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THE EFFECT OF PALM OIL SHELL BIOCAR AND P AND K FERTILIZER ON THE GROWTH AND PRODUCTION OF SOYBEAN PLANTS (Glycine max)

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Abstract

This study aimed to determine the effect of palm kernel shell biochar and phosphorus (P) and potassium (K) fertilizers on the growth and production of soybean (Glycine max) plants. The study was conducted at the Experimental Field of the Faculty of Agriculture, Al Washliyah University, Medan, using a factorial Randomized Block Design (RBD) with two treatment factors, namely biochar (B0, B1, B2, B3) and P and K fertilizers (P0, P1, P2, P3). The parameters observed included plant height, number of pods, seed weight, and other production parameters. The results showed that both biochar and P and K fertilizers independently had a very significant effect on all growth and yield parameters of soybean. The best treatment was the combination of B3 (6 kg/plot) and P3 (24 g P + 44 g K), which produced the highest average in plant height, number of pods, and seed weight. However, the interaction between biochar and P and K fertilizers did not show a significant effect on the growth and production of soybean plants. This study indicates that the appropriate application of biochar and P and K fertilizers can significantly increase soybean growth and yield, although the combination did not show a statistically significant synergistic effect. These findings support the use of biochar as an alternative organic material in sustainable agricultural systems.

Keywords:*biochar, palm shells, P and K fertilizers, and soybeans*

Introduction

Soybeans (Glycine max L.) are a strategic food commodity belonging to the seasonal legume group and have a very high protein content. Soybeans are a primary food source because they are rich in nutrients such as protein, carbohydrates, fat, fiber, calcium, iron, potassium, and vitamin A, which are beneficial for health and improving the nutritional quality of the community. In Indonesia, soybeans occupy an important position after rice and corn. This commodity is not only consumed directly by households but also serves as a primary raw material for the food industry, such as tofu, tempeh, and soy sauce, and is used for seed purposes (BPS, 2015).

However, national soybean production is not yet sufficient to meet domestic demand, so Indonesia still relies on imports from other countries each year. One of the main causes of low soybean production is the limited land suitable for cultivation, as well as the shrinking agricultural land area due to land conversion into residential and office areas. Furthermore, the excessive use of inorganic fertilizers also contributes to the deterioration of soil quality. Long-term use of chemical fertilizers can cause changes in soil physical properties such as compaction, damage to soil structure, and a decrease in the number of soil microorganisms that play a vital role in the decomposition of organic matter and the provision of nutrients (Triyono, 2013).

To improve soil conditions and increase soybean productivity, one alternative that can be developed is the use of organic materials such as biochar. Biochar is a biological charcoal produced from the pyrolysis process, or incomplete combustion of organic biomass, such as agricultural and forestry waste. Biochar has the ability to improve soil structure, increase cation exchange capacity, and improve water retention and nutrient availability. Each year, hundreds of millions of tons of organic waste are generated from the agricultural and livestock sectors, and this can be used as raw material for biochar. For example, of the approximately 50 million tons of rice production per year, approximately 60 million tons of waste in the form of rice husks and straw are produced, which have significant potential for processing into biochar (Brown, 2009). Rice husks, in particular, are one of the most easily accessible biomasses for farmers and have high utility value when processed into biochar (Gani, 2010). In addition to organic fertilization, proper inorganic fertilization is also crucial in soybean cultivation. Phosphorus (P) is an essential macronutrient that plays a role in various plant metabolic processes. Phosphorus aids in the transport of photosynthesis products, stimulates flowering and seed formation, and strengthens the root system. Furthermore, phosphorus accelerates fruit ripening and improves crop quality (Lingga and Marsono, 2001). According to Suprapto (2002), applying P fertilizer can accelerate the harvest period and increase the nutritional value of soybean seeds through optimal root development.

Potassium (K) Potassium is also a macronutrient essential for soybean plants. Potassium functions in activating various important enzymes, facilitating the transport of carbohydrates from leaves to other plant parts, and helping regulate water balance in plant cells (Agustina, 2004). Potassium has been shown to increase the number and activity of root nodules and nitrogenase—an enzyme essential for nitrogen fixation in legumes like soybeans. Potassium also helps strengthen plant tissues and increase resistance to environmental stress. Based on research by Suprapto (2003), to produce 3 tons of soybeans, approximately 52 kg of potassium is required. Potassium absorption is very high during the vegetative phase, then decreases as seeds begin to form, and is almost completely eliminated near harvest. Interestingly, approximately 60% of the potassium absorbed by plants is stored in the seeds (Zulfansyah et al., 2021). Considering the importance of using biochar and inorganic nutrients P and K in soybean cultivation, research is needed to evaluate the extent to which the combination of these three can affect soybean growth and yield. This approach is expected to provide a solution to reduce reliance on chemical fertilizers alone, while utilizing organic waste as an environmentally friendly and sustainable alternative (Mufriah et al., 2022).

