❏   52

Effect of Using Rice Husk Ash on the Growth of Chili (Capsicum annuum L.)

Okta Septi Hariani
Fakultas Tarbiyah dan Keguruan Institut Agama Islam Negeri Raden Fatah Palembang, Indonesia

Article Info	ABSTRACT
	Big chili (Capsicum annuum L.) is one of the vegetables that the request is high enough. One of the way to increase the production and quality of chili crops is by using a fertilizer that aims in increasing the supplay of nutrients needed by plants, that is by using the rice husk ash of waste factory beside giving the benefit of many biomass it also easy to be gotten. The objectives of this study were to know the influence of the use of rice husk ash for the plant of big chili plant with diffrent quality, and to know which one of the best for the plant to produce big chili with high quality. This research was conducted at MIPA Laboratory of Tarbiyah Faculty, IAIN Raden Fatah Palembang. The research used completely randomized design with 4 treatments and 3 replications, so we got 12 units of the experiment. The treatment were P0=0 gram/polybag, P1=24 gram/polybag, P2=48 gram/polybag, and P3=72 gram/polybag. The result of this research showed that giving 24 gram of rice husk ash got the average plant height 22,67 cm, the total stalks were 13,33, the age when the first flowering day was 50 days, and the total chili were 3,33. The treatment of 48 gram got the average plant height 27,17 cm, the total stalks were 21,33, the age when the first flowering day were 55,67 days and the total chili were 8,67. The treatment of 72 gram got the average plant height 33,33 cm, the total stalks were 35,33, the age when the first flowering day were 44,33 days and the total chili were 22. From the result of the research it can be conclude that the level of 72 gram/polybag give the best result for the growing of chili plant compared with another treatments. *This is an open access article under the CC BY-NC license.*

Corresponding Author:

Okta Septi Hariani
Fakultas Tarbiyah dan Keguruan Institut Agama Islam Negeri Raden Fatah Palembang, Indonesia
Jl. Prof. K. H. Zainal Abidin Fikri No.KM. 3, RW.5, Pahlawan, Kec. Kemuning, Kota Palembang, Sumatera Selatan 30126
Email: oktasepti@gmail.com

1.   INTRODUCTION

According to the Central Bureau of Statistics (2011) in line with the development of the population in the country of Indonesia, it is an obligation for us to immediately develop a strategy to provide the necessities of life for the community. To determine the types of food crops to be developed, consideration must first be given to the nutritional content, ease of cultivation and suitability for the general economic conditions of the community.

Winarno (2017)stated that one of the commodities that is popular and often cultivated by Indonesian people is chili. Chili is one of the leading national commodities and a source of vitamin C. According to(Muhamad Gratitude et al., 2012)The chili planting area is also wide because it can be cultivated in the lowlands and highlands, and can also be planted in narrow areas such as

yards. Currently, there are many hybrid chili seeds on the market with various varietal names with various advantages they have. In this experiment the researchers used a type of large red chili (Capsicum annuum L.), the choice of this type of commodity was because the demand for this type of chili was very large in the market, the price of large chili tends to be more stable, it can be harvested in stages, the maintenance of large chili is relatively easy .

Red chili (Capsicum annuum L.) is one of the vegetables whose demand is quite high, both for the domestic market and for export to foreign countries, such as Malaysia and Singapore (Sembiring, 2009).

(Salisbury & Ross, 1991)stated that chili plants need more K than Ca, therefore, the supply of K needs to be increased. The concentration range of K in the soil is 0.1-4% as K_2O and 0.2-10% in plant tissue(Santoso et al., 1985). Nitrogen fertilization using high yielding superior varieties and good irrigation management are the main factors in increasing the yield to be achieved. If it is not accompanied by sufficiently efficient potassium, nitrogen and phosphorus will be low and high production cannot be achieved (Suwahyono, 2017).

Fertilization as a part of agricultural intensification is a business that aims to increase the supply of nutrients needed by plants to increase production and quality of crop products. Along with the current development of agriculture towards sustainable agriculture, one alternative is the use of organic and inorganic materials as a source of nutrients to increase the growth and yield of chilies. Recently, the use of agricultural or urban waste has begun to be chosen and paid attention to as a source of organic matter, because in addition to producing a lot of biomass it is also easy to obtain. Rice husk ash agricultural waste is a fibrous material containing cellulose, lignin, hemicellulose, and if it is burned it can produce ash with a high silica content of 87% -97%, and contains nutrients N 1% and K 2% (Kiswondo, 2011).

