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Test the Adaptability of Several Soybean (Glycine Max L) F5 Strains with TSP Fertilizer

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Abstract: Growth and production strains need to be capability tested in many different environmental conditions. The research aims to obtain efficient strains against the use of phosphate fertilizer and obtain the best dose of TSP fertilizer for the growth and production of soybean strains. The study used the two-factor Factorial Group Randomized Design (RAKF) method. The first factor is the dose of TSP fertilizer with 3 levels, namely P1=25 kg/ha, P2=50 kg/ha, P3=75 kg/ha.The second Factor with 5 levels, treatments were obtained and repeated 3 times. The plot area is 1mx2m with a planting distance of 20 cm x 25 cm. Plant maintenance is carried out by spraying insecticides Decis 25 EC and Dithane. The variables observed were plant height (cm), number of productive branches (branches), number of pods per plant (pods), seed weight per plant (g), seed weight per plot (g), weight of 100 seeds (g). Data were analyzed with a 95% confidence level BNT test using SPSS 26. The results showed that the F5 strain is the most efficient strain in using TSP fertilizer is the G4 = F5-A-T-SSD-84 strain with a dose of 25 kg/ha or 75g/plot to produce planting seed weight 27.76g. TSP fertilizer dose of 75 kg/ha is the best dose to produce the highest planting seed weight.

Keywords: Adaptability; Soybean; Strains; TSP Fertilizer

Introduction

Various types of food ingredients that are very popular in Indonesian society come from soybeans, for example tempeh, tofu and soy sauce. The number of types of foods made from soybeans causes the need for soybeans every year continues to increase, while soybean production still tends to remain and can even be said to decrease. The need for protein can be met by consuming soybeans (Grace et al., 2021; Mahdi & Suharno, 2019; Meliza, 2015).

Every year the need for soybeans always increases with the increasing population and per capita income of the Indonesian people, while the expansion of planting area and soybean crop production showed a considerable decline, which is more than 50% over the last 10 years (Fadli et al., 2021; J. H. Purba et al., 2018; Zamriyetti et al., 2021).

High-yielding varieties will not show their superiority without being supported by optimal cultivation techniques, one of which is fertilization (Resiani et al., 2023). The use of appropriate fertilizers can support plant growth and can maintain environmental balance (Alavan et al., 2015).

The growth and production of soybean plants are strongly influenced by genetic and environmental factors (Li et al., 2020; Sobko et al., 2020). Several studies on the assembly of soybean expectancy strains that are efficient in absorbing phosphorus (P) nutrients under conditions of low P availability has been implemented but still needs to be evaluated before being released as a high-yielding variety (Permadi & Haryati, 2015; Roswita et al., 2021).

Evaluation of soybean strains needs to be carried out under various environmental conditions in order to determine the level of stability (Habtegebriel & Abebe, 2023). The application of P fertilizer can also increase the yield of strain crops, especially in soils that lack this element. The results of research that has been conducted in several locations on several soybean varieties with

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phosphate fertilizer treatment show a noticeable effect. The results of this study explain that phosphate fertilizers are needed by plants to stimulate root development so that plants will be more resistant to drought, accelerate the harvest period and increase the weight of seeds (Nursanti & Eko Widaryanto, 2018; Sajar, 2023).

Based on information about the efficient assembly of soybean strains against the use of phosphate fertilizer, therefore this study was carried out to obtain efficient strains against the use of TSP fertilizer and obtain the best dose of phosphate fertilizer for the growth and production of soybean strains.

Method

This research was conducted in Hamlet 5, Dolok Merawan Village, Dolok Merawan District, Serdang Bedagai Regency, held from November 2022 to January 2023. The study was conducted using the Factorial Group Random Design (RAKF) method with two factors (Pangestu, 2020; Prabowo, 2019). The first factor is the dose of TSP fertilizer with 3 levels, namely P1= 25 kg/ha (75g/plot), P2= 50 kg/ha (150 g/plot), P3= 75 kg/ha (225 g/plot), while the second factor of the F5 strain with 5 levels is G1= F5-A-T-SSD-121, G2=F5-A-T-SSD-23, G3=F5-A-T-SSD-195, G4=F5-A-T-SSD-84, G5=F5-A-T-SSD-77, 15 treatment combinations were obtained and repeated 3 times. The plot area is 1m x 2m with a planting distance of 20 cm x 25 cm. Plant maintenance is carried out by controlling pests and plant diseases by spraying insecticides Decis 25 EC and Dithane M-45.