Research methods

This research was conductedat the Experimental Land of the Faculty of Agriculture, Al Washliyah University, Jl. Sisingamangaraja No. 10, Harjosari I, Medan Amplas District, Medan City, North Sumatra Province with an altitude of ± 25 meters above sea level, with flat topography. This research was conducted from October 2023 until completion. The tools and materials used in this research are writing instruments, meters, hoes,watering can, documentation tool,jerry cans, planks,research banner,tools for plant analysis, soybean seeds, soil, water, P and K fertilizer, Biocar and tools and materials that support this research. This study used a factorial RAK (Randomized Block Design) with 2 treatment factors. The first factor is the provision of oil palm shell biochar consisting of four levels, namely: B0 = Without biochar, B1 = 5 tons / ha = 2 kg / plot, B2 = 10 tons / ha = 4 kg / plot, B3 = 15 tons / ha = 6 kg / plot and the second factor is the provision of Inorganic P and K Mutiara fertilizers carried out in four levels, namely: P0 = (Without fertilizer treatment / control), P1 = Phosphate 16 g + KCl 36 g / plot, P2 = Phosphate 20 g + KCl 40 g / plot, P3 = Phosphate 24 g + KCl 44 g / plot.

The research implementation began with the preparation of biochar by preparing a pyrolysis tool in the form of a used drum measuring ±80 cm high and ±60 cm in diameter, without a temperature controller. The raw material in the form of dried palm shells was put into the drum, and coconut fiber was used as fuel. The combustion was carried out for ±7 hours until the shells turned into black charcoal. The fire was extinguished by pouring water, then allowed to cool naturally. After that, the biochar was dried in the sun until the water content reached ±15%, then ground and sieved using a 50 mesh sieve (100% pass). The land was loosened by hoing after clearing weeds, then 200 cm x 200 cm beds were created. The distance between beds and between each replication was 50 cm, and the distance between the edges of the beds was 20 cm. Before planting, the seeds were soaked for several minutes in clean water to select good seeds.

Biochar is applied two weeks before planting by spreading it evenly over the seedbed and allowing it to settle for two weeks. Planting is done by inserting two seeds into a 1–2 cm deep hole, then covering and watering sufficiently. After one week, thinning is carried out, leaving one healthy plant in each planting hole. Phosphorus (P) and potassium (K) fertilizers were applied twice, 2 and 6 weeks after planting, according to the prescribed treatment. Watering was done twice daily, in the morning and evening, except during rain. Weeding was done manually every three days to remove weeds. Thinning was carried out one week after planting to replace dead plants with new plants of the same age taken from around the research area. Thinning was carried out again when the plants were 2 weeks old, leaving the best-growing plants. Pests and diseases were controlled manually, and pesticides were used only when pest or disease attacks were dangerous (Lisdayani, 2022). Harvesting is carried out when the plants are approximately 89 days old, indicated by 90–95% of the leaves turning yellow and falling off, the stems drying out, and the pods turning yellow-brown, fully filled, and easily peeled. Harvesting is done by directly uprooting the stems.

Observations included plant height, measured from the base of the stem to the growing point using a roller or tape measure, starting at 3 weeks after planting (WAP) and weekly until the plant entered the generative phase. The number of pods was counted from the time the plant fruited until harvest, including both ripe and unripe pods. Seed weight was measured from the harvest of ripe seeds per plant, calculated after the final harvest.

Results and Discussion

Plant Height

Based on the results obtained from the study, the average plant height of palm shell biochar on the growth and production of soybean plants (Glycine max) had a very significant effect and the effect of P and K fertilizer on the height of soybean plants had a very significant effect, while the effect of the interaction of palm shell biochar and P and K fertilizer on the height of soybean plants had no significant effect.