According to (Martanto, 2001)Giving husk ash to chilies has a significant effect on the growth rate of plant height and suppresses pest attacks. The role of potassium in husk ash strengthens the plant body so that leaves and flowers do not fall, regulates transpiration respiration, enzyme work and maintains osmotic potential and water uptake stimulates the formation of root hairs, hardens plant stems while stimulating seed formation, while the role of silicon as a growth promoter for several gramineae plants especially at optimal concentrations or doses.

2. METHOD

2.1 Time and place

This research was conducted for 3 months starting from November to January with the research location in the MIPA laboratory area of the Tarbiyah and Teacher Training Faculty of IAIN Raden Fatah Palembang.

2.2 Tools and materials

The tools used in this study were: polybags, plant sprinklers, shovels, tape measure, calculators, digital balances, PH meters, hygro-thermometers, knives, table paper and stationery. The materials used in this study were: chili seeds, rice husk ash, soil (ultisol soil type), and water.

2.3 Research methods

This study was included in the type of experimental research, using a completely randomized design (CRD) with 4 treatments and 3 replications, the treatment in this experiment was a single factor. The dose of rice husk ash needed is as follows: (Norhasanah, 2012) P0 = 0 t. ha-1 is equivalent to 0 gr/polybag P1 = 6 t. ha-1 is equivalent to 24 gr/polybag P2 = 12 t. ha-1 is equivalent to 48 gr/polybag P3 = 18 t. ha-1 is equivalent to 72 gr/polybag. To determine the number of treatment plots (by placing polybags) it was carried out by randomization where there were several patterns, namely using random number tables, using cards or by drawing lots (Gomez and Gomez, 1995). If the effect of the treatment is significantly different on variance, then a follow-up test is carried out with Duncan's multiple range test.

2.4 Research Implementation

2.4.1   Stage of Making Planting Media

The soil used for planting was ultisol type soil mixed with rice husk ash as an organic fertilizer evenly according to the research design; Put soil into polybags as much as 7 kilograms for each polybag; The soil that has been mixed evenly is sprinkled with water to balance the physical, biological and chemical conditions of planting so that it does not poison the plants when planting seeds.

2.4.2　Stage of Transfer of Plant Seeds

Seedlings are transferred into polybags when the condition of the seedlings has true leaves 4 - 6 pieces; Before planting the seeds, flush the planting medium with clean water, also do this for the planting medium for the seeds in the nursery; Carefully plant the seeds in the planting holes in the polybags. Backfill with a little compacting the planting medium around the base of the plant; After the seeds are moved, flush the planting medium with clean water regularly.

2.4.3　Stages of Maintenance of Large Chili Plants

Watering, carried out every day in the morning and evening (according to the weather); Weeding, weeding is usually done by pulling it out; Pest control, in this case done manually; The stakes are installed when the plants are 3-7 days old after transplanting.

2.4.4　Observation Stage

Observations were made every week until the end of the study, when the plants were transferred to polybags. Parameters observed were plant height, number of branches planted, age of plants at first flowering and number of fruit planted; Stem height is measured in cm, the distance from the base of the plant to the tip of the highest shoot; The number of planting branches was counted at the end of the observation manually; The age of the plant at first flowering was calculated from the first day it was transplanted until the first flower appeared on the plant; The number of fruits planted was counted at the end of the manual planting observation.

2.5　Data analysis.

The data obtained was tested statistically using the F test ANOVA (5%) to see the difference in effect between treatments. If there is an effect between treatments, continue with Duncan's test at the 5% level. Correlation test is used to determine the relationship between parameters.

3.　RESULTS AND DISCUSSION

3.1　Research results

Based on research that has been done on the effect of using rice husk ash on the growth and development of large chili plants, the following results can be obtained:

3.1.1　Plant height

Data on the results of research on the height of large chili plants based on treatment and repetition of observations made at 1-11 weeks after planting (MST) can be seen from table 1.