The variable observed is the height of the plant (cm) measured from the base of the stem to the growing point of the plant. The number of productive branches (branches) counted is the number of branches that produce pods, the number of pods per plant (pods) counted is all the number of pods containing from each sample plant. The weight of dry seeds per plant (g) is dried and then weighed all seeds per sample plant using an electric scale. The weight of dry seeds per plot (g) is dried and then weighed all seeds from all plants in each plot. The weight of 100 seeds (g) is measured by weighing 100 seeds using an electric scale. Sample plants as many as 5 plants for each plot. The observed variable data is analyzed by program SPSS 26 (Delele et al., 2021).

Result and Discussion

Based on the results analysis, Table 1 shows that the treatment of several soybean F5 strains significant on plant height, number of pods per plant, seed weight per plant and weight, while the number of branches and the weight of the seeds per plot showed not significant between strains. The results of this study prove that between strains there are different responses to different doses of TSP fertilizer, especially for plant height, number of pods per plant, seed weight per plant and weight 100 seeds.

Table 1. Results of Analysis of Various Adaptability Tests of Several F5 Strains with Phosphate Fertilizer Application

Observed Parameter	Strains (G)	TSP (P)	Interaction
Plant height	290.83*	99.68*	31.64*
Number of branches	1.60^{tn}	1.32^{tn}	15.47*
Number of pods	16.46*	58.74*	11.64*
Seed weight per plant	9.15*	76.27*	7.90*
Seed weight per plot	0.37^{tn}	97.40*	2.87^{tn}
Weight 100 seed	0.96*	5.33*	2.39*

Research by Idwar & Abdul Gafur (2012) resulted that the propagation of new varieties that excel in different locations and efficienty in the use of TSP fertilizer can be done by plant breeding. Crossbreeding and testing the adaptability of strains is one way to increase yield productivity. High yield potential is also a determining parameter of a variety called high yielding (Puspitasari et al., 2018).

Table 2 shows that plant height, number of pods and seed weight had a significant effect on the 5 strains used and the use of various doses of TSP fertilizer, while for the character of the number of branches, the weight of the seeds per plot and the weight of 100 seeds showed an unreal influence on the 5 strains used. The interaction between 5 strains of soybeans with the use of various doses of TSP fertilizer showed a significant effect on the character of plant height, number of branches, number of pods per plant, weight of seeds per plant and weight 100 seeds, only the character weight of the seed per plot shows not significant influence.

Phosphorus is a macronutrient that is needed for plant growth in large enough quantities. High P uptake by plants is influenced by the very high nutrient content of P available in the soil, high P availability in soil is also influenced by pH and organic matter content (S. T. Purba et al., 2017).

Table 2. Average Value of Growth and Production Parameters of Five Soybean Strains with Phosphate Fertilizer Application

Treatment	Plant height (cm)	Number of branches (branch)	Number of pods (pod)	Seed weight per plant (g)	Seed weight per plot (g)	Weight 100 seed (g)
Phosfat (BNT)	2.63	-	2.69	0.50	11.16	2.42
P_1	75.65 c	4.25	37.72 b	7.69 b	193.00 b	14.80 b
P_2	80.08 b	4.23	39.57 ab	8.03 b	199.40 b	16.07 ab
P_3	83.83 a	4.35	41.12 a	9.00 a	225.00 a	16.47 a
Variety (BNT)	2.04	-	1.03	0.39	-	-
G_1	69.24 e	4.24	33.22 d	8.71 a	204.22	16.00
G_2	72.42 d	4.16	37.60 c	8.31 ab	205.22	16.11
G_3	80.89 c	4.27	40.47 b	8.13 b	207.33	15.44
G_4	90.82 a	4.31	42.96 a	8.15 b	207.33	16.22
G_5	85.89 b	4.40	43.11 a	7.89 c	205.56	15.11
Combination (BNT)	3.22	0.43	2.30	0.61	-	2.96
P1G1	65.13 e	4.47 a	31.27 c	8.53 b	193.67	15.67 a
P1G2	69.33 e	4.27 b	35.13 b	7.80 c	195.00	14.33 a
P1G3	76.60 d	4.40 a	37.13 b	7.60 c	191.67	14.33 a
P1G4	88.47 b	4.07 c	43.53 a	7.33 d	193.33	15.67 a
P1G5	78.73 d	4.07 c	41.53 a	7.20 d	191.33	14.00 b
P2G1	69.87 e	4.20 b	33.87 bc	8.40 b	196.33	16.00 a
P2G2	72.67 d	4.13 c	36.47 b	8.07 bc	197.67	17.00 a
P2G3	82.87 c	4.13 c	41.67 a	8.00 bc	203.00	15.33 a
P2G4	90.93 b	4.27 b	41.73 a	7.87 c	204.33	15.67 a
P2G5	84.07 c	4.40 a	44.13 a	7.80 c	195.67	15.33 a
P3G1	72.73 d	4.07 c	34.53 bc	9.20 a	222.67	16.33 a
P3G2	75.27 d	4.07 c	41.20 a	9.07 a	223.00	17.00 a
P3G3	83.20 c	4.27 b	42.60 a	8.80 b	227.33	15.67 a
P3G4	93.07 a	4.60 a	43.60 a	9.27 a	224.33	17.33 a
P3G5	94.87 a	4.73 a	43.67 a	8.67 b	229.67	16.00 a