Table 1. The Effect of Palm Oil Shell Biochar and P and K Fertilizers on Soybean Plant Height (Glycine max) at 4 Weeks After Planting.

Treatment B	P Treatment				Average
	P0	P1	P2	P3	
B0	40.33	41.07	42.60	42.93	41.73 d
B1	43.33	43.80	44.07	44.60	43.95 c
B2	44.87	45.27	45.93	46.40	45.62 b
B3	46.93	47.33	47.73	48.27	47.57 a
Average	43.87 c	44.37 b	45.08 a	45.55 a	

Information : Numbers followed by different letters in the same treatment group are significantly different at the 5% level based on the DMRT test.

Based on table 1 above, it can be seen that the effect of palm shell biochar on soybean plant height has a very significant effect on soybean plant height. The highest average plant height was in treatment B3 (6 kg/plot), namely 47.57, which was significantly different from treatment B2 (4 kg/plot), namely 45.62, which was significantly different from treatment B1 (2 kg/plot), namely 43.95, which was significantly different from treatment B0 (0 kg/plot), namely 41.73 as the lowest average plant height.

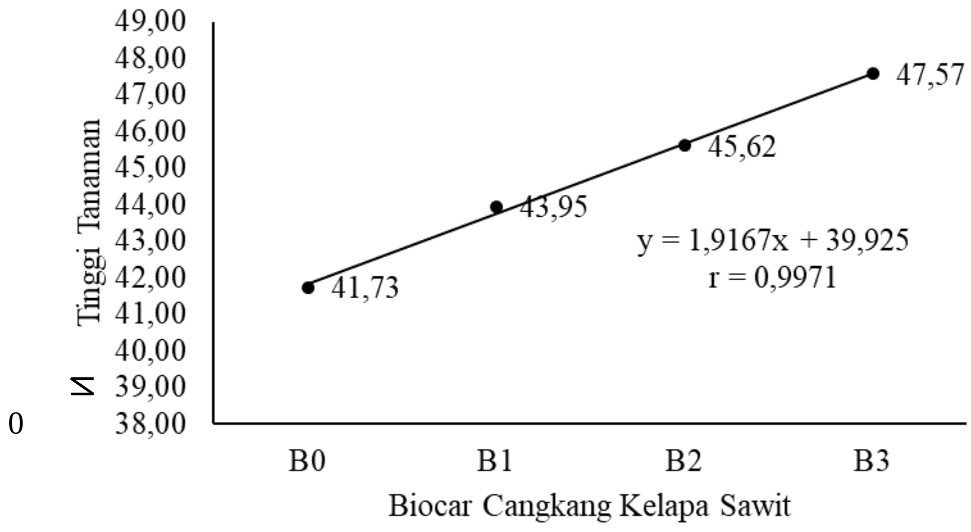

Figure 1. Graph of the Effect of Palm Kernel Shell Biochar on Average Plant Height on Soybean (Glycine max) Plant Growth and Production at 4 Weeks After Planting

Based on Figure 1 above, it shows thatThe effect of palm shell biochar on the height of soybean plants has a positive effect, namely the more it is givenThe higher the average height of the soybean plants produced, the higher the palm shell biochar content. Based on the linear regression analysis using the equation y = 1.9167 x + 39.925 with a correlation coefficient of 99.71%, it shows that the effect of palm shell biochar on the average height of soybean plants. This is because the growth of soybean plants is influenced by the genetics of the plant itself, besides the environment also affects the growth of soybean plants, an unsupportive environment can also reduce the height of soybean plants. According to Hana and Hariyono, 2019. Stated that there are several influencing factors, namely internal factors and external factors. Internal factors include factors from within the soybean plant itself, but external factors are external factors such as climate, weather, soil, and living things around it. Biochar to the soil increases the availability of major cations and phosphorus, total N and soil cation exchange capacity (CEC) which ultimately increases yields. The high availability of nutrients for plants is the result of increased nutrients directly from biochar, increased nutrient retention, and changes in soil microbial dynamics. Meanwhile, the effect of P and K fertilizers on soybean plant height was very significant. The highest average plant height was found in the P treatment.$_3$(P 24 g + K 44 g) which is 45.55 which is not significantly different from treatment P2 (P 20 g + K 40 g) which is 45.08 which is significantly different from treatment P1 (P 16 g + K 36 g) which is 44.37 which is significantly different from treatment P0 (P 0 g + K 0 g) which is 43.87 as the lowest average plant height.

