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Improving The Quality And Quantity Of Edamame (Glycine Max (L.) Merr.) Plant Products By Poc Dosage Of Beef Blood And Za Fertilizer

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This research was carried out at the Agricultural Training Center, Soropadanwith an altitude of 489 meters above sea level,in May – August 2022. The research is a factorial experiment (4x2) arranged in a complete randomized block design with 2 factors and 3 replications. The first factor is the dose of bovine blood POC consisting of 4 levels, namely: 0, 200, 400 and 600 ml/plot. The second factor is the application of ZA fertilizer at doses of 0 and 75kg/ha. The results of the research showed that administering a dose of bovine blood POC up to a dose of 600 ml/plot still increased yields in the parameters of pithy pod weight per plant, old seed weight per plant and old seed weight per m2. Optimum results in the parameters of weight of young seeds per plant, weight of fruity pods per m2, protein content of young seeds and protein content of old seeds were achieved at doses of POC of bovine blood of 479.50 ml/plot, 434.44 ml/plot, 485 ml/plot and 350 ml/plot. The ZA fertilizer dose of 75 kg/ha gave higher results in the parameters of pithy pod weight per plant, old seed weight per plant, young seed weight per plant and young seed protein content, compared to without the addition of ZA fertilizer. There was an interaction between giving doses of POC beef blood and ZA fertilizer on the parameters of young seed weight per plant and young seed protein content.

1. Introduction

Edamame is much liked by consumers because it contains nutrients that are beneficial for the human body. 100 g of edamame seeds contains 582 kcal, 11.4 g protein, 7.4 g carbohydrates, 6.6 g fat, 100 mg vitamin A or carotene, B1 0.27 mg, B2 0.14 mg, B3 1 mg and vitamin C 27 mg, as well as minerals such as phosphorus 140 mg, calcium 70 mg, iron 1.7 mg and potassium 140 mg(Pambudi, 2013). The nutritional content that is beneficial to humans and the larger pod size and sweeter taste compared to ordinary soybeans means that edamame has a very wide market opportunity, both local and export markets. One of the export destination countries for edamame is Japan, Japan is the main consumer of edamame. , with annual needs reaching 150,000 – 160,000 tons. Japan's domestic edamame production every year is around 90,000 tons, so Japan still needs to import edamame to other countries. Indonesia is the fourth country to export edamame to Japan after Taiwan, China and Thailand (Soewanto et al, 2015). Indonesia has not been able to fully meet the demands of the Japanese market because Indonesia's domestic production can only export 6,790 tons(Ministry of Agriculture, 2019).

Efforts that can be made to increase edamame production in Indonesia are by adding organic and inorganic materials to cultivated land to improve the physical, chemical and biological properties of the soil. One of the organic materials that can be given to plants is cow's blood liquid organic fertilizer (POC), which contains macro and micro nutrients so that it can fertilize and increase soil productivity. In general, cow's blood is not used and thrown away, so it can pollute the environment and cause an unpleasant odor. The addition of inorganic materials such as ZA fertilizer which contains ammonium and sulfate can be useful for providing additional nutrients such as nitrogen and sulfur for plants. Plant growth and development will be hampered if there is a lack of sulfur elements, so ZA fertilizer is one fertilizer that can be used to improve the quality of edamame plants.

2. Method

The research was structured factorial (4 x 2) using a Complete Randomized Block Design (RAKL) consisting of two treatment factors with three replications. The first factor is Bovine Blood POC Dose (P) with levels P0 = 0 ml/plot, P1 = 200 ml/plot, P2 = 400 ml/plot and P3 = 600 ml/plot. The second factor is ZA fertilizer with levels Z0 = 0 kg/ha and Z1 = 75 kg/ha. The observation data was analyzed using varianceAnalysis of Variance(ANOVA) at 5% and 1% levels, then continued with the orthogonal polynomial test for the POC dose of bovine blood.

3. Result and Discussion

1 Results of POC Analysis of Cow Blood

Bovine blood liquid organic fertilizer contains macro and micro nutrients needed by plants. The results of the test analysis are presented in table 1.

Table1.POC content of beef blood

No	Parameter	Unit	Results	POC Quality Standards
1	pH H2O	-	4.29	4 - 9
2	C Organic	%	5,10	Minimum 10
3	N-Total	%	2.14	2 – 6
4	C/N Ratio	-	2.44	Minimum 0.5
5	P2O5	%	0.02	2 – 6
6	K2O	%	0.19	2 – 6
7	Na	%	0.10	-
8	Ca	%	0.05	-
9	Mg	%	0.02	-
10	Fe	ppm	162.80	90 – 900
11	M N	ppm	4.15	25 – 500
12	Zn	ppm	Nr	25 – 500
13	Cu	ppm	1.28	25 – 500
14	B	ppm	11.89	12 – 250
15	S	%	0.33	-