Note: The number followed by the same notation in the same treatment and column are not significant according to BNT, p= 0.05.

The application of TSP fertilizer can increase the number of pithy pods so as to increase crop production, but depends on the strain planted and the support of growing environmental conditions, like research Zuhry & Nurbaiti (2015); Jaenudin et al. (2023) which says that the element phosphorus plays a role for the formation of roots and root hairs for the better, so that the formation of photosynthetes becomes more to be translocated to pods, so that the pods fill up faster and dense.

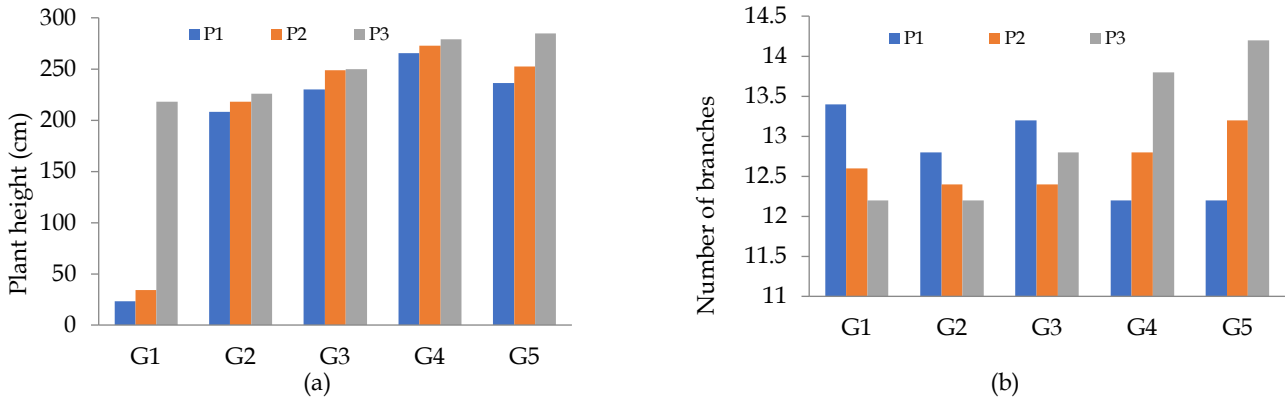

Figure 1. Growth Parameters of Several Soybean F5 Strains with Various Doses of Phosphate Fertilizer: (a) Average Plant Height of Several Soybean F5 Strains with Phosphate Fertilizer Application; and (b) Average Number of Branches of Several Soybean F5 Strains with Phosphate Fertilizer Application

The growth character of several strains of F5 soybeans with phosphate fertilizer application shows a noticeable effect (Figure 1), visible plant height strain G5=F5-A-T-SSD-77 low dose application of TSP fertilizer (25 kg/ha = 75 g/plot) compared to high doses of TSP fertilizer (75 kg/ha = 150 g/plot) gives a difference in

plant height that is not too noticeable, namely at a dose of 25 kg/ha = 75 g/plot, plant height is only about 235.67 cm, while the dose of TSP fertilizer 75 kg/ha = 150 g/plot height, plants are about 275.45 cm. The number of branches, the difference in TSP fertilizer dosing is very visible, especially in the G5=F5-A-T-SSD-77 strains, especially in the administration of low doses of TSP fertilizer (25 kg/ha = 75 g/plot), the number of branches formed is only 13.30 while in the application of high doses of TSP fertilizer (75 kg / ha = 150 g / plot), the number of branches formed is 14.2.

