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Effect of Organic Fertilizer Doses of Coal And Mutiara NPK on The Growth of Grafting Yields of Pomelo Seedlings (*Citrus grandis* L. Osbeck)

Ni Komang Ayu Aryawati Dewi[1*], Made Sri Yuliartini[1], Ida Bagus Komang Mahardika[1]

[1] Faculty of Agriculture, Warmadewa University, Indonesia
*Corresponding author. Email: ayuaryawati2@gmail.com

Abstract

This study aims to determine the effect of giving a dose of organic coal fertilizer and NPK fertilizer on the growth of grafting seedlings of pomelo varieties. This research is an experiment on polybag planting media conducted at UPT. Balai Benih Tanaman Pangan dan Hortikultura of Bali Province from February to July 2022. This study was arranged based on a Completely Randomized Block Design (RCBD) with 2 factors arranged in a factorial manner. The first factor is the dose of coal organic fertilizer (B) consisting of 4 levels: B0: 0 gr/polybag, B1: 71 gr/polybag, B2: 142 gr/polybag, B3: 213 gr/polybag. The second factor was the dose of NPK (N) consisting of 4 levels: N0:0 g/polybag, N1: 18.75 g/polybag, N2:37.5 g/polybag, N3:56.25 g/polybag. Thus, there were 16 treatment combinations, each of which was repeated 3 times to obtain 48 polybags. The results of statistical analysis showed that the interaction (B×N) and coal fertilizer (B) was significantly different (P≥0.05) on all observed variables. The application of NPK (N) fertilizer had a very significant effect (P <0.01) on rootstock cuttings (days) and significantly different (P≥0.05) on shoot growth variables (days), shoot cultation length (cm), bud grafting diameter (mm), number of leaves (strand), total leaf area (cm2). The fastest rootstock cuttings were obtained with a dose of NPK fertilizer of 37.5 g/polybag (N2) which was 6.67 days and the difference was not significant at a dose of 18.75 g/polybag (N1) which was 7.42 days.

Keywords : dose, coal fertilizer, npk fertilizer, grafting, pomelo

1. Introduction

Orange is one of the horticultural commodities that has agribusiness prospects that can improve the welfare of citrus farmers in Indonesia. One type of cultivated orange is the Pomelo (*Citrus grandis L. Osbeck*). The production of pomelo fruit in Bali in 2019 reached 1 019.00 tons but in 2021 the production decreased to 981.00 tons [1]. The opportunities for the development of this pomelo are quite good, because pomelo is beginning to be in great demand among consumers. Market demand from both local and export markets requires certain qualities such as uniform fruit sizes and fruits available throughout the year. To develop local fruits in Indonesia in order to compete with the international market, the government promoted agricultural development in the horticultural sector [2]. However, the potential of pomelo is still not supported by a commensurate improvement in the quality of production, so it is still very necessary to have guidance and the application of good cultivation technology and true. One of the factors that can support the success of horticultural agriculture is the availability of quality seeds that are free from systemic pat ogen (CVPD, CTV, CVEV, CPsV, CEVd). Commercially cultivated citrus plants generally use seeds derived from grafting [3]. Grafting is one way to improve plant quality by combining two plant properties through the attachment of entres or sticky eyes of certain varieties with rootstocks that have a strong root and are resistant to pests and diseases. The advantages of grafting include that plants have a strong root

and are resistant to diseases or pests, are drought resistant and obtain the same results as the mother plant.

Grafting is the process of linking between the scion/stick eye of a particular variety with the selected rootstock, the process of combining two different properties between the scion and the rootstock [4]. Grafting aims to combine the superior properties of each stem of the stem and scion [5]. The rootstocks used for grafting are local citrus types Japanese Citroen (JC) and Rough Lemon (RL). This rootstock is widely used in Indonesia because it has several advantages such as pest and disease resistance and has a strong root system. The scion which is commly called entres is a candidate for the scion that will be connected to the rotstock and is expected to produce fruit with superior quality. Because grafting is expected to produce one superior plant seed, the shoots to be used as scions mst be taken from the parent tree with known superior properties [6]. Fertilization in citrus nurseries is one of the important things to do becayse with fertiization can support good seed growth [7]