Source: Central Java BPTP Laboratory analysis results, 2022

2 Results of F calculated observation parameters

The results of the variance test obtained the calculated F value for all observation parameters as follows:

Table 2. F calculated observation parameters

Observation parameters	Treatment			
	P	Z	Px Z	
YOUNG EDAMAME RESULTS				
Weight of young seeds per plant	4.13*	5.23*	3.75*	
Young seed protein content	365.43**	45.80**	93.54**	
RESULTS OF OLD EDAMAME				
Weight of pithy pods per plant	9.25**	13.09**	2.90ns	
Weight of pithy pods per m2	5.40*	2.47ns	0.34ns	
Weight of mature seeds per plant	8.24**	10.46**	1.94ns	
Weight of old beans per m2	5.16*	3.91ns	0.89ns	
Protein content of mature seeds	3.96*	0.23ns	1.84n	

Source : Primary data analysis, 2022

Information :
P : POC dosage
Z : ZA Fertilizer
P x Z : Interaction of POC and ZA fertilizer
ns : Not significantly different
* : Really different
** : Really different

3 Dosing POC Cow Blood

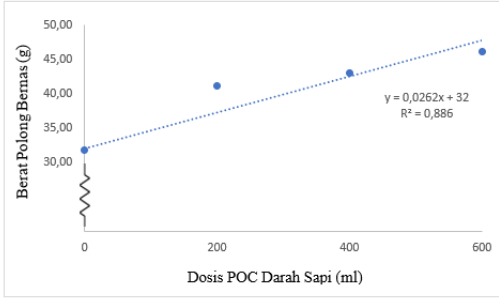

Figure 1. Effect of bovine blood POC dose on the weight of pithy pods per plant (g)

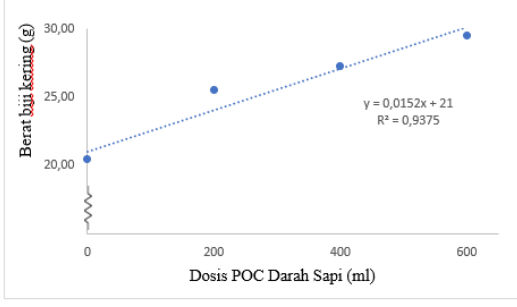

Figure 2. Effect of bovine blood POC dose on the weight of old seeds per plant (g)

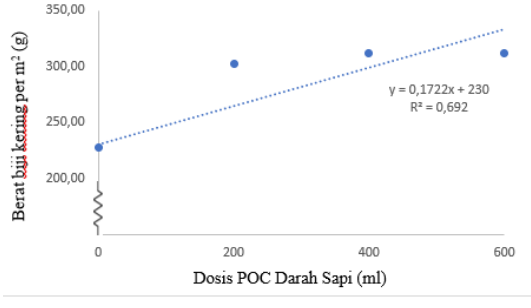

Figure 3. Effect of bovine blood POC dose on the weight of old beans per m2 (g)

Based on the linear graph above, the effect of bovine blood POC on the parameters of pithy pod weight per plant (Figure 1), old seed weight per plant (Figure 2) and old seed weight per m2 (Figure 3) shows that bovine blood POC was administered at a dose of 600 ml/plot still shows increased results in these parameters.This is because the nutrients in POC are well absorbed by plants, thereby helping in the photosynthesis process. In the process of growth and development, plants need energy, namely photosynthesis. The amount of assimilate

affects the increase in seed weight in plants (Irawati et al., 2019). The results of photosynthesis will be stored by plants as food reserves in the form of seeds. Optimal vegetative growth of edamame plants will run directly with the photosynthesis process and the results of photosynthesis will be stored by the plant as food reserves in the form of seeds.

The N element contained in bovine blood POC plays a role in stimulating plant vegetative growth (Suryati, 2014). The N element absorbed by the plant will be stored in the stems and leaves, but after the pods are formed, the N element will be included in the pod shell for filling and seed formation (Adisarwanto, 2005). The content of P and K elements in bovine blood POC also plays a role in pod filling. The P element plays a role in stimulating root development, speeding up the harvest period and increasing grain production (Suprapto, 2002). Element P can increase the photosynthesis process which influences fruit formation and ripening (Rachmadani et al., 2013). Element K plays a role in increasing growth and leaf area index. The wider the leaf index, the higher the photosynthate produced and translocated, thereby increasing the pod weight and seed weight of the edamame plant.