Table 1. Average Plant Height 1-11 Weeks After Planting (MST) on Various Treatments of Rice Husk Ash.

Treatment	Average Plant Height (cm)					
	1 MST	3 MST	5 MST	7 P.S	9 P.S	11 WST
Po	5.3c	6.8c	8.2d	11.83d	16.33d	19cd
P1	6.7b	7.8bc	14.3ab	21.5ab	22.5bc	22.67bc
P2	6.7b	8.2ab	11.2c	16c	23.17b	27.17ab
P3	7.3a	9a	15a	24.33a	31.17a	33.33a

Note: Numbers followed by the same lowercase letters in the same column are not significantly different at the 5% Duncan test level.

From the results of the research in table 1, the use of rice husk ash gives a fairly varied plant height. Based on the results of variance, the use of rice husk ash did not have a significant effect on the growth of plant height in large chili plants.

3.1.2　Number of Planting Branches.

Data from the research on the number of large chili planting branches at the end of the observation can be seen in table 2.

Table 2. Average Number of Planting Branches in Various Treatments of Rice Husk Ash

Treatment	Average Number of Planting Branches
Po	11c
P1	13.33c
P2	21.33b
P3	35.33a

Note: The numbers followed by the same lowercase letters show no significant difference at the 5% Duncan test level

Based on the results of variance, the use of rice husk ash had a significant effect on the number of planting branches on large chili plants.

3.1.3   Age of Plants at First Flowering

Data from the research on the age of the plants at the first flowering of large chilies at the end of the observation can be seen in table 3.

Table 3. Average Age of Plants at First Flowering in Various Treatments of Rice Husk Ash

Treatment	Average Age at First Flowering (Days)
Po	61,33c
P1	55,67bc
P2	50ab
P3	44.33a

Note: The numbers followed by the same lowercase letters show no significant difference at the 5% Duncan test level

Based on the results of the test of variance, the use of rice husk ash had a significant effect on the age of the plants at first flowering in large chili plants.

3.1.4   Number of Fruits Planted

Data from the research on the number of large chili plants at the end of the observation can be seen in table 4.

Table 4. Average Number of Fruits Planted in Various Treatments of Rice Husk Ash

Treatment	Average Number of Fruits Planted
Po	3c
P1	3.33c
P2	8,67b
P3	22a

Note: The numbers followed by the same lowercase letters show no significant difference at the 5% Duncan test level

Based on the results of the test of variance, the use of rice husk ash had a significant effect on the number of fruits planted in large chili plants.

3.2   Discussion

From the observational data and the results of statistical analysis, the results obtained were that the rice husk ash treatment had a significant effect on the number of planting branches and the number of fruit trees, while the parameters of plant height (cm) and the age of the plant at first flowering (days) had no significant effect. The plant height parameter (cm) showed no significant difference. We can see that the calculated F value is 1.74 which is smaller than the 5% table F value of 4.07. We can see that the parameter of the number of planting branches is that the calculated F value is 6.35, which is greater than the F table value of 5%, 4.07. This indicates that the treatment is significantly different. We can see the age of the plant at the first flowering that the calculated F value is 1.31 which is less than the F table 5% value of 4.07, this indicates that the treatment was not significantly different. We can see from the parameter number of fruit plants that the calculated F value is 7.09, which is greater than the F table value of 5%, 4.07. This indicates that the treatment is significantly different. In accordance with the(Hanafiah, 2012)which states that if the F count is greater than the F table 5% then there is a real difference in the treatment.

From the final results of observations on the parameters of the height of large chili plants, there was no significant effect on the ANOVA analysis, but there were significant differences between the treatments. The highest plant height was found in the P3 treatment, which was 33.33 cm, followed by P2, which was 27.17 cm, P1, which was 22.17 cm, and P0, which was 19 cm. Based on these results indicate that rice husk ash can increase the number of nutrients needed to increase the growth of chili plants. Kiswondo (2011) said that rice husk ash can increase pH and increase a number of important nutrients such as potassium, magnesium, calcium, nitrogen, phosphorus, and silica which are quite high in the soil. According to(Lakitan, 1993), suggested that the nutrient that influences the growth and development of leaves, stems, branches and roots is Nitrogen (N). High Nitrogen concentrations produce larger and more numerous leaves. Because stored nitrogen is an element that plays an important role in protoplasm and helps form leaves and stems in red chili plants, then in each treatment the highest level of nitrogen content can obtain optimal growth.(Aseptyo & Asngad, 2013).

