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Interaction of banana hump liquid organic fertilizer and N:P: K doses in supporting the agronomic potential of soybeans based on multivariate analysis

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Abstract: The development of soybeans can be carried out by optimizing a sustainable growing environment so that the use of NPK chemical fertilizer needs to be combined with organic fertilizer, such as banana hump liquid organic fertilizer (LOF). A systematic evaluation of the interaction between banana hump LOF and N:P: K fertilizer dosage on the agronomic potential of soybeans has yet to be widely studied. Therefore, it is suitable to use multivariate analysis to evaluate this interaction. Meanwhile, this research aims to determine the effectiveness of evaluation criteria based on multivariate analysis and determine the best combination of interactions between NPK fertilizer dosage and banana hump LOF concentration on the agronomic potential of soybeans. The research was arranged in a 3 x 4 factorial randomized complete block design that focused on two factors: the concentration of liquid organic fertilizer from banana hump (0 mL/L, 100 mL/L, and 200 mL/L) and NPK fertilizer dosage (0 kg/ha, 75 kg/ha, 150 kg/ha, and 225 kg/ha) that was repeated three times. Based on this research, the characteristics of plant height and the number of pods per plant are critical assessment criteria, along with productivity in the interaction of NPK and LOF fertilizers. The polynomial-polynomial interactions of these three characters show a dynamic quadratic pattern. The interaction of 150 kg/ha NPK fertilizer with a LOF concentration of 100 mL/L is a promising technology for stimulating soybean growth and production. Therefore, this technology package can be recommended for soybean cultivation in a sustainable system.

Keywords: Banana waste, *Glycine max*, NPK dosage, Path analysis, Sustainable farming.

Abbreviations: PH_ plant height, NL = number of leaves, NB = number of branches, chl t = total chlorophyll, chl a= chlorophyll A, chl b = chlorophyll B, RV = root volume, RDW = root dry weight, FA = flowering age, HA = harvest age, NPP = number of pods per plant, PEP = percentage of empty pods, NSP = number of seeds per plant, DWSP = dry weight of seeds per plant, W100DS = weight of 100 dry seeds.

Introduction

Soybeans are a legume commodity in the world's top five influential commodities (Faé et al., 2020; Kezar et al., 2023). This commodity has a vital role as the primary source of vegetable protein and seed oil for food, feed, and industrial product needs (Vogel et al., 2021; Wang et al., 2023), so various countries need soybeans in large quantities, including Indonesia. Indonesia is a tropical country, which is not a familiar environment for soybean cultivation (Saryoko et al., 2017; Sayaka et al., 2021). However, the significant demand for soybeans as processed tofu and tempeh requires the Indonesian government to import large quantities of soybeans to meet this need (Susilowati et al., 2014; Sayaka et al., 2021; Hulu & Rahayu, 2024). Based on Indonesian statistical data (2024), Indonesian soybean imports in 2023 will reach 2.27 million metric tons and increase along with population growth. This is very risky with the issue of global warming, which can reduce soybean production in the world (Saryoko et al., 2017; Vogel et al., 2021; Kezar et al., 2023), so food security in Indonesia could be threatened. For this reason, the Indonesian government has made the development of tropical soybeans one of the policy targets in several regions to reduce dependence on imports. Soybean intensification is an intensive approach to increasing soy production. Soybean intensification can be done by embracing some of the potential superior varieties in the tropics and using a package of cultivation technologies to support the potential of the varieties (Saryoko et al., 2017; Singh et al., 2023; Silva et al., 2023; Sulaeman et al., 2024). Exploiting potential varieties is one of the keys to sustaining production (Krisdiana et al., 2021). It is also by Poudel et al. (2023), so soy varieties are often assembled. However, the potential of soybean varieties will only be at its maximum if the growing environment is adequate. This indicates that soybean culture technology is becoming critical to optimization (Singh et al., 2023; Silva et al., 2023). One of them is fertilization technology. Fertilization technology is the key to improving the growing environment in terms of the availability of nutrients (Abduh et al., 2021; Farid et al., 2022). There are two common types of fertilizers: chemical and biological. Chemical fertilizer is focused on macronutrients (N, P, and K) that are an essential part of the basic metabolic process, so plants need these nutrients in large quantities (Baghdadi et al., 2018; Kong et al., 2022). However, these quantities are not naturally available in the environment, so significant nutritional optimization should be done with the administration of chemicals (Baghdadi et al., 2018; Anang et al., 2021; Fu et al., 2023). Several studies have examined optimizing chemical fertilizer doses in supporting production, both with soybean seeding and spraying systems (Buah et al., 2017; Fu et al., 2023). However, on the other hand, some studies have shown the effects of structural damage and aggregation of soil due to high fertilizer doses, so the soil cannot perform its physical function in maintaining air-water balance (Amy et al., 2023; Fu et al., 2023). Other studies have also found that excess chemical fertilizers will reduce the number of soil microorganism colonies supporting plant growth (Li et al., 2015; Farid et al., 2022; Fu et al., 2023). This is risky for soybean plantations, which have relatively good symbiosis with nitrogen-fixing microorganisms (Paradiso et al., 2015). Therefore, dependence on chemical fertilizers must be reduced and mixed with organic fertilizer in soybean cultivation, such as Liquid organic fertilizer (LOF).

