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The Effect of Planting Media Composition and NPK 16-16-16 Fertilizer Dosage on the Growth of Grafted Seedlings from *Syzygium aqueum* Burm.)

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Abstract

Background: The success of water guava plant propagation is determined by proper cultivation and the availability of superior seeds. Water guava seedlings can be produced through generative and vegetative propagation or a combination. Splicing is joining two different parts of a plant into a whole unit and growing as one plant after tissue regeneration occurs in the graft scar. This study aims to determine the effect of the planting media type, the correct NPK fertilizer dose, and the interaction between the two on the growth of water guava seedlings resulting from shoot grafting. **Methods:** This research was conducted at the Horticultural Seed Development Unit, Pasuruan, East Java. This research took place from April to June 2023. Consisting of 2 factors, namely the composition of the soil planting media, soil: cow dung, soil: cow dung: rice husk charcoal, and the dose of NPK fertilizer, namely 16-16-16 1.3 grams, 2.7 grams, 4 grams. with two factors carried out, 1) the composition of the planting media (M) consisting of 3 levels and 2) the dose of NPK fertilizer 16-16-16 (D) consisting of 3 levels of treatment. The parameters observed were the time of emergence, number of shoots, length of shoots, number of leaves, height of grafted plants, and percentage of finished grafts. **Results:** The results showed that the treatment of the best results with the interaction of the composition of planting media soil: cow manure: husk charcoal with a dose of NPK fertilizer four g/plant at the age of 86 hssp on the shoot length parameter (5.86 cm). Single treatment, namely the composition of soil planting media: cow dung showed the best results in the parameter of the number of leaves 43 hssp (9,59), 57 hssp (13,22 strands), 73 hssp (21,30 strands) and 86 hssp (28,11 strands) and the percentage of finished grafts (87.80%), and the dose of NPK fertilizer 2,3 g/plant showed the best results in the parameter of shoot emergence time (9,96 hssp) and the dose of NPK fertilizer four g/plant on the shoot length parameter at the age of 43 hssp (0,83 cm). **Conclusions**: Using the composition of planting media and the dose of NPK fertilizer 16:16:16 can increase the yield of shoot grafts of water guava plants.

Keywords: Planting media composition; NPK 16-16-16 Fertilizer Dose; Grafting; Water Guava

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Introduction

The water guava (*Syzigium aqueum* Burm.) is a horticultural plant in tropical climates. Citra water guava fruit has thick flesh, a sweet taste, a crunchy texture, and a high water content (juicy). 100 g of guava contains 0.1 mg of vitamin C, which is very good for maintaining youthful skin, and 75.9 mcg of vitamin A, which is good for the immune system and eye health. Citra water guava is in great demand by the public. Apart from being sweet, the 'Citra' water guava contains a lot of water, has no seeds, and has high economic value (Pradani, 2018).

Fruit development activities need to be supported by the availability of high-quality seeds because healthy and good seeds can increase plant production; these seeds are produced through nurseries, which are the nurseries responsible for the initial growth of a

plant (Mulyani & Julian, 2015). Propagation techniques such as shoot grafting can improve the development and quality of water guava plant seeds. The union occurs due to the fusion of the cambium of the upper stem and lower stem. The growth of vegetative propagation of water guava plants is primarily determined by the choice of planting media and fertilizer, in addition to the condition of the rootstock and scion of the better cultivar plant and the rootstock used. The successful grafting of water guava plants used scion from a superior variety, namely Citra, and rootstock using a local variety selected in the field, which until now has been widely used, namely Kerikil.

