilizer is a fertilizer that does not damage organicsoil, but will beneeded by the soilbecause the organicmatter in it has an important role in soilfertility, soil structure, and the growth of micro organisms in the soil (Hanafiah, 2012).

Soybean is known as a plant that associates well with Rhizobium bacteria. Giving a dose of 10 ml of inoculum from various Rhizobium species was able to increase growth, the number of root nodules, and the production of soybean varieties of Anjasmoro (Surtiningsih et al., 2012). Rhizobium is a bacterium that lives in symbiosis on host plants from the Leguminosae family by forming nodules on the roots. This root nodule is a symbiotic organ that is active in fixing N2 from the air(Prayoga, 2016).

The addition of materials such as manure into the soil has the benefit of improving soil aggregation so as to increase the number of soil pores and root reach so that nutrient absorption is easier (Marlina et al, 2015).

Multi-function fertilizer from a mixture or combination of animal waste with food waste and animal bedding. Where this mixture undergoes a process of decay and then does not form as it came from.

METHOD

Research methods

Research with a randomized block design, factorial (RBD) consisting of 2 treatment factors including the provision of Rhizobium (R) consisting of 4 levels of R0 (without treatment) R1 (10 g/plant), R2 (20 g/plant) and R3 (30 g/plant), and the treatment of Kohen Multi Organic Fertilizer (S) consisted of 4 levels, namely S0 (0 g/polybag), S1 (1 kg/polybag), S2 (2 kg/polybag) and S3 (3 kg g/plant). polybag).

Research Implementation

Provision of rhizobium according to treatment, manufacture of multi-organic fertilizers, land management, and plot making as well as rhizobium application, planting, then data collection.

Observation Parameter

The research parameters were plant height, stem diameter, number of productive branches, number of pods per sample, number of filled pods, number of empty pods, dry weight of seeds per plot, and dry weight of seeds per sample.

RESULTS AND DISCUSSION

Plant height

Observation data on plant height (cm) of soybeans with doses of Rhizobium and Kohen multi-organic fertilizers aged 2, 4, and 6 weeks after planting (WAP) can be seen in Table 1.

Table 1. Average plant height from treatment with doses of Rhizobium Fertilizer and Multi Organic Kohen at 2, 4, and 6 WAP.

Treatment		Plant height(cm)	
	2 WAP	4 WAP	6 WAP
R = Dosage of Rhizobium Rhizoka			
R0 = 0 g Dosage of Rhizobium Rhizoka	13,01 aA	30,10 aA	52,04aA
R1 = 5 g Dosage of Rhizobium Rhizoka	11,57 aA	25,53aA	45,13aA
R2 = 10 g Dosage of Rhizobium Rhizoka	11,18 aA	25,63aA	41,35aA
R3 = 15g Dosage of Rhizobium Rhizoka	12,42 aA	26,86aA	46,41aA
S = Kohen Multi Organic Fertilizer			
S0 = 0 kg Kohen Multi Organic Fertilizer	11,00 aA	24,44 aA	46,51aA
S1 = 0.5 kg Kohen Multi Organic Fertilizer	11,23 aA	24,34 aA	46,00aA
S2 = 1.5kg Kohen Multi Organic Fertilizer	10,54 aA	24,44 aA	47,15aA
S3 = 2.5 kg Kohen Multi Organic Fertilizer	11,35 aA	27,00 aA	52,20aA

Information: Numbers followed by the same letter in the same column show no significant difference at the 5% (lowercase) and 1% (uppercase) levels.

Rod Diameter

Observation of data stem diameter (mm) presenting doses of Rhizobium and multi-organic fertilizer Kohen age 12 WAP can be seen in Table 2.

Table 2. The mean stem diameter of soybeans treated with Rhizobium and Kohen Multi Organic Fertilizer at 12 WAP

Treatment	Rod Diameter (mm)
R = Dosage Rhizobium Rhizoka	
R0 = 0 g Dosage Rhizobium Rhizoka	2,41aA
R1 = 5 g Dosage Rhizobium Rhizoka	2,15aA
R2 = 10 g Dosage Rhizobium Rhizoka	2,16aA
R3 = 15g DosageRhizobium Rhizoka	2,30aA
S = Kohen Multi Organic Fertilizer	
S0 = 0 kg Kohen Multi Organic Fertilizer	2,15aA
S1 = 0.5 kg Kohen Multi Organic Fertilizer	2,10aA
S2 = 1.5 kg Kohen Multi Organic Fertilizer	2,22aA
S3 = 2.5 kg Kohen Multi Organic Fertilizer	2,42aA

Information: Numbers followed by the same letter in the same column show no significant difference at the 5% (lowercase) and 1% (uppercase) levels.