LOF can induce growth through growth sponsors and active symbiosis with microorganisms (Ji et al., 2017; Dungga et al., 2023). LOFs can also provide micronutrients directly to the leaves so that the supply of microelements can be directed toward the leaf (Toonsiri et al., 2016; Ji et al., 2017). Different essential ingredients, including soybeans, will influence the effectiveness of plant growth responses (Hou et al., 2017; Ji et al., 2017). One of the essential ingredients that could potentially be developed as a LOF is a banana hump.

Banana hump is an agricultural waste that is rich in nutrients and microorganisms that are good for plants (Cao et al., 2018; Ritongga et al., 2022; Dungga et al., 2023; Islam et al., 2023). Bananas generally contain phosphorus, potassium, calcium, and growth regulators such as gibberellin and cytokinin (Mohapatra et al., 2010; Bahtiar et al., 2017; Hasanah et al., 2020). Besides, the banana hump also contains microorganisms that are very useful to plants, such as Azospirillium, Azotobacter, Bacillus, Aeromonas, Aspergillus, and phosphate solvent microbes (Suprihatin et al., 2011; Aini et al., 2017). Both roles have been to enhance growth processes, resistance to pathogens, and phosphorus availability in the soil due to phenolic acid (Aini et al., 2017; Kumar et al., 2022). The superiority of banana hump as LOF has also been reported for its effectiveness in several studies (Dungga et al., 2023; Islam et al., 2023), including on soybean plants (Aini et al., 2017). Therefore, the combination of LO concentrations in banana shrimp with NPK fertilizer doses in soybeans must be evaluated. However, the evaluation required a systematic pattern to support its effectiveness against the combination of the two types of fertilizer so that multivariate analysis could potentially be applied.

Multivariate analysis becomes essential when dealing with many variables in a study. Several studies have used multivariate analysis to support plant selection and evaluation processes, including soybean (Momen et al., 2021; Padjung et al., 2021; Farid et al., 2022). In general, this analysis can simplify and reduce the less essential diversities in the evaluation process so that the assessment process becomes more focused (Momen et al., 2021; Padjung et al., 2021). Such potential will systematically streamline fertilization evaluation processes. Several studies have also used this concept in fertilization evaluation (Abduh et al., 2021; Farid et al., 2022; Fikri et al., 2022; Musa et al., 2023). Based on this, applying multivariate analysis to predict the best interaction between the combination of doses of chemical NPK fertilizer and LOF from banana debris is essential. Meanwhile, this research aims to determine the effectiveness of using multivariate analysis and determine the best combination of interactions between NPK fertilizer doses and banana hump LOF concentrations to soybean agronomic potential.