Nutrients are essential to support the vegetative propagation of water apples, especially grafting. The type of planting medium used also affects the growth of water apple seedlings. In addition, fertilization in plant breeding activities must also be considered in addition to the planting medium to encourage the growth of grafted polybag water apple plants. Planting media made from organic materials can benefit the environment and plant development; however, the amount of organic materials in the soil is decreasing. Given high-quality natural planting media, such as soil, rice husk charcoal, and manure, plants can grow and produce the best plants. A mixture of soil, rice husk charcoal, and manure is expected to supply nutrients to the soil, increase soil fertility levels, and have high water absorption. The planting medium provides most of the nutrients plants need, which are then absorbed by the roots and utilized for physiological functions.

Providing inorganic fertilizers to the soil can quickly increase the availability of nutrients for plants because of their high and quickly available nutrient content. NPK Mutiara fertilizer is one of the compound fertilizers that can be an alternative in adding nutrients to the planting medium because it has a relatively high content of macronutrients N, P, and K (Nasrullah et al. 2015). As conducted in the study of Nahak et al. (2018), the provision of NPK Mutiara 300 kg/ha or equivalent to 4.8 grams/plant can increase tomato plant yields during the vegetative and generative periods. In addition to inorganic fertilizers, manure is also recommended because it can improve soil structure, provide macro and micro nutrients for plants, increase water resistance, increase cation exchange capacity values , and increase soil microbiological activity. This study aims to determine the interaction between the treatment of planting medium composition and the dose of NPK Mutiara 16-16-16 fertilizer on the growth of water apple (*Syzigium aqueum* Burm) grafting.

Method

Place and Time of Research

This research was conducted at the UPT. Horticultural Seed Development of Pasuruan City, East Java, in April - June 2023. The area is a lowland with an average height of 4 meters above sea level, and the topography is sloping with a slope of 0 - 1% from south to north, with the temperature of Pasuruan city ranging from 24°C - 33°C.

Materials or tools

The tools used in the study were grafting knives, branch scissors, analytical scales, and rulers. The materials used in the study were water apple centers, water apple seedlings, soil planting media, cow manure, rice husk charcoal, 25x25 polybags, plastic bags, NPK 16-16-16 fertilizer, and shade paranet.

Procedure

The study was a factorial experiment arranged using a Randomized Block Design (RAK) consisting of 2 factors with three replications. Factor 1 is the composition of the planting medium (M), which consists of 3 levels: M0: Soil; M1: Soil: cow manure; M2: Soil: cow manure: rice husk charcoal. Factor 2 is the dose of NPK 16-16-16 fertilizer (D), which consists of 3 treatment levels: D1: 1.3 gr/plant; D2: 2.7 gr/plant; and D3: 4 gr/plant. Combined with these two factors, they will obtain nine combination treatments with three replications for 27 experimental units.

Preparation of Rootstock

These seedlings are obtained from sowing seeds that have been planted until they are 2-3 months old with a stem length of 20 cm from the soil surface with a more robust and deeper root system.

Preparation of Scuts

The scions used are healthy and normal shoots with a length of 18 cm. The characteristics of a good scion for grafting are that a good scion must have a brownish-green color, have bud eyes, be free from pests and diseases,

Preparation of Planting Media

Treatment of soil planting media (M0) is to fill a 25×25 polybag with soil until complete. Treatment of soil planting media: cow manure (M1) with a ratio of 1:1, namely by using a volume of taking 1 part soil and 1 part cow manure mixed evenly and then put into a 25×25 polybag. Processing of planting media: soil: cow manure: rice husk charcoal (M2) with a ratio of 1:1:1 with a volume of 1 part soil, 1 part cow manure, and 1 part rice husk charcoal, mixed evenly and then put into a 25x25 polybag. Then, the water apple seedlings filled with planting media are left for two weeks before grafting so that the plant remains healthy and does not experience saturation or stress on the plant.

Implementation of Grafting

After that, a slit incision is made on the lower stem for the place where the upper stem is attached. The slit incision on the lower stem is made with a depth of 5 cm. Then, an incision on the upper stem should be made with a "V" shape, with a length of 15-20 cm. The base is cut on both sides along 2-2.5 cm so that the shape of the incision is like an ax blade. The next stage combines the upper stem with the lower stem; the upper stem that has been formed into a point is placed in the gap made by the lower stem of the lower stem. After that, the plastic bag is pulled slowly so its length becomes 2-3 times the original plastic, forming a thin, limp plastic. The plastic is then wrapped around the upper stem and lower stem to the upper stem.