The application of rice husk ash had a significant effect on the parameter of the number of planting branches. From the results of the ANOVA analysis, the calculated F was greater than the F table, 5%. The highest number of plant branches was in the P3 treatment, which was 35.33, followed by P2, which was 21.33, P1, which was 13.33, and P0, which was 11 branches. The number of branches on chili plants will affect the number of leaves and the number of fruits on the

plant. Giving rice husk ash affects the vegetative growth of chili plants. It is suspected that the silica content in rice husk ash can increase the availability of nutrients needed by plants. According to(Astutik et al., 2019)that potassium in plants functions to accelerate the growth of meristematic tissue. By increasing the amount of potassium absorbed by plants, the growth of meristem tissue will also be more active and more branches will be produced.(Ulimaz et al., 2022)added that the element K is also an assistant organizer of plant photosynthesis. In the process of photosynthesis will produce carbohydrates, proteins and other organic compounds, the ongoing division and elongation of plant cells will spur growth on the shoots of plant shoots and will eventually encourage the addition of plant height.

In observing the age of the plants at first flowering, there was no significant effect on the analysis of variance, but there were differences between the treatments. The fastest age of the plants at first flowering was P3, which was 44.33, followed by P2, which was 50, P1, which was 55.67, and P0, which was 61. .33 days. The application of husk ash had an effect on the early age of flowering plants faster than the treatment of plants without rice husk ash, the faster flowering treatment was in the P3 and P2 treatments, but in the P2 treatment the flowers fell and did not become fruit like the P3 treatment, this was thought to be a lack of availability of P and K nutrients so that the flowers fall easily. According to(Lingga, 2001)states that, element P is needed for plants to increase generative growth (flowers and fruit) so that a deficiency of element P can cause plant production to decrease. Kiswondo (2011) added that, the role of potassium in rice husk ash strengthens the plant body so that leaves and flowers do not fall, and maintains osmotic potential and water uptake stimulates the formation of root hairs, stimulates plant stems while stimulating seed formation.

While the observation of the number of fruit plantations had a significant effect on the analysis of variance, the results of the highest number of fruit plantations were in the P3 treatment, namely 22 fruit, followed by P2, namely 8.67 fruit, P1, which was 3.33 fruit, and P0 3 fruit. The application of rice husk ash showed a significant effect on fruit crops compared to the treatment without husk ash. In the P0 and P1 treatments it was seen that several plants were attacked by pests and diseases, the leaves became curled and the fruit became rotten. Even though it doesn't damage the entire chili plant, it can interfere with its growth. This is because in the P0 and P1 treatments the plants lacked nutrients which made the plants susceptible to disease. According to(Makarim et al., 2007)that the element P plays a role in accelerating the formation of fruit, flowers and seeds, improving plant quality and increasing disease resistance.(Purwanto, 2012)stated that silica (Si) is a non-essential element for plants so that its role has received less attention. Si plays a role in increasing photosynthesis and plant resistance to biotic (pest and disease) and abiotic (drought, salinity, alkalinity, and extreme weather) stresses.

From the results of observations, the best application of rice husk ash on ultisol soil was in treatment P2 (48 g/polybag) for parameters of plant height and age at first flowering, while P3 (72 g/polybag) for parameters of the number of branches planted and the number of fruits on plants, because in the P2 and P3 treatments the provision of rice husk ash can meet the nutrient needs needed in large chili plants. According to(Setyawati et al., 2013)said that the growth of hybrid chilies really needs nutrients in the form of nitrogen (N) ± 0.02%, phosphorus (P) 16-25 ppm (Bray I) and potassium (K) 5-24 ppm. The nutrients in the chili plants can be fulfilled by providing rice husk ash, as the researchers did in the P2 and P3 treatments, that rice husk ash contains a high enough silica of 87% -97%, and contains nutrients N 1% and K 2% so that can meet the nutrients needed for the growth and yield of large chili plants.