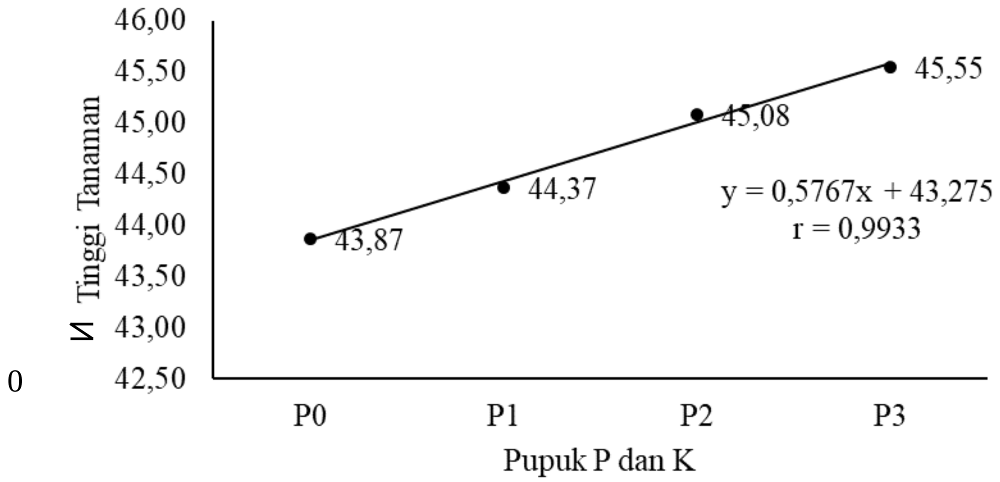

Figure 2. Graph of the Effect of P and K Fertilizer Application on Average Plant Height on Soybean Plant Growth and Production (Glycine max) at 4 Weeks After Planting

Based on Figure 2 above, it shows thatThe effect of P and K fertilizer on the height of soybean plants has a positive effect, namely the more it is given P and K fertilizerthen the higher the average height of the soybean plants produced. Based on the linear results obtained with the equation y = 0.5767 x + 43.275 with a correlation coefficient of 99.33%, it shows that the influence ofP and K fertilizeron the average height of soybean plants. P and K are among the nutrients required by plants for growth. These macronutrients (nutrients required in large quantities) are essential for soybean growth. Phosphorus can stimulate plant growth because it is a cell building block that functions to facilitate cell division (Murni, 2022). And the interaction effect of palm shell biochar and P and K fertilizer on soybean plant height was not significant. The highest average plant height was in treatment B.$_3$P3 (6 kg/plot and P 24 g + K 44 g) was 48.27, while in the B0P0 treatment (0 kg/plot and P 0 g + K 0 g) it was 40.33 as the lowest average plant height.

Number of Pods

The effect of palm shell biochar on the number of soybean pods has a very significant effect and the effect of P and K fertilizer on the number of soybean pods has a very significant effect, while the effect of the interaction of palm shell biochar and P and K fertilizer on the number of soybean pods has no significant effect.

Table 2. The Effect of Palm Oil Shell Biochar and P and K Fertilizers on the Number of Soybean (Glycine max) Pods at Harvest Time

Treatment B	P Treatment				Average
	P0	P1	P2	P3	
B0	21.27	22.53	23.33	23.80	22.73 d
B1	24.13	25.13	26.40	27.53	25.80 c
B2	28.13	28.53	29.13	30.13	28.98 b
B3	30.87	32.00	33.53	35.40	32.95 a
Average	26.10 c	27.05 b	28.10 a	29.22 a	

Information : Numbers followed by different letters in the same treatment group are significantly different at the 5% level based on the DMRT test.

Based on table 2 above, it can be seen that the effect of palm shell biochar on the number of soybean pods has a very significant effect on the number of soybean pods. The highest average number of plant pods was in treatment B3 (6 kg/plot), namely 32.95, which was significantly different from treatment B2 (4 kg/plot), namely 28.98, which was significantly different from treatment B1 (2 kg/plot), namely 25.80, which was significantly different from treatment B0 (0 kg/plot), namely 22.73 as the lowest average number of pods.