NPK Mutiara 16:16:16 Fertilizer Application

NPK Mutiara fertilizer is given after the plant is 30 HSSP old by sprinkling it around the graft of water apple seedlings at 2 cm from the plant stem by making a circular groove.

Data collection

Data collection is carried out by measuring several parameters on the graft of water apple plants, including the time of shoot emergence (hssp), number of shoots, shoot length (cm), number of leaves (strands), height of the grafted plant (cm), and percentage of grafted plants (%).

Data analysis

A statistical analysis was carried out to determine the effect of the treatment using analysis of variance (ANOVA). If the treatment results have a significant impact, then it is continued with the Least Significant Difference (LSD) test at a test level of 5%.

Result and Discussion

The Effect of Interaction of Planting Media Composition and NPK 16-16-16 Fertilizer Dosage on the Growth of Seedlings from Grafting of Water Apple Plants

The study's results stated that the combination of planting media composition and NPK 16-16-16 fertilizer dosage significantly interacted with the length of shoots. The average value of the length of shoots from grafting of Water Apple plants due to the combination of planting media and NPK 16:16:16 fertilizer is presented in Table 1.

Table 1. Length of Shoots from Grafting of Water Apple Plants Due to the Combination of Planting Media Composition and NPK 16-16-16 Fertilizer Dosage

Treatment		Shoot Length		
Age	Planting Media Composition	NPK Fertilizer Dosage 16-16-16		
		1.3 gr	2.7 gr	4 gr
86 HSSP	Soil	5,09 b	4,70 ab	4,82 ab
	Soil: cow manure	5,57 bc	5,63 bc	4,36 a
	Soil: cow manure: chaff charcoal	4,56 ab	5,50 bc	5,86 c
	BNT 5%		**0,70**	

Note: Numbers followed by the same letter show no significant difference in the 5% BNT test.

Based on Table 1. The average shows interaction in the combination treatment of planting media composition with a dose of NPK fertilizer 16:16:16, which significantly affects the growth of shoot length of rose apple plants at the age of 86 hssp. At the age of 86 hssp, the combination of planting media composition of soil, cow manure, and rice husk charcoal with a dose of 4 g/plant produced the highest shoot length of 5.86 cm. The lowest average in the treatment of planting media composition of soil: cow manure with a dose of NPK fertilizer 4 g produced a shoot length of 4.36 cm. The outcome variables have a very significant interaction, allegedly because the macro and micronutrients contained in the composition of the planting media and the dose of NPK fertilizer can increase the growth of seedlings from top grafting. This shows that the combination of adding inorganic fertilizers and organic materials can support good plant growth in a plant. This combination can improve physical and biological properties and provide plant nutrients (Wulandari, 2018).

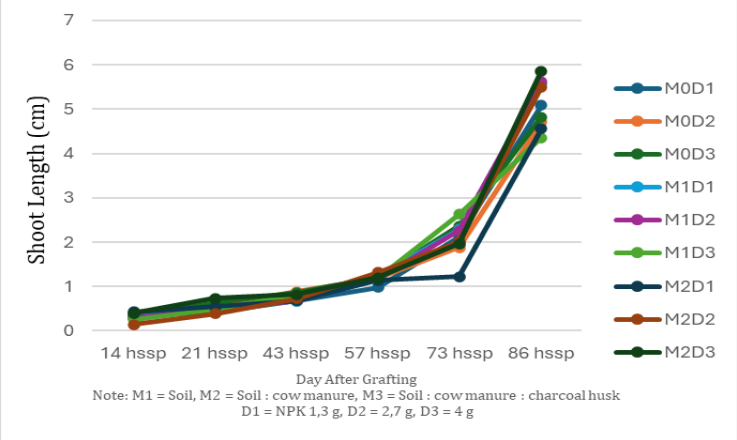

Figure 1. Graph of Combination of Shoot Length Results Due to Treatment of Planting Media Composition and NPK Fertilizer Dosage 16:16:16