Results

Identify evaluation criteria for the interaction of LOF and NPK fertilizer

The variance analysis results show that the variation coefficient for all growth characters is low, below 30% (Table 2). It indicated that all parameters have low environmental variance among objects so that this data analysis can be done more in-depth. The influence of the two single factors of giving LOF and NPK had a significant to very significant effect on the characteristics of plant height, number of pods per plant, percentage of empty pods, number of seeds per plant, dry weight of seeds per plant, weight of 100 dry seeds and seed production per hectare. The character of the number of leaves was only influenced by the single factor of LOF administration. Meanwhile, the interaction between the two treatments also significantly influenced the characteristics of plant height, percentage of empty pods, number of seeds per plant and seed production per hectare. These overall results form the basis for a more in-depth analysis.The results of the correlation analysis focused on soybean seed productivity per hectare (Table 3). Based on this correlation, the characters that had a significant positive correlation with the main characters were plant height (0.74), number of branches (0.60), number of pods per plant (0.78), and weight of 100 dry seeds (0.67). These characters are also positively correlated between these characters. The results of this correlation are the basis for path analysis. The results of path analysis show that the characteristics of plant height (0.30) and number of pods per plant (0.46) have an excellent direct influence on productivity (Table 4). Apart from that, the two characters (plant height (0.627) and number of pods per plant (0.621)) also had a high indirect influence on other characters, especially the number of branches and dry weight of 100 seeds. These results are considered for further in-depth tests on the effect of LOF and NPK fertilizers.

Analysis of polynomial-polynomial interactions to evaluation criteria

The results of the further test of the polynomial-polynomial interaction of plant height characteristics with LOF concentration and NPK fertilizer dose are shown in Figure 1. The results of this further test show that the two treatments of LOF concentration and NPK fertilizer dose have a quadratic interaction. However, the determination of this response is only around 0.397. Meanwhile, the best treatment to support plant height is a LOF concentration of 100 mL/L and an NPK fertilizer dose of 150 kg/ha with a value of 48.54 cm.

The results of the further test of the polynomial-polynomial interaction between the number of pods per plant and the LOF concentration and NPK fertilizer dose are shown in Figure 2. The results of the further test show that the two treatments of LOF concentration and NPK fertilizer dose had a quadratic response interaction. However, the determination value of this equation is considered low, with a value of 0.375. Meanwhile, the best treatment to support the number of pods per plant is a LOF concentration of 100 mL/L and an NPK fertilizer dose of 150 kg/ha with a value of 101.33 pods. The results of the further test of the polynomial-polynomial interaction of the characteristics of seed production per hectare on the LOF concentration and NPK fertilizer dose are shown in Figure 3. The further test results show that both LOF concentration and NPK fertilizer dose treatments have a dynamic quadratic response interaction with a high determination value of 0.687. Meanwhile, the best treatment to support seed production per hectare is a LOF concentration of 100 mL/L and an NPK fertilizer dose of 150 kg/ha with a value of 3,071 tonnes/ha.

Discussion

The LOF, NPK, and their interactions significantly influenced vegetative and dominant characters in almost all generative characters of soybeans. However, these results still show an insignificant influence on several observed characters. This indicates that not all characters are influenced by both treatments, especially characters unrelated to soybeans' agronomic characteristics.

Table 1. Analysis of variance between NPK dosage and banana hump LOF concentration on soybean plant growth

Parameter	Liquid organic fertilizer	N:P:K Fertilizer
kind of fertilizer	organic fertilizer	an organic (Nitrogen (N), phosphate (P), and Potassium fertilizer (K))
source	Banana Hump	Chemical industries
nutrient type	Focus on micronutrients	Focus on macronutrients
spread methods	spray or sprinkle	create a hole beside the soybean hole
Dosage/ concentration levels	0 mL/L 100 mL/L 200 mL/L	0 kg/ha 75 kg/ha 150 kg/ha 225 kg/ha