Productive Branch (branch)

Observation data of Productive Branches (branches) reduced the dosage of Rhizobium and Kohen multi-organic fertilizer can be seen in Table 3.

Table 3. The average number of productive branches of soybean plants treated with doses of Rhizobium and Kohen Multi Organic Fertilizer

Treatment	Number of Productive Branches
R = Dosage Rhizobium Rhizoka	
R0 = 0 g Dosage RhizobiumRhizoka	26,01aA
R1 = 5 g Dosage RhizobiumRhizoka	27,16aA
R2 = 10 g DosageRhizobium Rhizoka	27,23aA
R3 = 15 g Dosage RhizobiumRhizoka	27,56aA
S = Kohen Multi Organic Fertilizer	
S0 = 0 kg Kohen Multi Organic Fertilizer	26,15 aA
S1 = 0.5 kgKohen Multi Organic Fertilizer	26,21aA
S2 = 1.5 kg Kohen Multi Organic Fertilizer	27,77 aA
S3 = 2.5 kg Kohen Multi Organic Fertilizer	27,80aA

Information:Numbers followed by the same letter in the same column show no significant difference at the 5% (lowercase) and 1% (uppercase) levels.

Number of Pods Per Sample (pods)

Observation data on the number of pods per sample (pods) presenting doses of Rhizobium and Kohen multi-organic fertilizers can be seen in Table 4.

Table 4. The average number of plant pods containing soybean plants with doses of Rhizobium and Kohen multi-organic fertilizer

Treatment	Number of Pods Contains
R = DosageRhizobium Rhizoka	

R0 = 0 g Dosage Rhizobium Rhizoka	119,19 cC
R1 = 5 g Dosage Rhizobium Rhizoka	135,22 bB
R2 = 10 g Dosage Rhizobium Rhizoka	161,81 bB
R3 = 15g Dosage Rhizobium Rhizoka	140,50 aA
S = Kohen Multi Organic Fertilizer	
S0 = 0 kg Kohen Multi Organic Fertilizer	121,81 bB
S1 = 0.5 kg Kohen Multi Organic Fertilizer	121,44 bB
S2 = 1.5 kg Kohen Multi Organic Fertilizer	153,06 aA
S3 = 2.5 kg Kohen Multi Organic Fertilizer	160,41 aA

Information : Numbers followed by the same letter in the same column show no significantdifference at the 5% (lowercase) and 1% (uppercase) levels.

The results of the regression analysis of the dose of rhizobium on the parameter of the number of filled pods showed a linear relationship, as shown in Figure 1.

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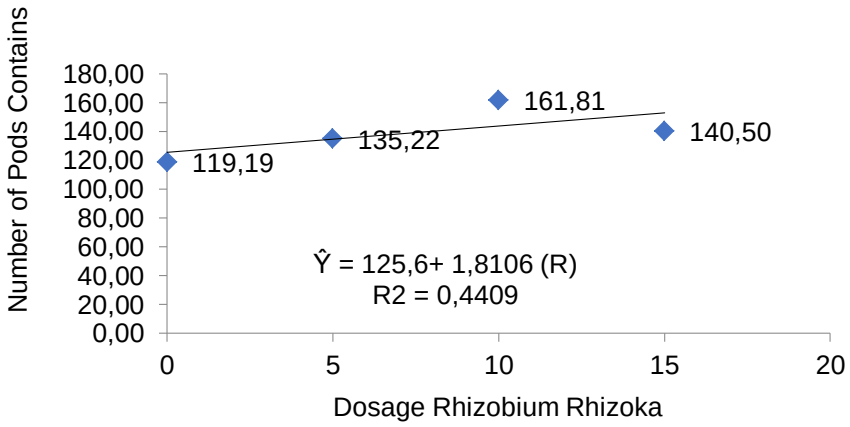

Figure 1. The relationship between the dosage of Rhizobium rhizoka and the number of filled pods

The results of the regression analysis of the application of multi-organic kohen fertilizer to the parameter number of pods containing showed a linear relationship, as shown in Figure 2.