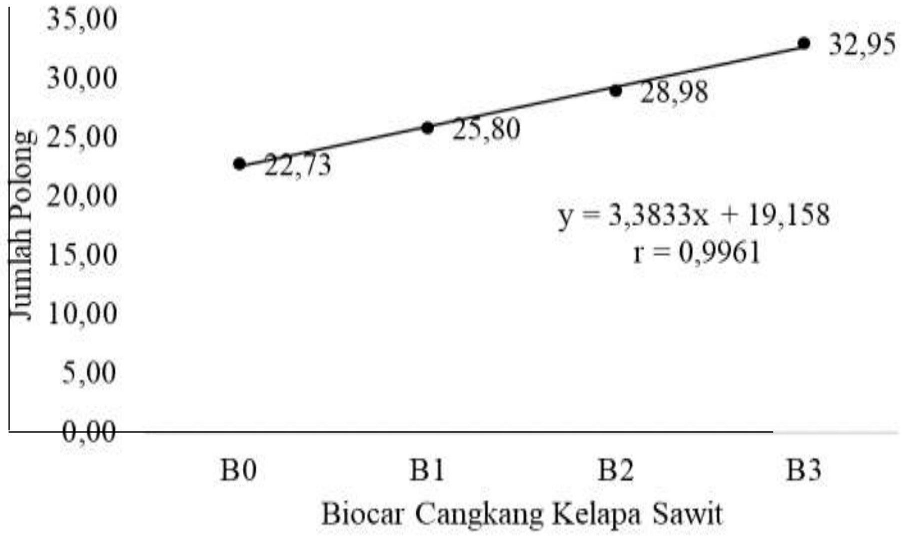

Figure 3. Graph of the Effect of Palm Kernel Shell Biochar on the Average Number of Pods on the Growth and Production of Soybean Plants (Glycine max) at Harvest Time

Based on Figure 3 above, it shows thatthe effect of palm oil shell biochar onnumber of podssoybean plants have a positive effect, namely the more they are givenThe higher the average number of soybean pods produced by palm oil shell biochar, the higher the linearity obtained with the equation y = 3.3833 x + 19.158 with a correlation coefficient of 99.61%, indicating that the influence of palm shell biochar on the average number of soybean pods. The number of pods is influenced by the growth of soybean plants, starting from the roots, stems, and leaves. Applying biochar can stimulate soybean growth because it is a biomass that can add organic matter to the soil, thereby improving soil fertility by adding nutrients to meet the needs of soybean plants. According to the Department of Agriculture and Food (2021), biochar is very beneficial for agriculture, especially in improving land quality. Meanwhile, the effect of P and K fertilizers on the number of soybean pods had a very significant effect on the number of soybean pods. The highest average number of pods was found in the P treatment.$_3$(P 24 g + K 44 g) which is 29.22 which is not significantly different from treatment P2 (P 20 g + K 40 g) which is 28.10 which is significantly different from treatment P1 (P 16 g + K 36 g) which is 27.05 which is significantly different from treatment P0 (P 0 g + K 0 g) which is 26.10 as the lowest average number of pods.

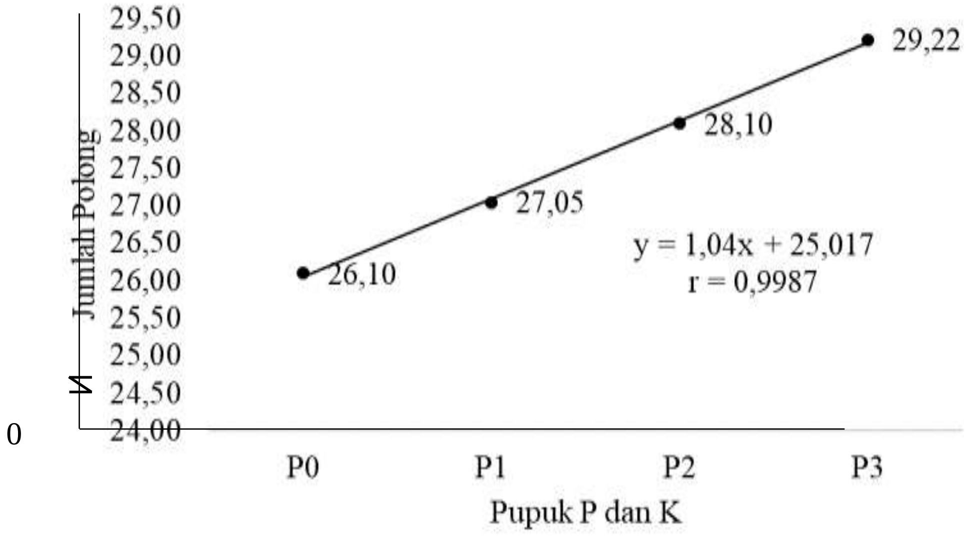

Figure 4. Graph of the Effect of P and K Fertilizer Application on the Average Number of Pods on the Growth and Production of Soybean Plants (Glycine max) at Harvest Time