Growth differences in the 5 strains studied show that there is still segregation in each strain which causes genetic differences which results in each strain having special properties and characteristics that are different from each other so that it will show a different appearance (Gumilar et al., 2013).

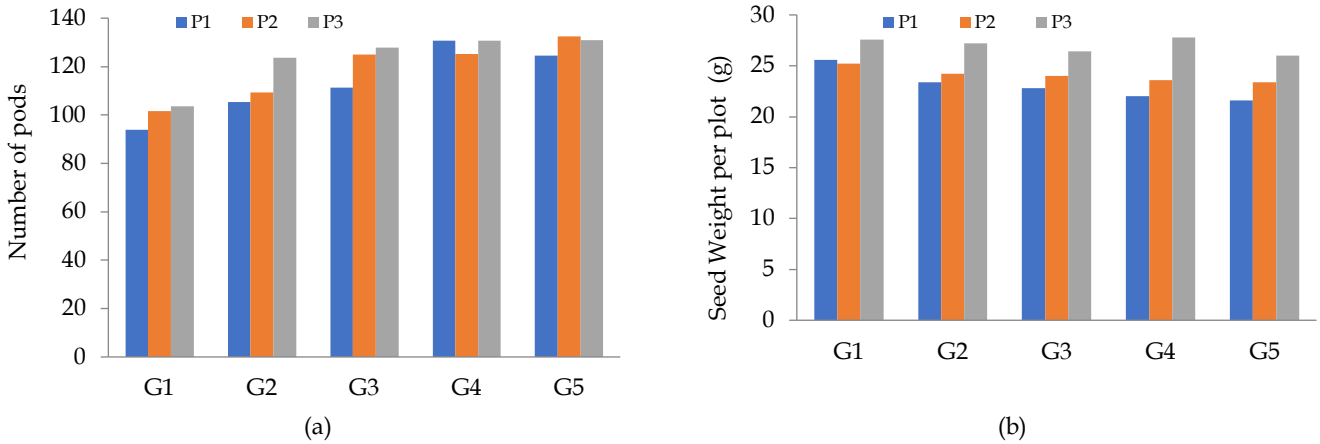

Figure 2. Production Parameters of Several Soybean F5 Strains with Various Doses of Phosphate Fertilizer: (a) Average Number of Pods of Several Soybean F5 Strains with Phosphate Fertilizer; and (b) Average Seed Weight per plot of Several Soybean F5 Strains with Phosphate Fertilizer Application.

The production characters shown in Figure 2 show that different doses of TSP fertilizer for the 5 strains studied, It turns out that the G4=F5-A-T-SSD-84 strain is efficient in the use of TSP fertilizer because the G4=F5-A-T-SSD-84 strain is given a low dose of TSP fertilizer (25 kg/ha = 75 g/plot) compared to the high dose of TSP fertilizer (75 kg/ha = 150 g/plot) resulting in a higher number of pods of 130.5 pods per plantation, as well as for the weight of seeds per plantation, strain G4=F5-A-T-SSD-84 showed the heaviest at 27.76 g per plant with the highest dose of fertilizer (75 kg/ha = 150 g/plot).

The application of phospate fertilizer causes the photosynthesis process to run smoothly so that the formation of soybean pods becomes more numerous and all pods contain. Phospate as a food substance is very important in physiological processes in plants, namely in the process of photosynthesis and respiration. This photosynthete will be used by plants for the growth of soybean plants and in the generative period will be allocated for the formation of soybean pods (Triyanto & Supriyanto, 2019).

Conclusion

Based on the results of the study, it can be concluded that, The F5 strain is the most efficient strain in using TSP fertilizer is the G4=F5-A-T-SSD-84 strain with a dose of 25 kg/ha or 75g/plot resulting in a plant seed weight of 27.76g. TSP fertilizer dose of 75 kg/ha is the best dose to produce the highest planting seed weight.

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Author Contribution
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The authors declare no conflict of interest.

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