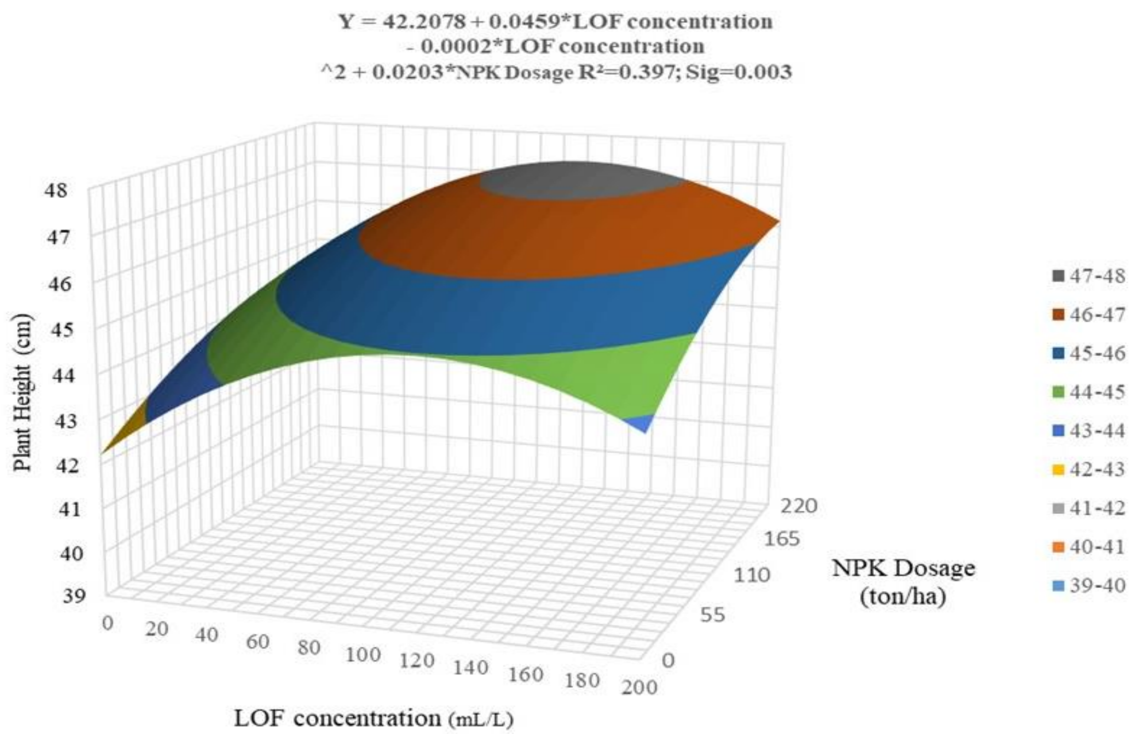

Fig 1. Graph of the relationship between LOF concentration and NPK fertilizer dose with plant height characteristics.

Table 2. Analysis of variance between NPK dosage and banana hump LOF concentration on soybean plant growth.

Characters	Mean Square			CV (%)
	LOF	NPK	LOF x NPK	
PH	21.71**	10.25**	11.32**	2.88
NL	118.11**	34.01ns	25.86ns	7.27
NB	0.08ns	0.019ns	0.02ns	3.54
Chl tot	448.37ns	818.75ns	1256.52ns	7.12
Chl tot	319.38ns	459.12ns	554.26ns	7.37
Chl B	59.07ns	90.28ns	136.80ns	8.48
RV	13.86ns	10.10ns	8.16ns	22.63
RDW	0.52ns	0.33ns	0.36ns	25.62
FA	1.00ns	1.29ns	0.81ns	1.96
HA	0.25ns	1.58ns	1.36ns	1.38
NPP	734.68*	620.29*	287.37ns	15.05
PEP	5.151*	3.247*	2.762*	24.52
NSP	5350.15**	2154.32*	2817.05**	16.23
DWS	149.66*	134.66*	52.40ns	22.04
W100S	7.38**	2.97**	0.73ns	4.28
Yield	0.48**	0.54**	0.10**	5.77

Notes: *: significant effect, **: very significant impact, ns: no significant effect, TT: plant height, JD: number of leaves, JC: number of branches, KT: total chlorophyll, KA: chlorophyll A, KB: chlorophyll B, VA: root volume, BKA: root dry weight, UB: flowering age, UP: harvest age, JPT: number of pods per plant, PPH: percentage of empty pods, JBPT: number of seeds per plant, BKT: dry weight of seeds per plant, W100S: weight of 100 dry seeds, PBPH: seed production per hectare.

