Jurnal Lahan Suboptimal : Journal of Suboptimal Lands
ISSN: 2252-6188 (Print), ISSN: 2302-3015 (Online, https://jlsuboptimal.unsri.ac.id/index.php/jlso)
Vol. 14, No.2: 182-191 October 2025
DOI: 10.36706/JLSO.14.2.2025.692

The growth and yield of *Capsicum annuum* L. variety Gada F1 on NPK 16:16:16 fertilizer

Zerika Regina Ramadhan Fitri*), Susilawati Susilawati
Department of Agronomy, Faculty of Agriculture, Universitas Sriwijaya, Indralaya, Ogan Ilir 30662, South Sumatra, Indonesia
*)Email address: reginazerika@gmail.com

(Received: 25 February 2024, Revision accepted: 22 September 2025)

Citation: Fitri, Z. R. R., & Susilawati, S. (2025). The growth and yield of *Capsicum annuum* L. variety Gada F1 on NPK 16:16:16 fertilizer. *Jurnal Lahan Suboptimal : Journal of Suboptimal Lands. 14* (2): 182-191. https://doi.org/10.36706/JLSO.14.2.2025.692

ABSTRACT

Red chili was one of the most strategic vegetable commodities because the market demand was high every day. Efforts to increase chili productivity were needed so that chili prices were stable and market demand was met. The research aimed to determine the growth and yield of the red chili Gada F1 variety against NPK 16:16:16 fertilizer. This research uses the Randomized Block Design (RBD) method, consisting of 4 treatment levels and 3 replications. P_0 = control, P_1 = NPK fertilizer 2.5 g/polybag, P_2 = NPK fertilizer 5 g/polybag, and P_3 = NPK fertilizer 7.5 g/polybag. The application of NPK 16:16:16 fertilizer to the growing medium significantly influenced several growth and yield parameters, including the number of leaves, crown diameter, leaf greenness, fruit weight, number of fruits, fruit length, and fruit diameter. In contrast, it had no statistically significant effect on plant height, flowering time, number of branches, root fresh weight, crown fresh weight, root dry weight, or crown dry weight. Among the treatments, the application rate of 7.5 g/polybag (P3) yielded the most favorable results across the majority of measured parameters. Accordingly, an NPK 16:16:16 dosage of 7.5 g/polybag was recommended for the cultivation of the red chili (*Capsicum annuum* L.) variety Gada F1.

Keywords: fertilizer dose, gada F1, NPK fertilizer, plant growth, red chili

INTRODUCTION

One of the seven most widely grown vegetables in the world is chili (Castillo-Téllez et al., 2017). Chili is a member of the Solanaceae family, which is a vegetable and spice plant (Pujar, 2017). One of the *C. annuum* cultivars that is quite popular in Indonesia is red chili or large chili (Ferniah et al., 2018). Red chili is a vegetable commodity that cannot be abandoned by the community in every life, so red chili is a strategic commodity because of the high demand every day (Arthanawa et al., 2022). The price of red chili, which can jump so high at any time, causes the red chili commodity to be the subject of interesting discussions in the community (Priyadi et al., 2022). Although chili productivity in some areas is quite high, there are many problems and obstacles in the field (Handayati et al., 2021). Attempts to increase the productivity of chili plants are needed because the market demand for chili also continues to increase (Putra et al., 2020).

Fertilization is one of the attempts to increase chili production (Rosadi & Andraini, 2021), as is the use of hybrid varieties that are part of agricultural intensification (Saragih et al., 2019). To increase chili production, farmers usually use high doses of inorganic fertilizers that often exceed the recommended amount, resulting in negative ecological, health, socio-cultural, and economic impacts arising from the inappropriate use of inorganic fertilizers (Priyadi et al., 2022). Although the use of organic fertilizers is increasing, it is known that the way they are applied is still often based on the experience of farmers (Kim et al., 2018). Excessive use of organic fertilizers may cause salt to accumulate in the soil, inhibit water absorption by plants, and interfere with plant growth (Kim et al., 2020). Therefore, red chili production must be increased through agronomic cultivation with the use of

fertilizers that are in accordance with plant needs to meet market demand (Putra et al., 2020).

The growth, yield and quality of a crop could be affected by various cultural practices, but its performance mainly depends on its genetic structure (Iqbal et al., 2017). East-West Seed Indonesia developed the hybrid variety Gada, which is known for its high productivity. he results of a research (Handayati et al., 2021) showed that the Gada variety produced a higher number of fruits per plant and higher production compared to local varieties. Furthermore, another factor that affects the production of red chili plants is fertilization (Arthanawa et al., 2022). Fertilization is one of the cultivation practices to increase plant growth and productivity as well as soil quality by providing nutrients needed by plants (Umami et al., 2019). Chili plants require nutrients in sufficient quantities (Maftu'Ah et al., 2019). Inorganic fertilizers provide nutrients to plants in large quantities, and organic matter maintains soil function and facilitates the absorption of these nutrients (Priyadi et al., 2022).

Organic and inorganic fertilizers both have an important role in plants. NPK fertilizers given below the recommended dose will actually cause plant growth to be inhibited (Markus et al., 2021). Inorganic fertilizers are made from synthetic materials so that if their use is excessive, the soil will become toxic (Moneruzzaman et al., 2017).

Balanced fertilization has been shown to enhance fertilizer use efficiency while improving the physical, chemical, and biological properties of the soil (Ichwan et al., 2022). The objective of this research was to assess the growth and yield performance of the red chili (*C. annuum* L.) Gada F1 variety in response to NPK 16:16:16 fertilization.