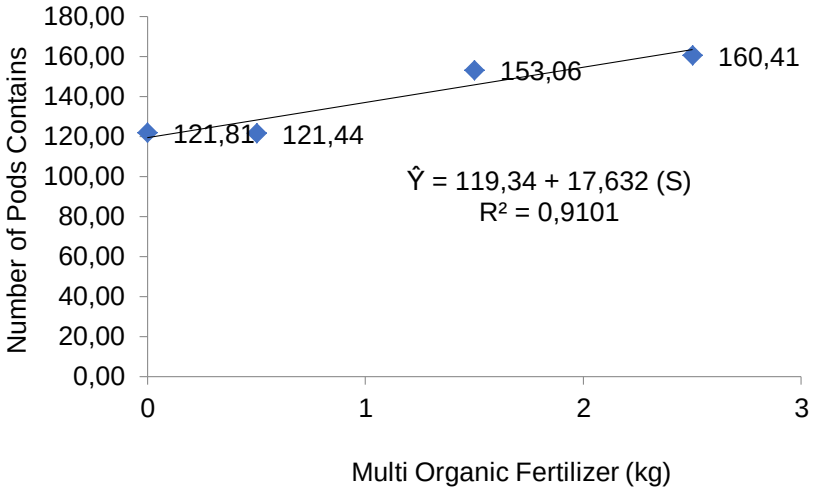

Figure 2. The relationship between the application of multi organic kohen fertilizer to the number of filled pods.

Dry Weight of Persample Seeds

Observation data of seed dry weight per sample on soybean plants on Rhizobium and Kohen multi-organic fertilizer can be seen in Table 5.

Table 5. Average dry weight of seeds per sample of soybean plants with treatment with Rhizobium and Multi Organic Kohen fertilizers

Treatment	Dry Weight of Seed Persample (g)
R = Dosage Rhizobium Rhizoka	
R0 = 0 g Dosage Rhizobium Rhizoka	36,47 aA
R1 = 5g Dosage Rhizobium Rhizoka	36,46 aA
R2 = 10 g DosageRhizobium Rhizoka	41,90 aA
R3 = 15g Dosage Rhizobium Rhizoka	37,56 aA
S = Kohen Multi Organic Fertilizer	
S0 = 0 kgKohen Multi Organic Fertilizer	36,34 bB
S1 = 0.5 kg Kohen Multi Organic Fertilizer	35,45 bB
S2 = 1.5 kg Kohen Multi Organic Fertilizer	38,42 aA
S3 = 2.5 kg Kohen Multi Organic Fertilizer	42,18 aA

Information : Numbers followed by the same letter in the same column show no significant difference at the 5% (lowercase) and 1% (uppercase) levels.

The results of the regression analysis of the application of multi organic kohen fertilizer on different dry weight parameters of seeds per sample showed a linear relationship, as shown in Figure 6.

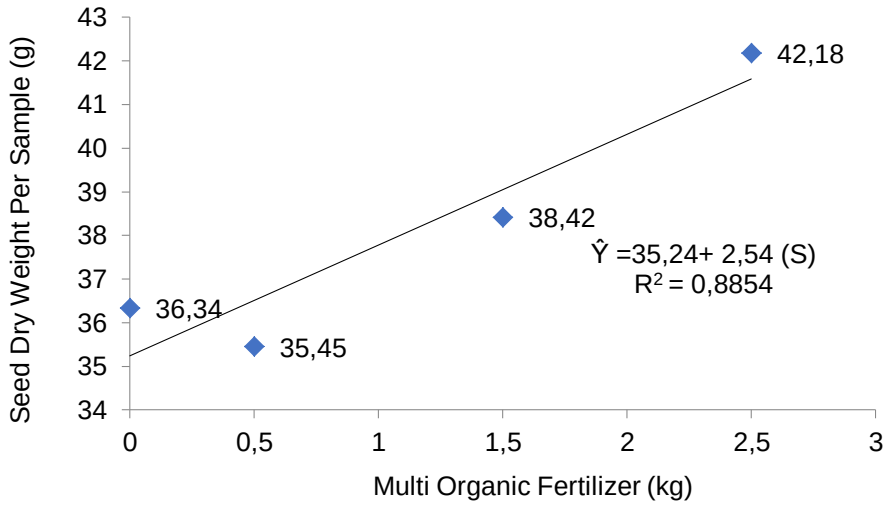

Figure 3. The relationship between the application of multi-organic kohen fertilizer to the dry weight of seeds per sample