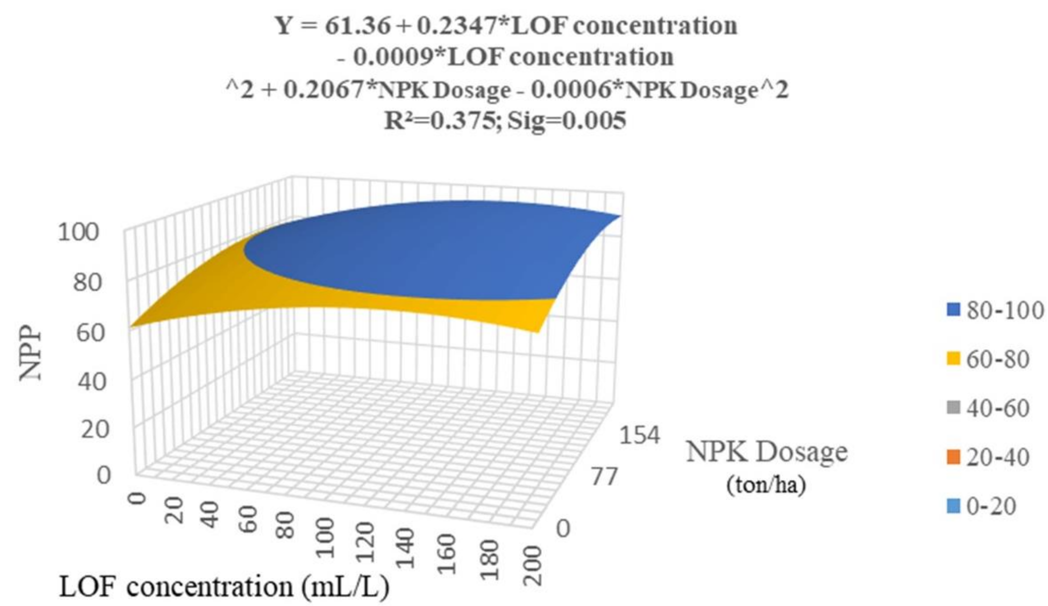

Fig 2. Graph of the relationship between LOF concentration and NPK fertilizer dose with the characteristics of the number of pods per plant (NPP).

Table 3. Correlation analysis to soybean growth characters.

	PH	NL	NB	Chl tot	Chl tot	Chl B	RV	RDW	FA	HA	NPP	PEP	NSP	DWS	W100S
NL	0.63*														
NB	0.62*	0.31ns													
Chl tot	0.22ns	0.30ns	0.11ns												
Chl tot	0.19ns	0.32ns	0.17ns	0.99**											
Chl B	0.23ns	0.33ns	0.12ns	1.00**	0.99**										
RV	0.63*	0.79**	0.33ns	-0.20ns	-0.20ns	-0.18ns									
RDW	0.34ns	0.57ns	0.16ns	-0.31ns	-0.30ns	-0.30ns	0.82**								
FA	-0.06ns	-0.44ns	0.29ns	-0.04ns	-0.02ns	-0.03ns	-0.44ns	-0.56ns							
HA	-0.44ns	-0.07ns	-0.44ns	0.20ns	0.22ns	0.21ns	-0.24ns	-0.31ns	0.23ns						
NPP	0.76**	0.58*	0.59*	0.45ns	0.45ns	0.45ns	0.51ns	0.18ns	-0.18ns	-0.22ns					
PEP	-0.79**	-0.47ns	-0.64*	-0.54ns	-0.53ns	-0.54ns	-0.37ns	-0.08ns	-0.10ns	0.20ns	-0.90**				
NSP	0.30ns	0.62*	0.28ns	0.65*	0.69*	0.66*	0.17ns	0.18ns	-0.15ns	0.29ns	0.58ns	-0.42ns			
DWS	0.71**	0.60*	0.46ns	0.33ns	0.34ns	0.32ns	0.62*	0.38ns	-0.26ns	-0.09ns	0.85**	-0.82**	0.39ns		
W100S	0.72**	0.54ns	0.70*	0.58*	0.59*	0.59*	0.35ns	0.13ns	-0.17ns	-0.37ns	0.77**	-0.72**	0.61*	0.56ns	
Yield	0.74**	0.54ns	0.60*	0.28ns	0.31ns	0.29ns	0.57ns	0.44ns	-0.23ns	-0.27ns	0.78**	-0.74**	0.31ns	0.91**	0.67*