MATERIALS AND METHODS

Location and Duration

This research was conducted at the Experimental Farm, Faculty of Agriculture, Sriwijaya University, Indralaya Sub-district, Ogan Ilir District. It was conducted from May 2022 to September 2022.

Tools and Materials

The tools that were used in this research includes: 1) Stationery, 2) Tray, 3) Hoe, 4) Bucket, 5) Hallway, 6) Analytical balance, 7) Oven, 8) Ruler, 9) Pot tray, 10) Smartphone, 11) SPAD. The materials used in this research were: 1) Water, 2) Red chili seedlings of the Gada F1 variety, 3) Polybag, 4) Chicken manure, 5) NPK fertilizer 16:16:16, 6) Urea, ZK, and KCL fertilizers, 7) Soil.

Research Methods

This study employed a Randomized Block Design (RBD) comprising four treatment levels, with three replicates per treatment. Each replicate included three plants, resulting in a total of 36 experimental units. The following were the treatments that will be used in this study: P_0= control, P_1=NPK fertilizer at a dose of 2.5 g/polybag, P_2=NPK fertilizer at a dose of 5 g/polybag, and P_3=NPK fertilizer at a dose of 7.5 g/polybag. Based on research (Gofar et al., 2023), the application of NPK fertilizer at 2.5 g/plant gives the best response in terms of increasing the number of branches, flowers, and fruits, while the dose of 2 g/plant gives a real effect on the weight of chili.

The research began with seed preparation and the preparation of planting media. Before seeding, red chili seeds were soaked in water for 30 minutes to facilitate the germination process and clean the seeds from fungi contained in the seeds, then the seeds were then sown in a tray, and after 14 days they were transferred to polybags. The planting media used was Top Soil and chicken manure (2:1) stirred evenly. As a basic treatment, organic material was added in the form of chicken manure at a dose of 20 tons/ha (Amartiya & Gofar, 2023). Then put into polybags measuring 35 cm x 35 cm to a height of ± 23cm, after which the NPK 16:16:16 fertilizer was applied to the planting media mixture according to the treatment dose.

Plantation was carried out using healthy seedlings that were upright, had green leaves, showed no deformities, and were free from pests and diseases. Uniform seed germination and good and healthy seedling development were key factors in increasing agricultural production (Solichatun et al., 2022). Planting media for

cultivation was watered first, then red chili seeds were planted into each prepared planting media, with a planting depth of 2-3 cm. The fertilizers applied were Urea 150 kg/ha, ZK 400 kg/ha, and KCL 150 kg/ha given at the ages of 4, 7, and 10 weeks after planting at 1/3 dose each. Fertilizers were applied sequentially and buried into the soil (Suddin et al., 2021). Maintenance included watering, pest and disease control, weed control, trimming, and the installation of stakes.

Watering was done twice a day, in the morning and evening except when it rains. To avoid pest attacks, the area around the plant was cleaned to prevent the growth of weeds or other wild plants, weeding was done every two weeks or by looking at field conditions (Cendana et al., 2021). Harvest was done when the fruit showed the general characteristics of maturity. Fruit that meet the harvest criteria (80% ripe fruit, solid shape, and reddish green color), were harvested with an interval of 5 days (Sopialena et al., 2018). The method of harvesting was by picking the chili fruit along with the stalk (Gofar et al., 2023).

Observed variables

The observed variables include several growth and production characteristics, namely plant height, number of leaves, leaf greenness, number of branches, crown diameter, flowering age, number of fruits per plant, fruit weight, fruit length, fruit diameter, root fresh weight, root dry weight, crown fresh weight, and crown dry weight. Observations of plant production (number and fresh weight of fruits) were made at harvest time (Honin & Bako, 2022).

Data Analysis

The data that had been obtained was analyzed using the Analysis of Variance with F table, this analysis was done by comparing the F count.If the F count was smaller than the F table 5%, then the treatment had no real effect. If the F count was greater than F table 5% then the treatment had a real effect. If the F count was real or very real, it was continued with the 5% LSD (the least significant difference) test to see the difference between treatments (Sopialena et al., 2018). LSD (the least significant difference) analysis was a method introduced by Ronald Fisher (Jasmi et al., 2023).

RESULTS

Plant Height

Based on the results of the analysis of variance, it shows that the treatment of NPK 16:16:16 fertilizer did not significantly affect the parameters of plant height. The highest mean of plant height was found in the P_3 treatment, while the lowest mean of plant height was found in the P_0 treatment (Figure 1).

Flowering Age and Number of Branches

The application of NPK fertilizer to red chili produced the fastest average flowering age in the P_3 treatment which was 24 days after planting, and the lowest in P_0 without NPK fertilizer which was 37.56 days after planting (Figure 2). Likewise, the highest number of branches was found in the P_3 treatment which was 12.34, while the lowest was in the P_0 treatment which was 9.67 (Figure 3).

Number of Leaves, Crown Diameter, and Leaf Greenness Level

The results of the analysis of variance showed that NPK fertilizer had a significant effect on the growth of the number of leaves, crown diameter, and greenness of the leaves. Based on the results of further tests using the Least Significant Difference (LSD) on several growth parameters (Table 1), it was obtained that the number of leaves 5 and 8 weeks after planting in the P_3 = NPK 7.5 g/polybag treatment was significantly different from the P_0 = without NPK fertilizer, as well as the crown diameter 14 and 15 weeks after planting, and the green level of leaves 6 weeks after planting in the highest P_3 treatment was significantly different from the P_0 treatment.