Dry Weight of Perplot Seeds (g)

Observation data on the production of samples (g) of soybeans dosed with Rhizobium and Kohen multi organic fertilizer can be seen in Table 6.

Table 6. Average seed dry weight per plot of soybean plants treated with doses of Rhizobium and Kohen multi-organic fertilizer

Treatment	Dry Weight Conversion Tonnes/Ha Seeds per plot (g)
R = Dosage Rhizobium Rhizoka	
R0 = 0 g Dosage Rhizobium Rhizoka	270,36 cC
R1 = 5g Dosage Rhizobium Rhizoka	314,09 bB
R2 = 10 g DosageRhizobium Rhizoka	388,56 aA
R3 = 15g Dosage Rhizobium Rhizoka	366,36 aA
S = Kohen Multi Organic Fertilizer	
S0 = 0 kg Kohen Multi Organic Fertilizer	276,83 bB
S1 = 0.5 kg Kohen Multi Organic Fertilizer	292,28 bB
S2 = 1.5 kg Kohen Multi Organic Fertilizer	376,41 aA
S3 = 2.5 kg Kohen Multi Organic Fertilizer	393,86 aA

Information: Numbers followed by the same letter in the same column show no significant difference at the 5% (lowercase) and 1% (uppercase) levels.

The results of the regression analysis of rhizobium dosing on the seed dry weight parameter per plot showed a linear relationship, as shown in Figure 3.

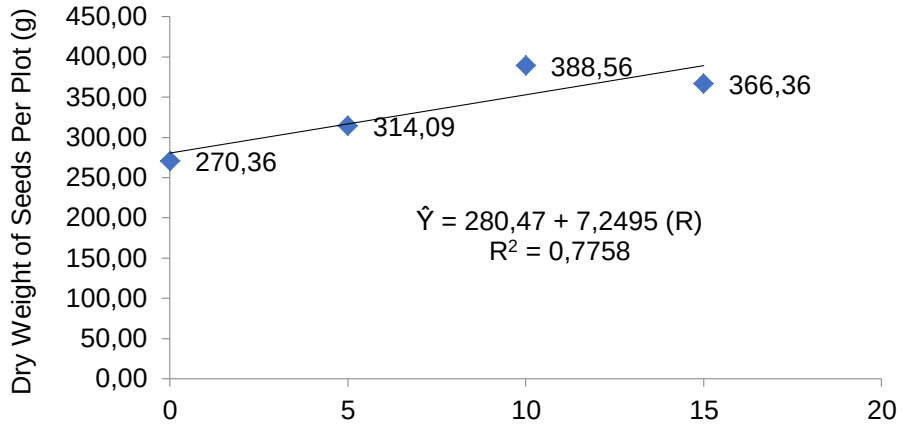

Figure 4. The relationship between the doses of Rhizobium rhizoka to the total dry weight of seeds per plot

The results of the regression analysis of the application of multi-organic kohen fertilizer to the parameter of seed dry weight per plot showed a linear relationship, as shown in Figure 4.