Notes: *: significant effect, **: very significant impact, ns: no significant effect, PH: plant height, NL: number of leaves, NB: number of branches, Chl tot: total chlorophyll, Chl A: chlorophyll A, Chl B: chlorophyll B, RV: root volume, RDW: root dry weight, FA: flowering age, HA: harvest age, NPP: number of pods per plant, PEP: percentage of empty pods, NSP: number of seeds per plant, DWS: dry weight of seeds per plant, W100S : weight of 100 dry seeds.

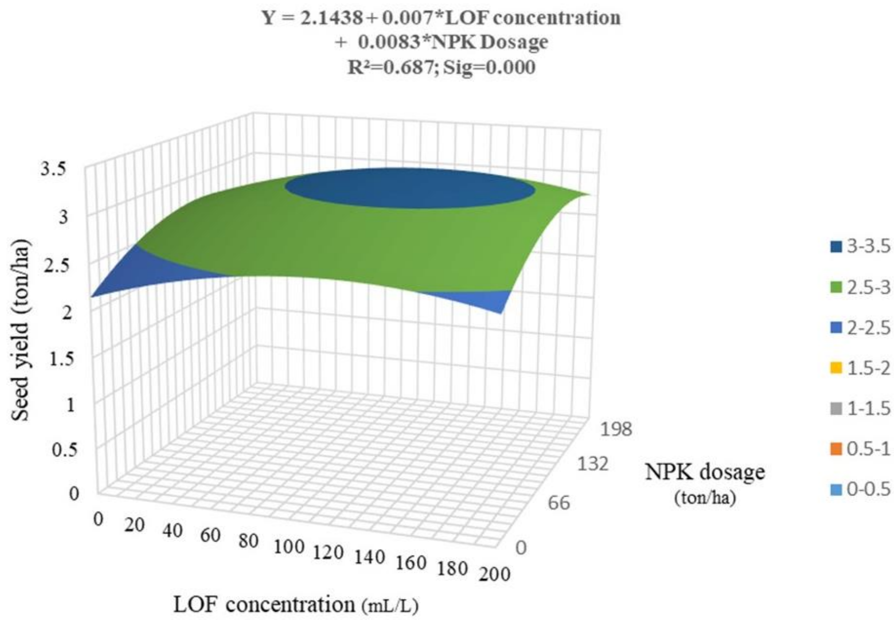

Fig 3. Graph of the relationship between LOF concentration and NPK fertilizer dosage with seed yield characteristics per hectare.

Table 4. Path analysis of several characters that correlate with the yield.

Character	Direct effect	Indirect Influence				Influence Total
		PH	NB	NPP	W100S	
PH	0.3		0.086	0.348	0.007	0.74
NB	0.14	0.185		0.269	0.007	0.6
NPP	0.46	0.227	0.082		0.008	0.78
W100S	0.01	0.215	0.098	0.352		0.67
Indirect Influence		0.627	0.18	0.621	0.015	

Notes: PH: plant height, NB: number of branches, NPP: number of pods per plant, W100S: weight of 100 dry seeds.