Based on Figure 4 above, it shows thatthe effect of P and K fertilizers onnumber of podssoybean plants have a positive effect, namely the more they are given P and K fertilizerthen the higher the average number of soybean pods produced. Based on the linear results obtained with the equation y = 1.40 x + 25.017 with a correlation coefficient of 99.87% shows that the influenceP and K fertilizerto the average number of pods in soybean plants. P and K fertilizers are nutrients that influence the generative phase (flowering/fertilization). This phase is a phase that greatly influences the production of soybean plants because the more flowering on the soybean plant, the more pods the soybean plant will produce. The same thing was said by Havlin, et al., 2014. P has an important role in root development and flowering. And the interaction effect of palm shell biochar and P and K fertilizer on the number of soybean pods did not have a significant effect. The highest average number of pods was in treatment $B._3$P3 (6 kg/plot and P 24 g + K 44 g) was 35.40, while in the B0P0 treatment (0 kg/plot and P 0 g + K 0 g) it was 21.27 as the lowest average number of pods.

Seed Weight

Based on the results obtained from the study of the average seed weight of oil palm shell biochar and P and K fertilizers on the growth and production of soybean plants (Glycine max) which can be seen in appendices 16-17. The effect of palm shell biochar on the weight of soybean seeds had a very significant effect and the effect of P and K fertilizer on the weight of soybean seeds had a very significant effect, while the effect of the interaction of palm shell biochar and P and K fertilizer on the weight of soybean seeds had no significant effect.

Table 3. The Effect of Palm Oil Shell Biochar and P and K Fertilizers on Soybean (Glycine max) Seed Weight at Harvest Time.

Treatment B	P Treatment				Average
	P0	**P1**	**P2**	**P3**	
B0	380.64	395.52	404.64	428.16	402.24 d
B1	435.84	446.88	461.28	487.68	457.92 c
B2	501.12	512.64	529.44	553.44	524.16 b
B3	558.72	583.68	604.80	631.20	594.60 a
Average	469.08 bc	484.68 b	500.04 b	525.12 a	

Information : Numbers followed by different letters in the same treatment group are significantly different at the 5% level based on the DMRT test.

Based on table 3 above, it can be seen that the effect of palm shell biochar on the weight of soybean seeds has a very significant effect on the weight of soybean seeds. The highest average weight of plant seeds was in treatment B3 (6 kg/plot), namely 594.60, which was significantly different from treatment B2 (4 kg/plot), namely 524.16, which was significantly different from treatment B1 (2 kg/plot), namely 457.92, which was significantly different from treatment B0 (0 kg/plot), namely 402.24 as the lowest average seed weight.

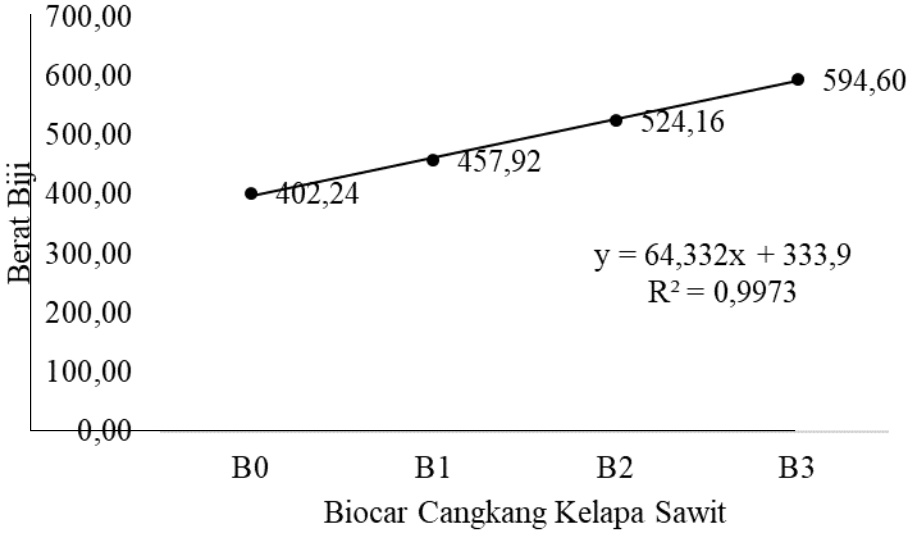

Figure 5. Graph of the Effect of Palm Kernel Shell Biochar on Average Seed Weight on the Growth and Production of Soybean Plants (Glycine max) at Harvest Time