Number of Fruits, Weight of Fruits, Length of Fruits, and Diameter of Fruits per Plant

The results of the analysis of variance showed that NPK fertilizer had a significant effect on the parameters of fruit number, fruit weight, fruit length, and fruit diameter. Based on the results of the LSD further test on several yield parameters (Table 2), it was found that the number of fruits,

fruit weight, fruit length, and fruit diameter in the highest treatment P_3 (NPK 7.5 g/polybag) were significantly different from the treatment P_0 (without NPK fertilizer).

Root Fresh Weight and Root Dry Weight

The results of the analysis of variance showed that the application of NPK fertilizer had no significant effect on the parameters of root fresh weight and root dry weight. The application of NPK fertilizer on red chili produced the highest root fresh weight in the P_3 treatment which was 35.28 g, while the lowest root fresh weight was in the P_1 treatment which was 19.09 g (Figure 4). The analysis of variance showed that NPK fertilizer application had no significant effect on crown fresh and dry weight. However, the highest crown fresh weight (145.38 g) and dry weight (39.61 g) were observed in the P3 treatment, while the lowest fresh weight (85.09 g) and dry weight (25.96 g) occurred in the P0 treatment (Figure 5).

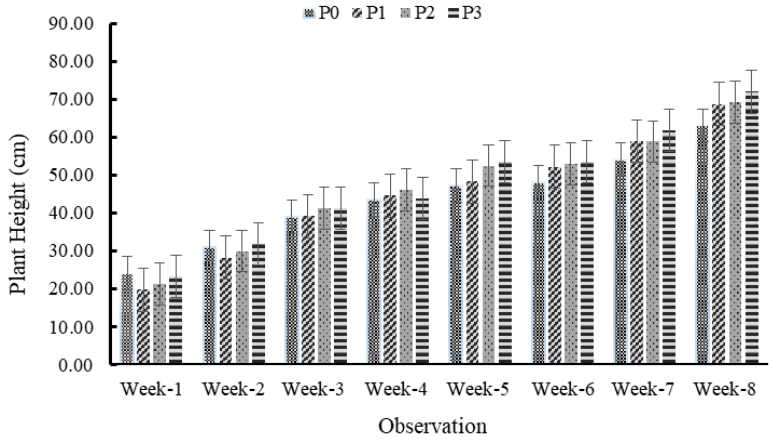

Figure 1. Mean of plant height of red chili in various NPK fertilizer treatments

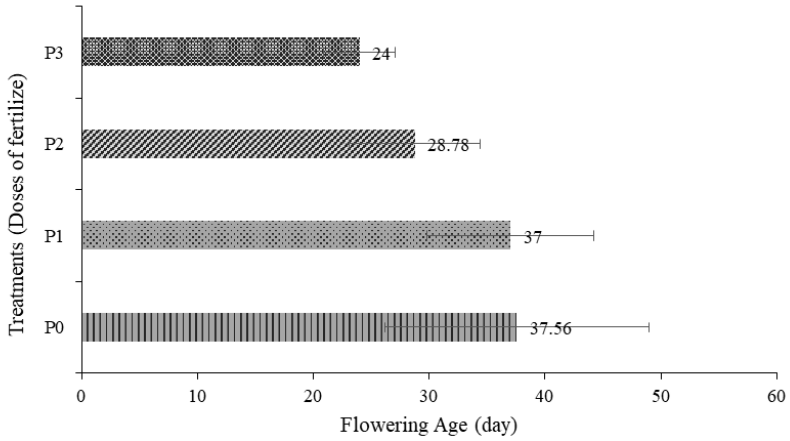

Figure 2. Mean of flowering age of red chili on various NPK fertilizer treatments

Table 1. Results of the 5% LSD test on the number of leaves, crown diameter, and leaf greenness

Treatments (Doses of fertilize)	Number of Leaves week-5 (blade)	Number of Leaves week-8 (blade)	Crown Diameter week-14 (cm)	Crown Diameter week-15 (cm)	Leaf Greennes Level week-6 (units)
P_0	63.62 a	162.26 a	68.33 a	72.29 a	88.92 a
P_1	57.52 a	195.66 b	89.29 b	92.92 b	96.22 a
P_2	81.85 b	212.56 b	89.43 b	91.65 b	110.05 b
P_3	87.62 b	249.59 c	92.29 b	96.99 b	111.05 b
LSD 5%	11.62	21.79	7.66	9.62	7.72

Note: Numbers followed by the same letter indicate differences that were not significant in the 5% LSD test.

Table 2. Results of the of 5% LSD test on the number of fruits, weight of fruits, length of fruits, and diameter of fruits per plant

Treatments (Doses of fertilize)	Number of Fruit (fruit)	Weight of Fruits (g)	Length of Fruits (cm)	Diameter of Fruits (mm)
P_0	30.55 a	253.72 a	11.73 a	10.64 a
P_1	38.89 b	260.71 a	13.51 b	11.75 b
P_2	53.55 c	341.10 b	13.52 b	12.77 c
P_3	58.55 c	428.48 c	14.53 c	12.98 c
BNT 5%	8.22	67.92	1.00	0.49

Note: Numbers followed by the same letter indicate differences that were not significant in the 5% LSD test.