Providing NPK is the basis for supporting potential yields because this fertilizer is closely associated with cell division and differentiation. This is further supported by the provision of LOF, which further stimulates increased production due to the effectiveness of its interaction with NPK fertilizer. The interaction phenomenon of LOF and NPK dose was also reported by Kurnianta et al. (2021) in Bok Coy, Effendi et al. (2023) in rice, and Sara et al. (2023) in maize. This pattern is different from the chlorophyll content or root parts, which are relatively less responsive to minor environmental differences, or the environment does not experience abiotic stress (Karlova et al., 2021; Chauhan et al., 2023). Apart from that, soybeans have an excellent symbiotic pattern with rhizobium, so giving 0 kg/L will not affect the quality of nitrogen, which is correlated with leaf greenness or leaf chlorophyll (Wongdee et al., 2021; Nakei et al., 2022; Goyal & Habtewold, 2023). Therefore, the significantly influenced characters can be an initial indication in evaluating fertilizer packages on soybean growth and production. The concept of significant character-based evaluation was also reported by Litrico and Violle (2015), Fellahi et al. (2018), Anshori et al. (2022), Farid et al. (2022) and Fadhilah et al. (2022).

The research results indicate that several characters can be selection characters in selecting essential characters for the subsequent evaluation process. However, the use of many characters in an evaluation process can reduce the effectiveness of the evaluation so that the review of the main characters and supporting characters is in line with the research objectives to be achieved (Sabouri et al., 2008; Mustafa et al., 2019; Anshori et al., 2019; Anshori et al., 2021). Therefore, selecting these essential characters is a crucial thing to do.

Based on both analyses, the characteristics of plant height, number of branches, and number of pods per plant have an excellent direct influence on the characteristics of soybean seed production per hectare. Therefore, these four characters can be used as supporting characters for the main character (soybean seed production per hectare).

Determining the evaluation character is based on two analyses: correlation and path analysis. Both analyses are systematic approaches widely used in determining evaluation or selection criteria (Khapte and Jansirani, 2014; Fadhilah et al., 2022). In general, correlation analysis shows the relationship between two variables. However, this analysis cannot show a causal relationship and calculate the contribution value of a supporting character to the improvement of the main character (Anshori et al., 2021). However, this analysis can reduce the number of characters used for path analysis. This will increase the efficiency and effectiveness of path analysis results.

Potential plant height, number of pods per plant, and weight of 100 seeds as selection characters were also reported by Kale et al. (2023), Leolato et al. (2023), Kezar et al. (2023) and Singh et al. (2023). These two characters have vital roles and different roles in determining potential outcomes. Plant height is generally a vegetative character closely related to a plant's growth pattern. Suppose there is a decrease in the plant height of a plant variety. In that case, it can indicate that the plant is experiencing growth inhibition due to the environment, so the concept of interaction treatment is often seen in plant height, including soybean plants. Meanwhile, the character of the number of pods is part of the yield component of a soybean. The role of pod number as one of the main determinants of soybean yield components has also been reported by Uzala et al. (2018), Fang et al. (2021), He et al. (2023), and Zhang et al. (2023). Ning et al. (2018) and Fang et al. (2021) also explain how the quantitative trait LOFi (QTL) concept has been discovered regarding the role and pattern of pod number in determining the potential yield of soybean plants. Apart from that, the character of the number of pods is also related to the number of nodes, which is associated with the height of the soybean plant (Egli 2013). Therefore, the potential of evaluation criteria and productivity is worthy of being analyzed in depth to determine the best technology package for soybean cultivation.

The characteristics of plant height, number of pods per plant, and seed production per hectare were significantly influenced by applying several LOF concentrations, NPK fertilizer doses, and the interaction between the two. Figures 1, 2, and 3 illustrate the interaction effect of LOF concentration and NPK fertilizer dosage on the characteristics of plant height, number of pods per plant, and seed production per hectare, respectively. The equation of the three curves shows a dynamic quadratic graph that has an optimal peak point in increasing the characteristics of plant height, number of pods per plant, and seed production per hectare so that expanding the LOF concentration and NPK fertilizer dose beyond this optimal point becomes no longer effective. Based on these three graphs, a LOF concentration of 100 mL/L and an NPK fertilizer dose of 150 kg/ha is the best combination to support an increase in plant height, number of pods per plant, and seed production per hectare. These results are also in line with research by Saputra et al. (2019), Tony et al. (2020) and Kurniawati et al. (2022). This indicates that increasing the LOF concentration and NPK fertilizer dose can optimize the potential for soybean seed production. Therefore, both combinations of a LOF concentration level of 100 mL/L and an NPK fertilizer dose of 150 kg/ha are recommended for soybean cultivation. Meanwhile, increasing the LOF concentration and NPK fertilizer dosage can still be considered in further research