Based on Figure 5 above, it shows thatthe effect of palm oil shell biochar onseed weightsoybean plants have a positive effect, namely the more they are givenThe higher the average weight of soybean seeds produced, the higher the palm shell biochar. Based on the linear results obtained with the equation y = 64.332 x + 333.9 with a correlation coefficient of 99.73%, it shows the effect of palm shell biochar on the average weight of soybean seeds. Seed weight is influenced by the genetics of the soybean plant itself, but there are also external factors that affect the weight of soybean seeds. Seeds in donkey plants are composed of water, protein, fat, and so on. The water content in soybeans covers 54.30%. This makes water absorption in plants affect the weight of soybean seeds. According to Desnataliansyah, 2021, biochar can increase water holding capacity, resulting in water being available in the soil that can be absorbed by soybean plants to meet their needs.

Meanwhile, the effect of P and K fertilizers on soybean seed weight had a very significant effect on soybean seed weight. The highest average seed weight was in the P treatment.$_3$(P 24 g + K 44 g) which is 525.12 which is significantly different from treatment P2 (P 20 g + K 40 g) which is 500.04 which is not significantly different from treatment P1 (P 16 g + K 36 g) which is 484.68 which is not significantly different from treatment P0 (P 0 g + K 0 g) which is 469.08 as the lowest average seed weight.

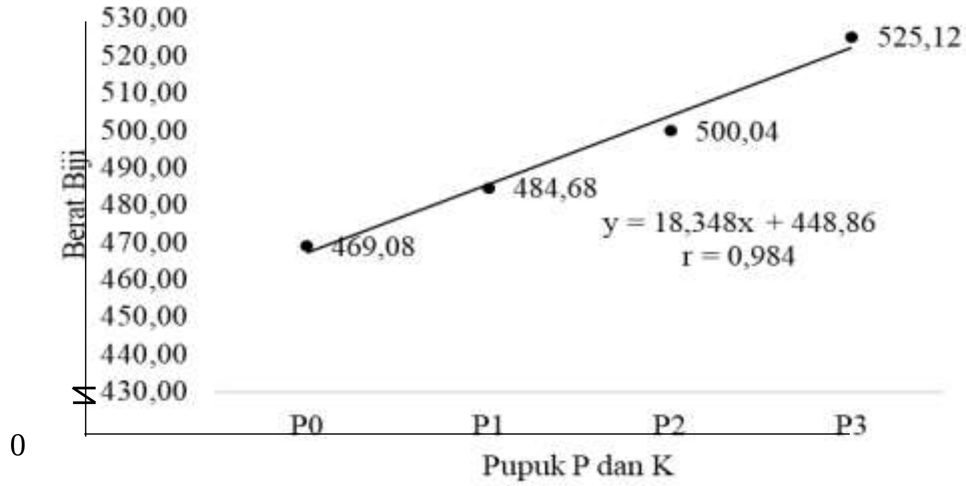

Figure 6. Graph of the Effect of P and K Fertilizer Application on Average Seed Weight on the Growth and Production of Soybean Plants (Glycine max) at Harvest Time

Based on Figure 6 above, it shows thatthe effect of P and K fertilizers onseed weightsoybean plants have a positive effect, namely the more they are given P and K fertilizerthen the higher the average weight of soybean seeds produced. Based on the linear results obtained with the equation y = 18.348 x + 448.86 with a correlation coefficient of 98.40% shows that the influenceP and K fertilizeron the average seed weight of soybean plants. This is likely due to the role of P and K fertilizers in regulating plant osmosis, namely the entry of water into the plant and the water balance within plant cells (Smith & Murray, 2014). This is why P and K fertilizers can increase seed weight in soybean plants. And the interaction effect of palm shell biochar and P and K fertilizer on soybean seed weight was not significant. The highest average seed weight was in treatment $B._3$P3 (6 kg/plot and P 24 g + K 44 g) was 631.20, while in the B0P0 treatment (0 kg/plot and P 0 g + K 0 g) it was 380.64 as the lowest average seed weight.