Organic fertilizer is the end result of changing or adjusting part of plant and animal debris. Organic fertilizers contain a variety of elements, characterized by the presence of nitrogen in the form of compounds so that they are easily absorbed by plants. One type of organic fertilizer that has an almost perfect nutrient content is coal fertilizer. This coal fertilizer is still classified as a new fertilizer that is not yet known by the wider community. Coal is a hydrocarbon material that is formed naturally from the rest of the plants and is generally used as an energy producer. In addition to being formed from organic compounds, coal also contains inorganic compounds, especially mineral elements derived from clay, quartz sand, limestone and so on [8]. Coal fertilizer has benefits for various crops, using coal fertilizer will increase crop production, both in terms of quantity and quality. Coal fertilizer can also improve soil structure so that soil fertility applied by coal fertilizer will increase from season to season . The general recommended dose of organic fertilizer for seedlings is around 20-30 tons/ha [9]. This organic fertilizer will not leave residual inorganic acid in the soil and has high levels of C-Organic compounds [10]. This C-organic value is what distinguishes it from organic fertilizers [11]. With the slower release of nitrogen into nitrates, the loss of fertilizer applied due to evaporation and washing is getting smaller, so that plants get more nitrogen opportunities. This means that humic acids can increase the efficiency of nitrogen fertilizers [12].

Fertilization can be done by applying organic fertilizers and chemical fertilizers such as applying Compound NPK fertilizer. Mutiara Fertilizer (16:16:16) an inorganic fertilizer compound with nutrins macro N, P and K each of 16% [13]. The advantage of using Compound NPK fertilizer is that it can be used by taking into account the nutrient content equal to a single fertilizer, if you don't get a single fertilizer, you can use Compound NPK fertilizer [14]. The results of the study Widowati et. al, 2017 resulted in the conclusion that in the compound fertilizer treatment NPK 15-15-15 with a content of 15-15-15 15g / polybag can give a result of 50% better growth of orange seedlings compared to other treatments.

The nutrient content contained in NPKfertilizer is very quickly absorbed by plants. This is because some of the nitrogenin the form of NO_3 (Nitrate) which has been available to plants and can help the absorption of potassium, magnesium, and calcium nutrients. It makes fertilizer can speed up the flowering process , fruitin and accelerating the growth of new shoots [15]. NPK fertilizer is generally useful in helping plant growth so that it can develop optimally, this is after research by Fiolita which states that applying NPK Mutiara fertilizer can increase plant growth and accelerate growth [16]. The potential of pomelo is still not supported by a commensurate increase in production quality, so it is still very necessary to cultivate and apply good and correct cultivation technology. Currently, the quality and production of oranges in general

is still low so that research is needed regarding good pomelo seedling in order to produce quality seeds.

2. Material and Methods

This research was carried out at UPT. Balai Benih Induk Tanaman Pangan dan Hortikultura of Bali Province with an altitude of 500 meters above sea level with a flat soil topography and clay soil texture. The study was conducted from February to July 2022. The tools used in this study were writing stationery, sprayer, PE plastic, grafting knife, bucket and scale. The materials used in this study include rootstocks of Orange seedlings of the *Japanese Citroen* (JC), entres of pomelo varieties, 5 kg size polybags, coal organic fertilizer and Mutiara NPK fertilizer.

This study used the Completely Randomized Block Design (RCBD) method with 2 factors arranged factorially. The first factor is the dose of coal organic fertilizer (B) which consists of 4 levels, namely: B_0: 0 g/polybag, B_1: 71 g/polybag, B_2: 142 /polybag, B_3: 213 g/polybag. The second factor is the dose of Mutiara NPK fertilizer (N) which consists of 4 levels, namely: N_0: 0 g / polybag, N_1: 18.75 g/polybag, N_2: 37.5 g/polybag, N_3: 56,25 g/polybag. Thus there are 16 combinations of treatments, each of which is repeated 3 times so that 48 polybags are obtained. Citrus seeds used as rootstocks in this study were citrus seedlings aged 6 months with uniform growth with a diameter of 10 mm. Variables observed in this study include shoot growth days (days) when shoots grow, grafting is the day or time required for bud break, rootstock cuttings (days) rootstock cut after 10 cm shoot length, grafting shoot length (cm) measurement carried out from the base of the shoot to the tip of the shoot and counted at the age of 6, 8, 10, and 12 weeks after grafting, grafting eye diameter (mm) was measured 1 cm from the base of the shoot and measurements were made at the age of 6, 8, 10, and 12 weeks after grafting. grafting, the number of leaves (sheets) the number of leaves that are counted are leaves that have a length of > 2 cm. The number of leaves was counted at the age of 6, 8, 10, and 12 weeks after grafting. and total leaf area (cm2), the total leaf area was calculated at the last week of the study. Measurements were made using the millimeter block method. The data from the observations were tabulated, then analyzed statically using a analysis of variance that was in accordance with the design used. If the treatment has a real effect, then the analysis continues to find a single influence of each factor with a 5% Least Significance Different (LSD) test.