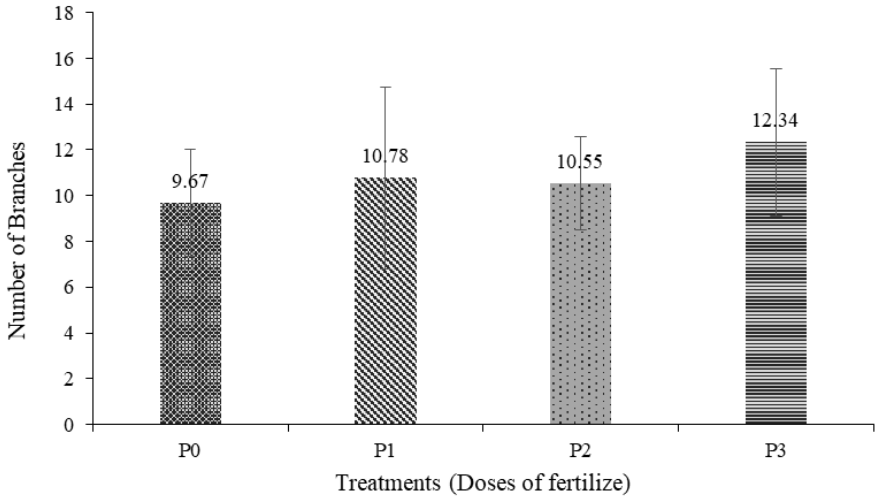

Figure 3. Mean of number of branches of red chili on various NPK fertilizer treatments

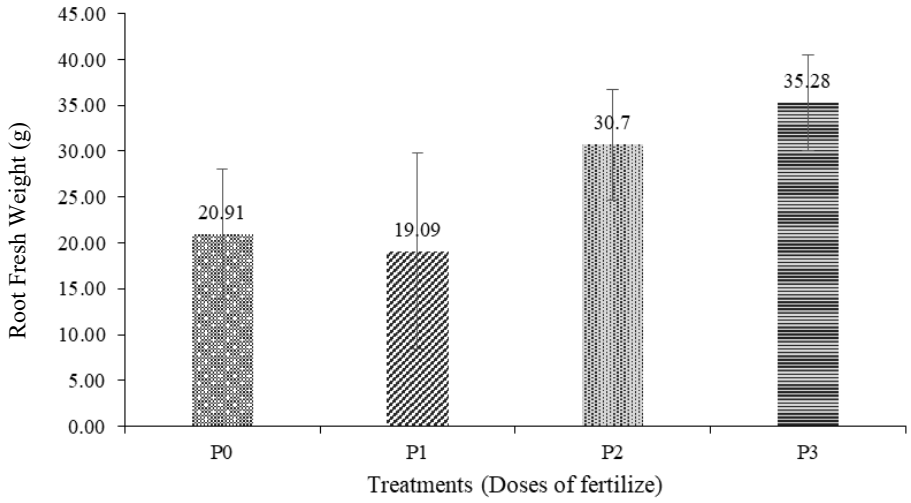

Figure 4. Mean of root fresh weight of red chili at various NPK fertilizer treatments

Crown Fresh Weight and Crown Dry Weight

The results of the analysis of variance showed that the application of NPK fertilizer had no significant effect on the parameters of crown fresh weight and crown dry weight. The application of NPK fertilizer on red chili produces the highest crown fresh weight in the P_3 treatment which was 145.38 g, while the lowest crown fresh weight was in the P_0 treatment which was 85.09 g (Figure 6). Likewise, the highest crown dry weight was found in the P_3 treatment which was 39.61 g and the lowest crown dry weight was found in the P_0 treatment which was 25.96 g (Figure 7).

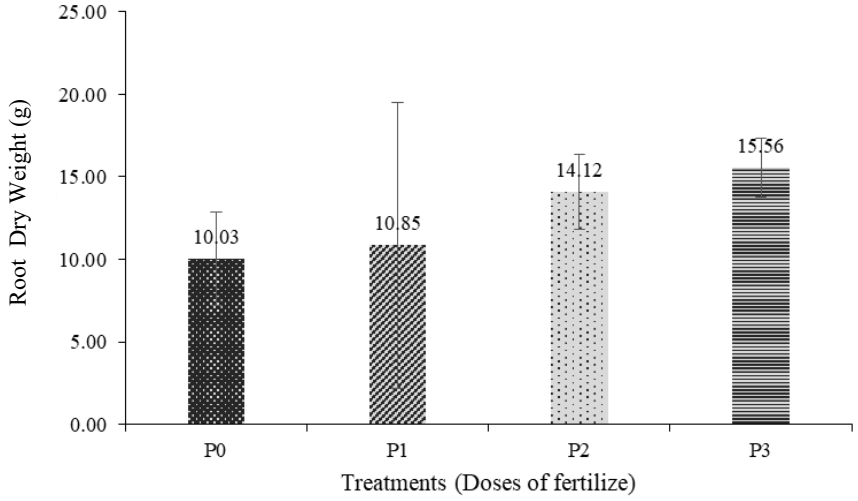

Figure 5. Mean of root dry weight of red chili at various NPK fertilizer treatments