Conclusion

The application of biochar from palm shells and P and K fertilizers separately had a very significant effect on the growth and production of soybean plants, indicated by an increase in parameters such as plant height, number of pods, and seed weight. The best treatment for biochar was a dose of 6 kg/plot (B3), and for P and K fertilizers was a combination of 24 g P + 44 g K (P3). However, the interaction between biochar and P and K fertilizers did not have a significant effect, although the combined treatment B3P3 showed the highest average data for all parameters.

REFERENCES

Agustina, L. 2004. Dasar Nutrisi Tanaman. Penerbit Rineka Cipta. Jakarta

BPS. 2015. Produksi kedelai menurut provinsi (ton), 1993-2015. http:WWW.bps.go.id/ linkTableDinamis/view/id/871 (akses 4 Januari 2016).

Brown, R. 2009. Biochar Production Technology. In: Biochar for Environmental Management: Science and Technology (Eds) First published by Earthscan in th e UK and USA in 2009. 416 p.

Desnataliansyah, 2021. Pemanfaatan Biochar Dalam Pertanian, dari Limbah Menjadi Berkah. Academic Faculty of Agriciltire Unila. Universitas Lampung. Lampung.

Dinpertan Pangan, 2021. Manfaatnya Biochar atau Arang Untuk Perbaikan Kualitas Lahan. Artikel Dinas Pertanian & Pangan Kabupaten Demak. WordPress : Semarang.

Gani, A. 2010. Multiguna Arang - Hayati Biochar. Balai Besar Penelitian Tanaman Padi. Sinar Tani. 13 : 1-4.

Hana, S., O. dan Hariyono, K., 2019. Pendugaan Komponen Generatif dan Kandungan Protein Pada Lima Varietas Kedelai (Glycine max (L.) Merril). Jurnal Ilmiah Pertanian 5 (4) : 250-255.

Havlin, J., L., Tisdale, S., L., Beaton, J., D., & Nelson, W., L., 2014. Soil fertility and fertilizers: An introduction to nutrient management (8th ed.). Pearson.

Lisdayani, R. (2022). Aplikasi Suhu terhadap Mortalitas Hama Sitophilus zeamais dan Tribolium castaneum pada Jagung. Agrotechnology Research Journal, 6(1), 16. https://doi.org/10.20961/agrotechresj.v6i1.55423

Lingga, P dan Marsono. 2001. Petunjuk Penggunaan Pupuk. Penebar Swadaya. Jakarta

Murni, S., R., 2022. Respon Pertumbuhan Tanaman Kedelai Di Tanah Marginal dengan Pemberian Pupuk P dan Jenis Pupuk Orgnaik. Jurnal Agriland 10 (1) : 68-80.

Mufriah, D., Sulistiani, R., & Dibisono, M. Y. (2022). Penggunaan pupuk anorganik dan campuran biochar dengan pupuk kandang terhadap pertumbuhan kacang kedelai (Glycine max L. Merril). Jurnal Al Ulum LPPM Universitas Al Washliyah Medan, 10(1), 6–13.

Smith, K., A., & Murray, A., M., B., 2014. Principles of agronomy for sustainable agriculture (2nd ed.). Springer.

Suprapto, 2003. Bertanaman Kedelai. Penebar Swadaya. Anggota IKAPI. Jakarta.

Suprapto, H. S. 2002. Bertanam Kedelai. Penebar Swadaya. Jakarta.

Triyono.A., Purwanto., dan Budiyono .2013. Efesiensi Penggunaan Pupuk N Untuk Pengurangan Kehilangan Nutrisi Pada Lahan Pertanian. Prosiding seminar nasional pengelolaan sumber daya alam dan lingkungan. ISBN 978-602-1700-1-2:526-531

Zulfansyah, I., Tambunan, J. O., Sidabutar, M. N. A., Samosir, H. J., & Samosir, A. (2021). Analysis of organic and conventional lowland rice (Oryza sativa L) cultivation in supporting environmentally friendly agriculture in the District Banyan tree, Deli Serdang Regency. International Conference on Health Science, Green Economics, Educational Review and Technology, 3, 177–190.