3. Results and Discussion

Table 1.
The results of the soil analysis of the experimental site

No.	Types of Analysis	Value	Information
1.	pH (1 : 2.5)		
	- H_2O	7,1	Neutral
	- Kcl		
2.	Electrical Conductivity (mmhos/cm)	0,39	Very Low
3.	Organic C (%)	2,88	Currently
4.	N Total (%)	0,32	Currently
5.	Available P (ppm)	164,78	Very High
6.	Available K (ppm)	237,93	High
7.	Moisture Content (%)		
	- Dry Air	5,51	
	- Field Capacity	42,39	
8.	Texture (%)		
	- Sand	46,54	Clay
	- Dust	32,29	
	- Clay	21,17	

Source: Soil Science Laboratory, Faculty of Agriculture, Udayana University, Denpasar 2022 [17]

The results of statistical analysis of all variables observed in the study are presented in Table 2. signification of the effect of applying coal fertilizer (B) and Mutiara NPK fertilizer (N) and their interaction (B×N) against the observed variables as presented in Table 2.

Table 2.
Signification of the effect of applying coal fertilizer (B) and Mutiara NPK fertilizer (N) and their interaction (B×N) against the growth of pomelo seedlings from grafting.

No.	Variable	Treatment		
		(B)	(N)	(B×N)
1	Growing Grafting Shoots (days)	ns	ns	ns
2	Rootstock Cutting (days)	ns	**	ns
3	Grafting bud length (cm)	ns	ns	ns
4	Grafting bud diameter (mm)	ns	ns	ns
5	Number of Leaves (sheets)	ns	ns	ns
6	Total Leaf Area (cm^2)	ns	ns	ns

Description: ** = very significant effect (P<0,01)
ns = non significant (P≥0.05)

By Table. 2 shows the interaction of coal fertilizer with Mutiara NPK fertilizer (B×N); coal fertilizer (B) non significant (P≥0.05) against all observed variables. Mutiara NPK (N) fertilizer treatment has a very significant effect (P< 0.01) against rootstock cutting (days) and non significant (P≥0.05) against other treatments. The results obtained were non-significant because the soil used was good so that when given the treatment it did not show any influence from the application of fertilizers.

Table 3.
Average variable yields observed in the treatment of coal fertilizer (B), and Mutiara NPK fertilizer (N)

Treatment	Days of sprouting shoots (day)	Rootstock Cutting (day)	Shoot Length (cm)	The diameter of the stem of the grafting bud (mm)	Number of Leave (sheet)	Total Leaf Area (cm^2)
Coal fertilizer (B)						
B_0 (0 g/polybag)	8.75 a	8.33 a	28.55 a	4.54 a	10.92 a	250.07 a
B_1 (71g/polybag)	9.42 a	7.33 a	26.81 a	4.62 a	8.92 a	322.95 a
B_2 (142 g/polybag)	9.50 a	7.42 a	31.16 a	5.25 a	10.08 a	292.82 a
B_3 (213 g/polybag)	9.08 a	8.08 a	29.75 a	4.73 a	9.33 a	240.04 a
BNT 5%	-	-	-	-	-	-
Mutiara NPK Fertilizer (N)						
N_0 (0 g/poybag)	9.17 a	9.00 a	27.82 a	4.76 a	9.67 a	264.40 a
N_1 (18.75 g/polybag)	9.00 a	7.42 bc	31.26 a	4.85 a	9.83 a	318.83 a
N_2 (37.5 g/polybag)	9.17 a	6.67 c	28.91 a	4.84 a	10.58 a	282.59 a
N_3 (56,25 g/polybag)	9.42 a	8.08 ab	28.28 a	4.69 a	9.17 a	240.05 a
BNT 5%	-	1.31	-	-	-	-

Description: The average value followed by the same letter in the same treatment and column, different is not significantly at the level of the 5% LSD Test

Interaction of coal fertilizer with Mutiara NPK fertilizer (B×N); coal fertilizer (B) non significant (P≥0.05) against all observed variables. Mutiara NPK (N) fertilizer treatment has a very significant effect (P<0.01) against rootstock cutting (days) and non significant (P≥0.05) against other treatments.