4. CONCLUSION

The addition of rice husk ash content had a significant effect on the number of branches planted and the number of fruits planted, but had no significant effect on plant height and age at first flowering. From the research results, it was found that giving rice husk ash content of 48 g/polybag was a good concentration to increase the parameters of plant height and age at first flowering. Meanwhile, rice husk ash content of 72 gr/polybag is a good content for increasing the parameters of the number of planting branches and the number of fruits on large chili plants.

ACKNOWLEDGEMENTS

REFERENCES

Aseptyo, F. R., & Asngad, A. (2013). Pemanfaatan Ampas Tebu dan Ampas Teh Sebagai Media Tanam Terhadap Pertumbuhan Tanaman Cabai Merah Keriting (Capsicum annum L.) Ditinjau dari Intensitas Penyiraman Air Teh. Universitas Muhammadiyah Surakarta.

Astutik, D., Suryaningndari, D., & Raranda, U. (2019). Hubungan pupuk kalium dan kebutuhan air terhadap sifat fisiologis, sistem perakaran dan biomassa tanaman jagung (Zea mays). Jurnal Citra Widya Edukasi, 11(1), 67–76.

Hanafiah, K. A. (2012). Rancangan percobaan teori dan aplikasi edisi ketiga. PT Raja Grafindo Persada, Jakarta, 260.

Kiswondo, S. (2011). Penggunaan abu sekam dan pupuk ZA terhadap pertumbuhan dan hasil tanaman tomat (Lycopersicum esculentum Mill.). Jurnal Embryo, 8(1), 9–17.

Lakitan, B. (1993). Dasar-Dasar Fisiologi. Raja Grafindo Persada, Jakarta. Hal, 43–52.

Lingga, P. (2001). Petunjuk penggunaan pupuk. Niaga Swadaya.

Makarim, A. K., Suhartatik, E., & Kartohardjono, A. (2007). Silikon: hara penting pada sistem produksi padi.

Martanto, E. A. (2001). Pengaruh abu sekam terhadap pertumbuhan tanaman dan intensitas penyakit layu fusarium pada tomat. Irian Jaya Agro, 8(2), 37–40.

Muhamad Syukur, S. P., Rahmi Yunianti, S. P., & Rahmansyah Dermawan, S. P. (2012). Sukses Panen Cabai Tiap Hari. Penebar Swadaya Grup.

Purwanto, J. (2012). Pengaruh media tanam arang sekam dan batang pakis terhadap pertumbuhan cabai merah keriting (capsicum annum l.) ditinjau dari intensitas penyiraman air kelapa. Universitas Muhammadiyah Surakarta.

Salisbury, F. B., & Ross, C. W. (1991). Hormone and growth regulators: Cytokinins, ethylene and abscisic acid. SALISBURY, F. B; ROSS, CW Plant Physiology. Belmont: Wadswort, 258–271.

Santoso, T., Roelandt, J., Mansyoer, H., Abdurahman, N., Meltzer, R. S., & Hugenholtz, P. G. (1985). Myocardial perfusion imaging in humans by contrast echocardiography using polygelin colloid solution. Journal of the American College of Cardiology, 6(3), 612–620.

Sembiring, N. N. (2009). Pengaruh Jenis Bahan Pengemas terhadap Kualitas Produk Cabai Merah (Capsicum annuum L.) Segar Kemasan Selama Penyimpanan Dingin. Universitas Sumatera Utara.

Setyawati, T. R., Linda, R., & Erpina, I. (2013). Pertumbuhan cabai hibrida (Capsicum annuum L.) pada kombinasi tanah pmk dengan kompos limbah TKKS. Jurnal Protobiont, 2(2), 19–25.

Suwahyono, U. (2017). Panduan penggunaan pupuk organik. Penebar Swadaya.

Ulimaz, A., Vertygo, S., Mulyani, Y. W. T., Suriani, H., Hariyanto, B., Muliana, G. H., & Azmi, Y. (2022). Anatomi Tumbuhan. Global Eksekutif Teknologi.

Winarno, F. G. (2017). Cabai: Potensi Pengembangan Agrobisnis & Agroindustri. Gramedia Pustaka Utama.