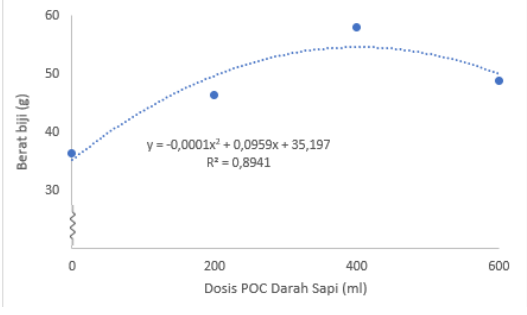

Figure 4. Effect of bovine blood POC dose on the weight of young seeds per plant

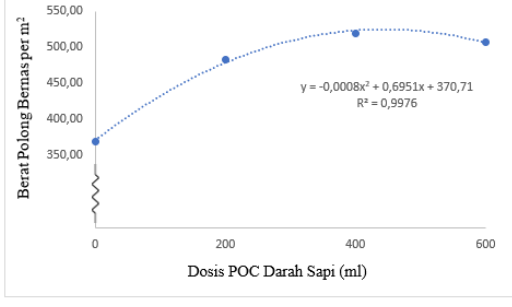

Figure 5. Effect of bovine blood POC dose on the weight of pithy pods per m2 (g)

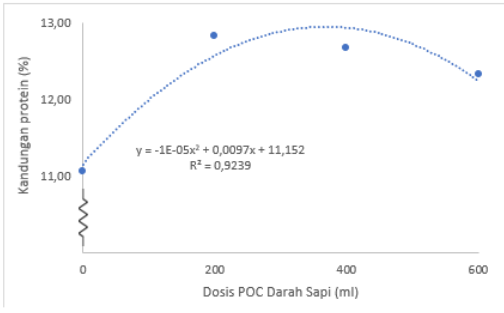

Figure 6. Effect of giving a dose of bovine blood POC on the protein content of young seeds (%)

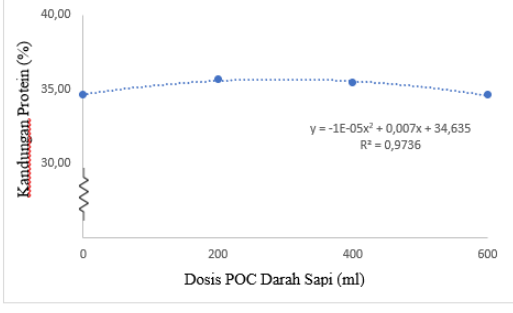

Figure 7. Effect of bovine blood POC dosage on old seed protein content (%)

Based on the quadratic graph above, it shows the effect of bovine blood POC on the parameters of young seed weight per plant (Figure 4), pithy pod weight per m2 (Figure 5), young seed protein content (Figure 6) and old seed protein content (Figure 7) respectively. Also obtained were optimum doses of 479.50 ml/plot, 434.44 ml/plot, 485 ml/plot and 350 ml/plot. This is because at this dose the nutrients contained in beef blood POC play a role in increasing pod weight, seed weight and protein content of edamame plants. The availability of nutrients and the fulfillment of plant nutrient needs will influence the photosynthesis produced, which will then be broken down into amino acids and proteins for the process of plant growth and development. The N element that is available during the growth period causes photosynthesis to run optimally, so that cell elongation and division will be faster, as well as increasing pod weight and seed weight. In the vegetative phase, the addition of N elements plays a role in the development of leaves, stems, branches and roots (Wahyudin, 2017). The element N is a macro nutrient that can play a role in the formation of protein in seeds, chlorophyll and helps in plant growth (Gardner et al., 1991).

The elements P and K are needed more by plants in the generative phase, especially during the fruit formation process (Imran, 2017). Element P can function to trigger cell division, trigger root development, seed fertilization and improve plant quality. The P element contained in bovine blood POC can play a role in protein formation, stimulating the formation of flowers, fruit and seeds (Novizan, 2002). Element K is one of the main elements that plays an important role in increasing soybean production. Potassium absorbed by plants can act as an activator of essential enzymes in photosynthesis and respiration reactions, as well as enzymes involved in protein and starch synthesis (Lakitan, 2001). Element K can also play a role in helping the formation of proteins and carbohydrates.

Essential micronutrients contained in bovine blood POC such as Boron also influence all parameters in plant growth and production. The boron content found in bovine blood POC is 11.89 ppm, according to (Hasnain et al., 2011) the dose of boron needed for plant growth and production is 5-10 ppm and doses exceeding 15 ppm will reduce plant growth and production . The element Boron can help flower formation, pollen and seed fertility (Praveena et al., 2018).