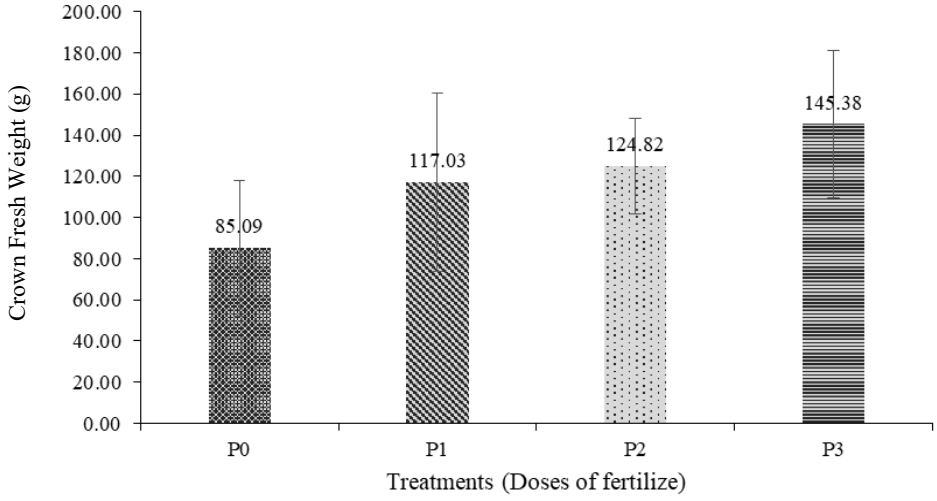

Figure 6. Mean of crown fresh weight of red chili on various NPK fertilizer treatments

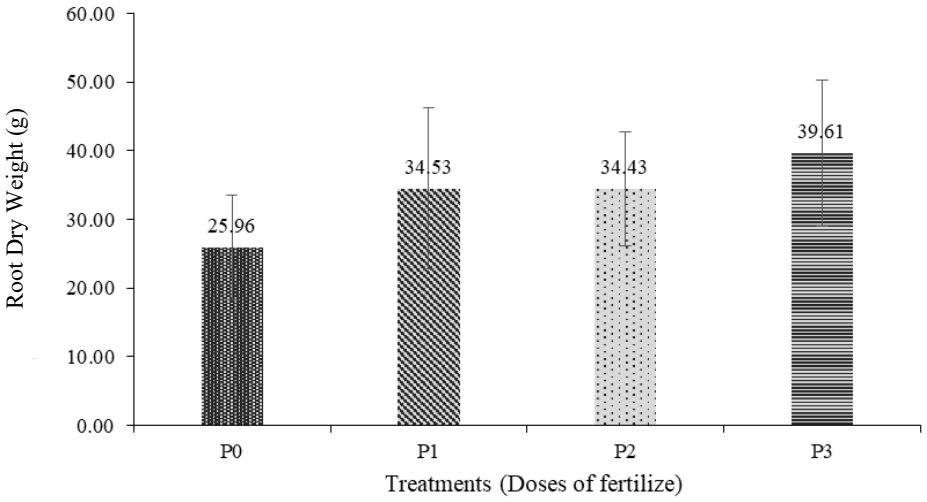

Figure 7. Mean of crown dry weight of red chili on various NPK fertilizer treatments

DISCUSSION

Analysis of variance revealed that the application of NPK 16:16:16 fertilizer to the planting medium significantly influenced the number of leaves, crown diameter, leaf greenness, fruit weight, fruit count, fruit length, and fruit diameter. Conversely, no significant effects were observed on plant height, flowering age, number of branches, root fresh weight, crown fresh weight, root dry weight, or crown dry weight. The Pearl 16:16:16 NPK fertilizer plays a critical role in various plant metabolic processes: nitrogen (N) promotes overall vegetative growth; phosphorus (P) facilitates energy transfer within plant cells, including molecules such as ADP and ATP, thereby enhancing young root development; and potassium (K) contributes to the strengthening of plant tissues, reducing abscission of flowers and leaves, and supports protein translocation (Dias et al., 2023). Previous investigations have demonstrated that NPK fertilization optimizes most growth parameters, with the exception of stem diameter (Arthanawa et al., 2022). Furthermore, Herison et al. (2020) reported that full NPK fertilization significantly improves growth and yield in chili hybrids cultivated in ultisol soils.

Based on the results of the analysis of variance, the NPK fertilizer treatment did not significantly affect the observation of plant height. Nevertheless, P_3 treatment (NPK 7.5 g/polybag) showed the highest plant height compared to P_0 (without NPK fertilizer). The higher the dose of NPK fertilizer, the higher the growth of the red chili plant height. This is in line with (Dubey et al., 2017) who founded that plant growth and yield parameters increase with increasing doses of NPK at certain doses. The high plants may be due to the abundant supply of nitrogen and phosphorus which help the plants in better photosynthesis and achieve better growth. Plant height is influenced by the nutrient nitrogen (N), if the nutrient N is fulfilled then the growth of plant height can reach a maximum (Leyna, 2019). The parameters of flowering age and the number of branches did not show significant differences. It is suspected that there are other factors that affect flowering age and number of branches. Based on (Wahyudi et al., 2022) sunlight affects plant growth through the length of irradiation (day length) and also affects plant flowering through three factors: quality, intensity, and photoperiodism. Nevertheless, the treatment of NPK fertilizer (P_1, P_2, P_3) resulted in faster flowering and a larger number of branches than without the application of NPK fertilizer (P_0). It is suspected that the nutrients from NPK fertilizer are available to the plants. Nutrient P played a very important role in flower formation (Gofar et al., 2023) Whereas Nitrogen functions to accelerate plant growth, one of which is branches. If the productive branches are higher, it could increase the production of chili plants (Rofanno et al., 2023).