Materials and Methods

Plant Materials and Experimental Design

The research was conducted in Pammase Hamlet, Selli Village, Bengo District, Bone Regency, South Sulawesi. The research took place from January 2022 to April 2022. The cultivar was used to focus on the Anjosmoro variety. The study used a two-factor randomized completed block design (RCBD). The first factor is the liquid organic fertilizer (LOF) concentration, which consists of 3 levels: 0 mL/L, 100 mL/L, and 200 mL/L. Meanwhile, the second factor is the provision of N:P: K fertilizer doses consisting of 4 levels, namely 0 kg/ha (without NPK fertilizer), 75 kg/ha, 150 kg/ha, and 225 kg/ha (Table 1). The combination of the two treatments was repeated three times, so there were 36 experimental units. Each experimental unit has a plot size of 1.5 m x 2 m with a planting distance of 40 x 20 cm.

Research Procedures

Implementation is done by cultivating the land with a tractor and printing plots according to the size and design used. Then, each plot is given compost at 3 tons/ha. The variety used in this research is the Anjosmoro variety. Before planting, the seeds of this variety are given 7.5 g of rhizobium per 1.5 kg of soybean seeds and air-dried for approximately 5 minutes. Seeds applied with rhizobium are immediately planted at one seed per planting hole. Seeds that do not grow will be embroidered one week after planting. Then, the plants are maintained using general procedures for soybean maintenance, which include watering, replanting, weeding, and controlling pests and diseases.

Meanwhile, fertilization is carried out according to treatment. NPK treatment was given when the plants were 15 HST. The application of the LOF banana hump is carried out according to concentration and sprinkled on the ground. The time to apply LOF is when the plants are 14 days after planting, 28 days after planting, 42 days after planting, 56 days after planting, and 70 days after planting and is done in the morning. The final activity is harvesting the soybeans, carried out when the leaves are yellow, 90% have fallen off, and the pods are brownish.

Banana hump LOF

LOF is made using several ingredients, namely 5 kg of banana stems, 1 kg of brown sugar as a source of glucose, and 10 liters of rice washing water as a source of carbohydrates. The bulbs are chopped and mashed first, then fermented for 15 days in a cool place and not exposed to direct sunlight. Every two days, the lid of the fermentation bucket is opened to improve air circulation. Successful LOF is characterized by a characteristic sour smell of fermentation, no maggots, and clearer LOF (Aini et al., 2017).

Data observation and statistical analysis

Data observed included plant height, number of leaves, number of branches, total chlorophyll, chlorophyll A, chlorophyll B, root volume, root dry weight, flowering age, harvest age, number of pods per plant, percentage of empty pods, number of seeds per plant, weight dry seeds per plant, weight of 100 dry seeds, and seed production per hectare. The data was analyzed using variance. Significant characteristics based on an alpha of 5% are further analyzed using correlation analysis with an error rate of 5%. Considerable correlation with productivity is followed by path analysis to determine evaluation criteria. The characters selected as evaluation criteria are followed by polynomial-polynomial interaction analysis.

Conclusion

This research concludes that plant height and number of pods planted are essential evaluation criteria along with productivity in the interaction between NPK and LOF fertilizers. The polynomial-polynomial interactions of these three characters show a dynamic quadratic pattern. The interaction of 150 kg/ha NPK fertilizer with a LOF concentration of 100 mL/L is a promising technology for stimulating soybean growth and production, especially against the three evaluation criteria. This interaction package can be recommended as a reference in supporting soybean cultivation in the community. However, the technology package in this research still needs to be optimized with other technological approaches, such as providing organic material for the soil or providing hormones or biostimulants, which can also support the productivity potential of soybeans.

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