The average rootstock cutting is the fastest obtained with a dose of Mutiara NPK fertilizer of 37.5 g/polybag (N_2) which is 6.67 days and has an intangible effect on a dose of 18.75 g/polybag (N_1) which is 7.42 days and the longest is obtained at a dose of 0 g/polybag (N_0) which is 9.00 days. Faster cutting of rootstocks will lead to higher lengths of grafting shoots. This can be seen in the average length of the

grafting shoots, which has a higher tendency in Mutiara NPK fertilizer. The average length of grafting shoots at npk mutiara fertilizer dose tends to be higher with a dose of 18.75 g/polybag, which is 31.26 cm which is an increase of 12.36% compared to the dose of NPK Mutiara fertilizer with a dose of fertilizer 0 g/polybag which is 27.82 cm. The influence on the length of grafting shoots is caused because NPK fertilizer is able to provide nitrogen nutrients in sufficient quantities and is available in meeting the needs of plant nutrients in the vegetative period. That the elements N, P and K have their respective functions that are equally important for plant growth both in the vegetative phase and during the generative phase [18]

Coal fertilizer treatment on variables of the highest average cendereng bud length was obtained at a dose of 142 g/polybag (B_2) which was 31.16 cm, an increase of 16.22% compared to the average length of the lowest grafting shoots at a dose of 71 g/polybag (B_1) namely 26.81 cm. Plants applied with coal fertilizer have a greater growth in the stem diameter of the grafting bud (mm), a larger number of leaves (sheets) and a larger total leaf area (cm^2), namely 5.25 mm, 10.92 sheets, and 322.95 cm^2 but differed unreally in the growth of plants applied with Mutiara NPK fertilizer. This is thought to be caused because in addition to improving the soil structure, organic fertilizers also improve the physical properties of the soil, so that the soil becomes loose. Stated that organic fertilizers increase the availability of N, P and K nutrients and improve soil structure [19]. This is related to the results of the analysis of organic fertilizers where the N content is low, namely 0.84% [20].Nutrients N, P and K are the nutrients that are most absorbed by plants, so that if there is an element that day it will cause a decrease in growth activity and crop production. According to Wijaya (2008), nitrogen promotes the growth of organs related to photosynthesis, namely leaves [21]. Added that nitrogen is the main nutrient for plant growth because it is a constituent of all proteins and nucleic acids, and thus is a constituent of the protoplasm as a whole [22]. According to Lakitan at the beginning of plant growth, the nutrient content has not been absorbed by plants, besides that in the vegetative growth phase of plants it is influenced by the genetic properties of the plant itself so that influences from outside plant factors do not have much effect on plant height [23]. According to Agustina that the availability of nutrients in sufficient and balanced quantities is the main factor that largely determines the success of plant growth and production [24]. Added by Lakitan if the nutrient needs of plants are met, plants will be more optimal in utilizing sunlight and water in carrying out metabolic processes in tissues, namely in improving the process of photosynthesis so as to increase photosynthetic which is useful for helping cell division and enlargement so that plants can grow and produce maximum production [25]. Furthermore, Jumin (2005), stated that in addition to external factors (environment), plant growth is also influenced by factors that exist within the plant itself. In the vegetative period, the results of photosynthesis (photosynthetic) will be translocated to the roots, stems and leaves [26]. Increased photosynthetics in the vegetative phase lead to the occurrence of division, elongation and differentiation of cells or tissue formation.

4. Conclusion

Coal fertilizer treatment (B); interaction of coal fertilizer with Mutiara NPK fertilizer (B×N) non significant ($P \geq 0.05$) against all observed variables. Mutiara NPK (N) fertilizer treatment has a very significant effect ($P < 0.01$) against rootstock cutting (days) and non significant ($P \geq 0.05$) against other treatments.

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References

[1] BPS. (2021). Produksi Tanaman Buah-buahan. https://www.bps.go.id/indicator/55/62/1/produksi-tanaman-buah- buahan.html, Jakarta.

[2] Rahardi, F.S.I.S. R.N. (2003). Agribisnis Tanaman Perkebunanan, Jakarta: Penebar Swadaya.

[3] Samson, J.A. (1980). Tropical Fruit, Longman Group Limited: New York.

[4] Hardiyanto, A.S.A.S.S.d.M.H. (2010). Panduan Teknis, Teknologi Produksi Benih Jeruk Bebas Penyakit, Jakarta: Kementerian Pertanian.

[5] Insan M. (2019). Pengaruh Posisi Mata Tempel Pada Keberhasilan Okulasi Beberapa Varietas Jruk Keprok (Citrus reticulate). *Jurnal Produksi Tanaman,* 7 (5), 867-873.