Leaves function as the main organ of photosynthesis to produce assimilate in plants (Putra et al., 2020). The application of NPK fertilizer has a significant effect on the parameters of the number of red chili leaves at 5 and 8 weeks after planting. The same is true for the greenness level of the leaves measured using SPAD, which has a significant effect on red chili at 6 weeks after planting. N nutrients from NPK fertilizer are available for the processes of leaf formation, cell division, and enlargement, so the leaves will form faster and the color will be greener (Rofanno et al., 2023). Nitrogen is an integral part of the chlorophyll structure responsible for the greenness of plant leaves. In accordance with (Nimatu et al., 2022) nutrients such as N, P, and K have been shown to increase the SPAD meter value and NPK 200 kg/ha is applied to plants grown in Nigeria. The application of NPK fertilizer to the planting media has a significant effect on the diameter parameter of the red chili crown at the age of 14 and 15 weeks after planting. This was caused by good vegetative conditions in plant growth so that the availability of nitrogen, phosphorus, and potassium is sufficient, coupled with soil that provides other essential nutrients for plant needs (Dubey et al., 2017).

The application of NPK fertilizer to the planting media has a significant effect on the parameters of the number of fruits and the weight of red chili fruit. The highest number of fruits was found in the P_3 treatment which was 58.55, while the lowest number of fruits in the P0

treatment was 30.55. The highest average fruit weight was found in the P_3 treatment which was 428,48 g, while the lowest average fruit weight was in the P_0 treatment (without NPK fertilizer) which was 253.72 g. This is in accordance with the research results (Arthanawa et al., 2022) that the NPK fertilizer treatment produced the highest fruit weight per plant at 611.93 g, while the control treatment without treatment had the lowest fruit weight at 378.14 g. Based on (Fidiyawati et al., 2021) the availability of adequate amounts of potassium has proven to have a huge influence and play an important role in affecting yield quality. The availability of nutrients needed by plants, especially essential macronutrients such as N, P, and K, can increase optimal yields. The application of compound NPK fertilizers that contain nutrients needed by plants such as N, P, and K could meet the needs of plants both during the vegetative and generative phases (Amanda et al., 2023). This is in line with the results of research (Amanda et al., 2023) showing that the provision of various doses of NPK fertilizer can increase the yield of cayenne pepper (fruit weight per plant, number of fruits per plant, and fruit length per plant). Analysis of variance showed that NPK fertilizer treatment had a significant effect on the parameters of fruit length and fruit diameter. LSD further test showed that the length of fruit in the P_3 treatment was 14.53 cm, significantly different from the P_0 treatment which was 11.73 cm. Likewise, the fruit diameter in the P_3 treatment was 12.98 mm, significantly different from the P_0 treatment which was 10.64 mm. Phosphorus is considered essential for plant growth and also tends to be found in every living plant cell, where it is also involved in several major plant functions, including strengthening plant roots and stems and potassium serves to improve fruit and seed quality (Suddin et al., 2021). Phosphorus, especially potassium contributes dynamically and significantly to the production and development of good quality fruit sizes (length and diameter) (Dubey et al., 2017).

Based on the analysis of variance, the NPK fertilizer treatment did not significantly affect the parameters of root fresh weight and crown fresh weight. However, the dose of NPK fertilizer in the P_3 treatment showed the highest root and crown fresh weight. It is suspected that the red chili plants in the P_3 treatment absorbed the nutrient content better. Based on (Constantia & Ferniah, 2020) in addition to the availability of sufficient N elements, the fresh weight of plant biomass is also influenced by several external and internal factors of the plant. Based on the results of the analysis of variance, the NPK fertilizer treatment did not significantly affect the parameters of root dry weight and crown dry weight. The dry weight of a plant is the accumulation of organic compounds synthesized by plants from inorganic compounds, especially water and carbon dioxide (Putra et al., 2020).

CONCLUSSION

In conclusion, the application of NPK 16:16:16 fertilizer significantly improved the growth and yield of Gada F1 red chili compared to no fertilizer. The P3 treatment, with a dose of 7.5 g per polybag, consistently produced the best results across most parameters. Further research is needed to determine whether higher doses of NPK fertilizer can enhance outcomes even further.

ACKNOWLEDGEMENTS

This research was funded by the Research and Public Service Institute (LPPM) at Universitas Sriwijaya under the Competitive Research Scheme in 2022.

REFERENCES

Amanda, A. P., Mulyana, M. A., & Wahyuningtyas, A. (2023). Effect of NPK dose (16:16:16) on growth and yield of cayenne chili (*Capsicum frutescens* L.) in Tasikmalaya. *Jurnal Biologi Tropis*, *23*(4), 233–237. https://doi.org/10.29303/jbt.v23i4.5561

Amartiya, S. S., & Gofar, N. (2023). Percentage of flower and fruit fall, and red chili production in ultisol applied biostimulants and inorganic fertilizers. *Jurnal Lahan Suboptimal : Journal of Suboptimal Lands*, *12*(2), 184–194. https://doi.org/10.36706/jlso.12.2.2023.639

Arthanawa, I. G. N., Astika, I. N., Darmawan, I. K., Yana, D. P. S., Situmeang, Y. P., & n Sudita, I. D. N. (2022). The effects of organic and inorganic fertilizers on red chili plants. *SEAS* (*Sustainable Environment Agricultural Science*), *6*(1), 70–80. https://doi.org/10.22225/seas.6.1.5104.70-80

Castillo-Téllez, M., Pilatowsky-Figueroa, I., López-Vidaña, E. C., Sarracino-Martínez, O., & Hernández-Galvez, G. (2017). Dehydration of the red chilli (*Capsicum annuum* L., costeño) using an indirect-type forced convection solar dryer. *Applied*

Thermal Engineering, *114*, 1137–1144.