4 Providing ZA Fertilizer

The average results of ZA fertilizer treatment are as follows:

Table 3. Average results of ZA fertilizer application parameters

Observation Parameters	Z0 (0 kg/ha)	Z1 (75 kg/ha)
YOUNG EDAMAME RESULTS		
Weight of young seeds per plant (g)	126.96	156.89
Young seed protein content (%)	12.08	12.37
RESULTS OF OLD EDAMAME		
Weight of pithy pods per plant (g)	36.88	44.16
Weight of old seeds per plant (g)	25.53	27.85

Table 3 shows that application of ZA fertilizer provides higher yields compared to without application of ZA fertilizer in the parameters of weight of young seeds per plant, protein content of young seeds, weight of pithy pods per plant and weight of old seeds per plant.This is because ZA fertilizer can provide the nutrients plants need to produce pods and seeds and increase the protein content of the seeds. The compound content contained in ZA fertilizer, namely the elements N (21%) and S (24%) can function as a provider of nutrients to plants. ZA fertilizer is given at the beginning of planting as a starter so that it helps plants to escape stress earlier. Providing ZA fertilizer at the beginning of planting can also increase the volume of roots and root nodules, thereby increasing the effectiveness of Rhizobium bacteria in fixing N2 in the air (Bachtiar et al., 2016). The elements N and S are the building blocks of chlorophyll as raw materials for photosynthesis. The higher the photosynthesis process, the

more photosynthate will be produced (Wibowo et al., 2012). The results of photosynthesis will then be translocated to the pods to increase seed size, number of seeds, improve seed quality and increase protein content.

4.2 Interaction of Cow Blood POC and ZA Fertilizer

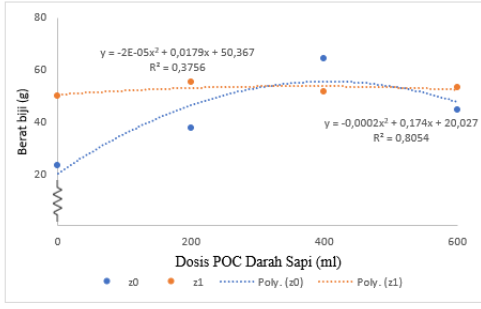

Figure 8. Effect of interaction between treatment doses of POC beef blood and ZA fertilizer on the weight of young seeds per plant (g)

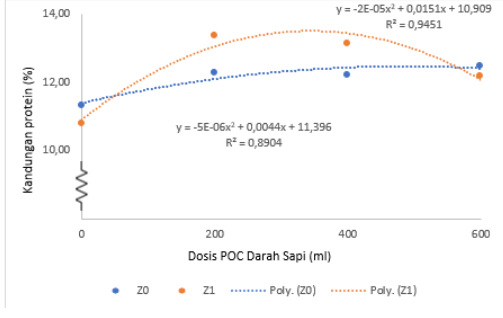

Figure 9. Effect of interaction between treatment doses of POC beef blood and ZA fertilizer on young seed protein content %

The picture above shows the effect of the interaction between bovine blood POC and ZA fertilizer on the weight parameters of young seeds per plant (Figure 8) and the protein content of young seeds (Figure 9) and the optimum dose was obtained at 447.50 ml/plot with 75 kg/ha ZA fertilizer. and 377 ml/plot with 75 kg/ha ZA fertilizer.This is because the nutrient content in POC and ZA fertilizer is well absorbed by plants, thereby helping in the photosynthesis process. The increase in seed weight is influenced by the amount of assimilate in the plant (Irawati et al., 2019). The flowering process is complete, the results of focal photosynthesis are translocated to the seed filling. Sufficient P and K elements result in a more optimal photosynthesis process, so that the photosynthesis produced is used in the formation and arrangement of plant organs, the remainder is stored in the form of protein and carbohydrates for the formation of seeds and pods in peanut plants (Munawar, 2011). The formation of protein in plants apart from bovine blood POC is also supported by the S element from ZA fertilizer. Sulfur is an element that plays a role in the

preparation of essential amino acids such as the formation of chlorophyll, and protein synthesis and plant structure (Mangel and Kirby, 1987). This is also supported by the statement by Tisdale et al., (1985), that the formation of chlorophyll plays a role in carbohydrate, fat and protein metabolism. Deficient plants The sulfur element will hamper the protein synthesis process and the quality of the plant will decrease.

4. Conclusion

Based on the results of the research that has been carried out, it can be concluded that:

1) Providing a dose of bovine blood POC up to a dose of 600 ml/plot still increases yields in the parameters of weight of pithy pods per plant, weight of old seeds per plant and weight of old seeds per m^2
2) Optimum results in the parameters of young seed weight per plant, weight

pithy pods per m2, young seed protein content and old seed protein content were achieved at bovine blood POC doses of 479.50 ml/plot, 434.44 ml/plot, 485 ml/plot and 350 ml/plot.

3) A dose of ZA fertilizer of 75 kg/ha can provide higher results in the parameters of weight of young seeds per plant, protein content of young seeds, weight of fruity pods per plant and weight of old seeds per plant compared to without the addition of ZA fertilizer.
4) There was an interaction between giving doses of POC beef blood and ZA fertilizer on the parameters of young seed weight per plant and young seed protein content.

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