[6] Prastowo, N J. R. G. E. M. E. N. J. M. T. F. H. (2006). Teknik Pembibitan dan Perbanyakan Vegetatif Tanaman Buah, Bogor, Indonesia: World Agroforestry Center (ICRAF) dan Winrock International, p 100.

[7] Widowati, R.E.A. (2017). Keberhasilan Okulasi Varietas Jeruk Manis Pada Berbagai Dosis Pupuk Majemuk NPK. *Jurnal AgoSainT UKI Toraja,* 7(1), 56-61.

[8] Arif, I. (2014). Batubara Indonesia, Jakarta: Gramedia Pustaka Utama.

[9] Purwa. (2007). Petunjuk Pemupukan, Jakarta: PT. Agromedia Pustaka.

[10] Sumekto. (2006). Pupuk-pupuk Organik, Klaten: PT. Intan Sejati.

[11] Dwicaksono, M. R. B. B. S. d. L. D. S. (2013). Pengaruh Penambahan Effective Microorganisme pada Limbah Cair Industri Perikanan Terhadap Kualitas Pupuk Cair Organik. *Jurnal Sumberdaya Perairan,* 23-26.

[12] Darmono, N. G. S. d. D. (2009). Pola Pelepasan Nitrogen dari Pupuk Tersedia Lambat (Slow Release Fertilizer) Urea- Zeolit – Asam Humat. *Journal Zeolit Indonesia,* 89-96.

[13] Fahmi. (2014). Pengaruh Pupuk Organik dan Anorganik Terhadap Pertumbuhan dan Hasil Kedelai (Gylycine max (L.) Merril). *Jurnal Floratex,* 53-62.

[14] Kaya, E. (2013). Pengaruh Kompos Jerami Dan Pupuk NPK Terhadap N-Tersedia Tanah, Serapan-N, Pertumbuhan dan Hasil Padi Sawah (Oryza sativa L). *Jurnal Agologia,* 2(1), 43-50.

[15] Marlina. (2012). Pengaruh urin sapi dan NPK (16:16:16) pada pertumbuhan dan produksi Tanaman Mentimun Hibrida.*Skripsi Prodi Agroteknologi Fakultas Pertanian Universitas Islam Riau,* p. Pekanbaru.

[16] Fiolita, V. M. F. (2017). Penggunaan Pupuk NPK Mutiara Untuk Meningkatkan Pertumbuhan Tanaman aharu aquilaria spp. Pada Lahan Terbuka di Tanah Ultisol. *J. Hutan Lestar,* 850-857.

[17] Soil Science Laboratory. (2022). Faculty of Agriculture, Udayana University, Denpasar.

[18] Yustina S, R. G. A. I. 2020. Pengaruh Pemberian Pupuk NPK Mutiara dan Banyaknya Biji Per Lubang Tanam Terhadap Pertumbuhan dan Produksi Kacang tanah Vaietas tasia (arachis hypogaea L.). *Jurnal Darma* Agung, 28 (3), 525-548.

[19] Raharjo, M. D. E. P. (2010). Pengaruh Pupuk Urea, SP-36 dan KCL Terhadap Pertubumhan dan Produksi Temulawak (Curcuma xanthorhiza, Roxb.). *Jurnal Penelitian Tanaman Industri (Industrial Corps Research Journal,* 98-105.

[20] Balitra. (2013). Hasil Analisis Tanah Desa Teluk Sarikat Kecamatan Banjang Kabupaten Hulu Sungai Utara., Banjarbau: Balai Penelitian Pertanian Lahan Rawa.

[21] Wijaya. (2008). Nutrisi Tanaman Sebagai Penentu Kualitas Hasil dan Resistensi Alami Tanaman. *Jurnal Agrosain,* 12-15.

[22] Sarif, E.S.(1985). Kesuburan dan Pemupukan Tanah Pertanian., Bandung: Pustaka Buana.

[23] Lakitan, B. 2004. Dasar-Dasar Fisiologi Tumbuhan., Jakarta: Raja Grafindo Perseda.

[24] Agustina, L. (1990). Nutrisi Tanaman, Jakarta: Rineka Cipta.

[25] Lakitam, B. (2007). Dasar-Dasar Fisiologi Tumbuhan, Jakarta: Raja Grafindo.

[26] Jumin, H.B. (2005). Dasar-Dasar Agronomi, Jakarta: Raja Grafindo Perseda. Cetakan Kelima.