Cendana, U. N., Sumiyati, S., Cendana, U. N., Lion, T., Cendana, U. N., Nubatonis, R., Cendana, U. N., & Dose, C. M. (2021). The effect of chicken and cow manure dose combination on the growth and production of red chili (*Capsicum annum* L.). *Journal of Biological Science and Education*, *3*(2), 53–58. https://doi.org/10.31327/jbse.v3i2.1574dc

Constantia, J., & Ferniah, R. S. (2020). Vegetative growth of rainbow chili (*Capsicum annuum* L.) in the treatment of PGPR (Plant Growth Promoting Rhizobacteria), PGPR-NPK fertilizer, and pgpr-compost combination. *Journal of Agricultural Science* (*Agric*), *32*(2), 95–104. https://doi.org/10.24246/agric.2020.v32.i2.p95-104

Dias, S. A. C., Fonseca, J. G., & Ramadhan, D. (2023). The effect of vermicompost fertilizer and mutiara NPK 16:16:16 on the Growth and production of pakcoy plant (*Brassica Rapa* L.). *Journal of Geoscience, Engineering, Environment, and Technology*, *8*(2), 148–157. https://doi.org/10.25299/jgeet.2023.8.2.14493

Dubey, A. K., Singh, D., Rajput, P. S., Kumar, Y., Verma, A. K., & Chandraker, S. K. (2017). Effect of NPK on plant growth, yield and quality of capsicum (*Capsicum annum* L.) C.V. Swarna Under Shade Net Condition. *International Journal of Current Microbiology and Applied Sciences*, *6*(3), 1085–1091. https://doi.org/10.20546/ijcmas.2017.603.125

Ferniah, R. S., Pujiyanto, S., & Kusumaningrum, H. P. (2018). Indonesian red chilli (*Capsicum annuum* L.) capsaicin and its correlation with their responses to pathogenic Fusarium oxysporum. *NICHE Journal of Tropical Biology*, *1*(2), 7–12. https://doi.org/10.14710/niche.1.2.7-12

Fidiyawati, E., Setyorini, D., Sa'Adah, S. Z., Prayitno, A., & Istiqomah, N. (2021). The effect of the consentration of macro-nutrient-liquid-foliar- NPK and dosage of NPK 15-5-15 fertilizer to improve the quality of red chilies (*Capsicum annum* L.). *IOP Conference Series: Earth and Environmental Science*, *759*(1),1–2. https://doi.org/10.1088/1755-1315/759/1/012039

Gofar, N., Nur, T. P., Amartiya, S., Haryono, A., Pujiati, & Utami, H. A. (2023). Application of liquid organic pusri fertilizer (LOPF) and inorganic fertilizer on ultisols planted with red chili (*Capsicum annuum* L.). *IOP Conference Series: Earth and Environmental Science*, *1162*(1), 1–11. https://doi.org/10.1088/1755-1315/1162/1/012001

Handayati, W., Baswarsiati, Handoko, & Sihombing, D. (2021). Study on improvement of red chili pepper (*Capsicum annuum* L.) cultivation technology. *IOP Conference Series: Earth and Environmental Science*, *672*(1), 1–2. https://doi.org/10.1088/1755-1315/672/1/012013

Herison, C., Rustikawati, R., Hasanudin, H., Suharjo, U. K. J., Handajaningsih, M., & Nursalim, N. (2020). Manually feed NPK fertigation improves growth and yield of chili pepper hybrids in ultisol. *Akta Agrosia*, *23*(1), 19–26. https://doi.org/10.31186/aa.23.1.19-26

Honin, M. C., & Bako, D. (2022). The Effectiveness of sargassum sp as liquid organic fertilizer in increasing the growth of red chillies. *Indonesian Journal of Science and Education*, *6*(1), 1–7.

Ichwan, B., Eliyanti, E., Irianto, I., & Zulkarnain, Z. (2022). Combining humic acid with NPK fertilizer improved growth and yield of chili pepper in dry season. *Advances in Horticultural Science*, *36*(4), 275–281. https://doi.org/10.36253/ahsc12816

Iqbal, S., Inam, A., Inam, A., Ashfaque, F., & Sahay, S. (2017). Potassium and waste water interaction in the regulation of photosynthetic capacity, ascorbic acid and capsaicin in chilli (*Capsicum annuum* L.) plant. *Agricultural Water Management*, *184*, 201–210.

Jasmi, Afrillah, M., & Nasution, A. (2023). Effect of refugia plants on whitefly population and red chili (*Capsicum Annuum* L.) production. *Sabrao Journal of Breeding and Genetics*, *55*(5), 1703–1712. https://doi.org/10.54910/sabrao2023.55.5.22

Kim, S. cheol, Ko, B. G., Park, S. J., Kim, M. S., Kim, S. H., & Lee, C. H. (2018). Estimation of optimum organic fertilizer application under fertilizer recommendation system. *Korean Journal of Soil Science and Fertilizer*, *51*(3), 296–305. https://doi.org/10.7745/kjssf.2018.51.3.296e

Kim, S. H., Park, S. J., Shim, J. H., Seo, H. Bin, Lim, J. E., Lee, Y. H., Hwang, H. Y., & Kim, M. S. (2020). Effects of different organic fertilizers and fertilization method on red pepper growth and soil chemical properties. *Korean Journal of Soil Science and Fertilizer*, *53*(2), 110–117. https://doi.org/10.7745/kjssf.2020.53.2.110

Leyna, Z. (2019). The effect of TKKS compost, rice straw and NPK fertilizer on the growth and production of chili plants (*Capsicum annuum* L.). *Jurnal Hortikultura Indonesia*, *10*(April), 20–26.