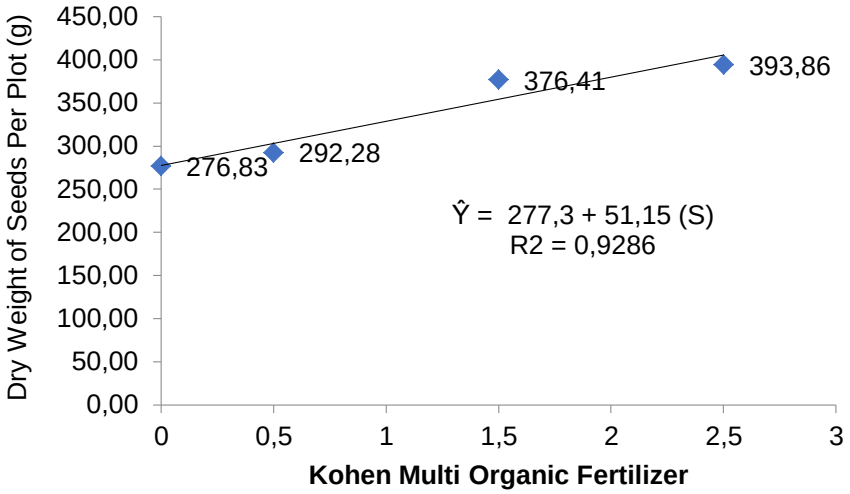

Figure 5. The relationship between the application of multi-organic kohen fertilizer to the total dry weight of seeds per plot

Discussion

Rhizobium Dosage Test on Growth and Production Soybean Plant (*Glycine max* L)

The results of statistical data analysis showed that the effect of Rhizobium dosing on the growth and production of soybeans had no effect on the parameters of plant height, the number of productive branches.This is because research on Rhizobium on leguminous plants includes one of them, soybean plants do not always give good results, do not always have a real influence on plant growth, and often fail. There are several factors that might cause this to happen, including the low ability of Rhizobium bacteria to compete with native bacteria in infecting roots. Other factors that affect the development and activity of Rhizobium in the soil are organic matter content, moisture, aeration, temperature, soil acidity, organic nutrient supply, soil type and sand and clay content. The decrease in Rhizobium populations in soil through Rhizobium legin was greater than the treatment without legin. This situation indicates that the adaptability of Rhizobium (input of micro-organisms) is lower than that of natural Rhizobia(Armiadi 2016).

Kohen Multi Organic Fertilizer Test on Growth and Production Soybean Plants*(Glycine max* L*)*

The results of statistical data analysis showed that the effect of multi-organic fertilizer application on soybean growth and yield did not affect the parameters of plant height, number of productive branches.It is suspected that the low rate of growth and production is due to the application of 5 ton ha of multi organic kohen fertilizer that has not been able to provide sufficient and balanced nutrients to support the growth and production of soybean plants so that they can grow optimally. Treatment without multi-organic kohen fertilizer gave low growth to the vegetative growth of soybean plants. This is because the nutrients available in the soil are still insufficient to meet the needs of plants and too many nutrients in the soil can result in an overdose in plants.sehinggamenyebabkanrendahnyatinggitanaman, jumlahcabangproduktif(Luthfyrakhman, 2013).

In the application of multi organic kohen fertilizer on the growth and yield of soybean plants, it has an influence on the parameters of the number of pods per sample, the dry weight of the seeds per sample and the dry weight of the seeds per plot.This is because multi organic kohen fertilizer is an organic fertilizer that can be used to add nutrients, improve the physical and biological properties of the soil. Multi-organic fertilizers contain organic matter that functions to maintain and increase soil fertility, also contain micro-nutrients needed by plants. Organic fertilizers are very beneficial for increasing agricultural production both in quality and quantity, reducing environmental pollution, and improving land quality in a sustainable manner. Long-term use of organic fertilizers can increase land productivity and prevent land degradation (Santoso, 2012).

Interaction Test of Rhizobium Dosage and Kohen Multi Organic Fertilizer on the Growth and Production of Soybean Plants*(Glycine max* L*)*

Based on the results of statistical analysis, it is known that the interaction between the dose of Rhizobium and cohen multi organic fertilizer on the growth and yield of soybeans does not affect all parameters, it is suspected that the administration of rhizobium and multi organic kohen fertilizer given to soybean plants do not support each other and still work. individually.

CONCLUSION

The dosage of rhizobium showed a significant effect on the observed parameters such as the number of pods per sample, dry weight of seeds per sample dry weight of seeds per plot, and had no significant effect on the observed parameters namely, plant height, stem diameter, number of productive branches, dry weight of seeds per sample and per plot.

Multi organic kohen fertilizer showed a significant effect on the observation parameters of the number of pods per sample, dry weight of seeds per sample, dry weight of seeds per plot. And no significant effect on the parameters of plant height, number of productive branches.

The interaction between rhizobium application doses and kohen multi organic fertilizer showed no significant different effect on all observed parameters.

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