Maftu'Ah, E., Susilawati, A., & Hayati, A. (2019). Effectiveness of ameliorant and fertilizer on improving soil fertility, growth and yields of red chili in degraded peatland. *IOP Conference Series: Earth and Environmental Science*, *393*(1),1–2. https://doi.org/10.1088/17551315/393/1/012011

Markus, R. J. B., Atman, Sahara, D., Indrasti, R., Idaryani, Mustaha, M. A., Fadwiwati, A. Y., & Yapanto, L. M. (2021). Increasing fruit yields and income of red chili farming by using chemical and biological fertilizers in rainfed rice fields. *Academy of Strategic Management Journal*, *20*(SpecialIssue2), 1–10.

Moneruzzaman, K. M., Rohani, F., Dalorima, T., & Mat, N. (2017). Effects of different organic fertilizers on growth, yield and quality of *Capsicum Annuum* L. Var. Kulai (Red Chilli Kulai). *Biosciences, Biotechnology Research Asia*, *14*(1), 185–192. https://doi.org/10.13005/bbra/2434

Nimatu, H. M., Nyarko, G., & Dawuda, M. M. (2022). Preliminary study on the Effect of NPK (15-15-15) fertilizer and plastic mulch on growth and yield of three chili cultivars grown in field and pot conditions. *Ghana Journal of Science, Technology and Development*, *8*(2), 131–146.

Priyadi, R., Juhaeni, A. H., Meylani, V., & Fudholi, A. (2022). The development of inorganic fertilizer and bio-fertilizer combination and the effectiveness of application on the growth and production of red chili. *International Journal of Design and Nature and Ecodynamics*, *17*(1), 87–93. https://doi.org/10.18280/ijdne.170111

Pujar, U. U. (2017). Analysis of genetic divergence in chilli (*Capsicum annuum* L.) genotypes. *International Journal of Pure & Applied Bioscience*, *5*(5), 503–508. https://doi.org/10.18782/2320-7051.5877

Putra, S. S., Putra, E. T. S., & Widada, J. (2020). The effects of types of manure and mycorrhizal applications on sandy soils on the growth and yield of curly red chili (*Capsicum annum* L.). *Caraka Tani: Journal of Sustainable Agriculture*, *35*(2), 258–267. https://doi.org/10.20961/carakatani.v35i2.34971

Rofanno, D., Assan, S., Situmeang, Y. P., Suarta, M., & Program, A. S. (2023). Optimizing cayenne pepper growth through liquid organic fertilizer and NPK fertilizer application. *Agriwar journal*. *3*(2), 80–87.

Rosadi, F. N., & Andraini, H. (2021). The effect of organic fertilizer types and phosphate fertilizer dosage on growth and yield of chili (*Capsicum Annum* L.) lotanbar variety. *JERAMI Indonesian Journal of Crop Science*, *3*(2), 45–49. https://doi.org/10.25077/jijcs.3.2.45-49.2021

Saragih, B. W. M., Setyowati, N., Prasetyo, Nurjanah, U. (2019). Land optimization in sweet corn intercropping system. *Jurnal*

Agroqua, *17*(2), 115–125. https://doi.org/10.32663/ja.v17i2.831

Solichatun, S., Putri, T., & Mudyantini, W. (2022). Effect of seed priming using KCL on the growth and proline accumulation of paprika (*Capsicum annuum*) growing at different water availability. *Asian Journal of Tropical Biotechnology*, *19*(1), 1–6. https://doi.org/10.13057/biotek/c190101

Sopialena, S., Sila, S., Rosfiansyah, R., & Nurdiana, J. (2018). The role of neem leaves as organic pesticides in chili pepper (*Capsicum frutescens*). *Nusantara Bioscience*, *10*(4), 246–250. https://doi.org/10.13057/nusbiosci/n100408

Suddin, A. F., Maintang, Asri, M., Wahditiya, A. A., Rauf, A. W., & Syam, A. (2021). The growth response and shallot production on some dosage of npk nitrate compound fertilizer 16-16-16. *IOP Conference Series: Earth and Environmental Science*, *911*(1),1–2. https://doi.org/10.1088/1755-1315/911/1/012048

Umami, N., Abdiyansah, A., & Agus, A. (2019). Effects of different doses of NPK fertilization on growth and productivity of Cichorium intybus. *IOP Conference Series: Earth and Environmental Science*, *387*(1),1–2. https://doi.org/10.1088/1755-1315/387/1/012097

Wahyudi, M., Sepriani, Y., Ainy Dalimunthe, B., & Hariyati Adam, D. (2022). The effect of NPK 16 16 16 fertilizer and time of application on the growth of red chili plants in afdeling 2 plantation, West Bilah District, Labuhanbatu Regency. *International Journal of Science and Environment* (*IJSE*), *2*(2), 79–84. https://doi.org/10.51601/ijse.v2i2.26