Treatment in Figure 1. the shoot length graph shows a genuine interaction of planting media composition treatments and NPK 16:16:16 fertilizer doses on shoot length parameters. The combination treatment at the age of 86 hssp of planting media composition of soil: cow manure: rice husk charcoal with a volume ratio of 1:1:1 and a dose of NPK fertilizer of 4 g became the highest combination treatment by giving an average shoot length of 5.86 cm. In contrast, the combination treatment of planting media composition of soil: cow manure with a dose of NPK fertilizer 16:16:16 1.3 g produced the lowest shoot length of 4.36. The interaction of organic matter of cow manure and NPK fertilizer is thought to be because providing cow manure helps maintain soil fertility and imbalances the nutrients plants need. Auxin and sucrose interact to regulate plant growth and development in a plant's vegetative and generative phases. This study's results align with Afifi et al. (2021) that administering the highest dose of NPK fertilizer of 3-4.5 g/plant provides the highest N content for water apple plants so that the high yield of water apple plants increases. Masinde & Wahome (2022) stated that increasing soil quality by adding rice husk charcoal will stimulate better vegetative growth. Planting media added with rice husk charcoal will make it easier for roots to absorb plant nutrients better.

The Effect of Giving Planting Media Composition on the Growth of Seedlings from Water Apple Plant Top Grafting

The study's results stated that planting media composition significantly affected the number of leaves and the percentage of grafted plants. The average value of the number of leaves from Water Apple plant top grafting due to the treatment of planting media composition is presented in Table 2.

Table 2. Number of Leaves from Water Apple Plant Top Grafting Due to Planting Media Composition Treatment.

Treatment	Number of Leaves (blades)					
Planting Media Composition	14	21	43	57	73	86
	----------HSSP----------					
Soil	1,48	5,00	6,59 a	8,67 a	14,00 a	19,19 a
Soil: cow manure	0,89	5,04	9,59 b	13,22 b	21,30 c	28,11 c
Soil: cow manure: husk charcoal	1,41	5,44	6,65 a	12,52 b	17,19 b	24,52 b
BNT 5%	tn	tn	2,39	2,85	1,34	1,50
NPK Fertilizer Dosage 16:16:16						
1.3 g/plant	1,26	5,11	8,17	11,30	17,26	23,78
2.7 g/plant	1,19	5,19	8,26	11,96	16,52	25,30
4 g/plant	1,33	5,19	6,41	11,15	18,70	22,74
BNT 5%	tn	tn	tn	tn	tn	tn

Description: Numbers followed by the same letter indicate no significant difference in the 5% BNT test; tn = insignificant; HSSP = Days After Grafting.

Based on Table 2. the average shows that the treatment of planting media composition significantly affects the number of leaves parameter at the age of 43 to 86 hssp. The provision of soil planting media composition: cow manure (M1) by giving the highest average, namely 9.59, 13.22, 21.30, and 28.11 leaves, respectively, and is significantly different from all treatments except for the age of 57 hssp. The average number of leaves is the lowest at the age of 43 to 86 and is found in the composition of soil planting media (M0) with values of 6.59, 8.67, 14.00, and 19.19 leaves, respectively. The treatment of giving NPK fertilizer doses of 16:16:16 at 14 to 86 hssp did not significantly affect the average number of leaves. The treatment of the planting media soil composition: cow manure produced the best therapy in both parameters. The content of nutrients and organic materials in cow manure is reasonably available; the fulfillment of nutrients and organic materials for plants will help the plant growth process, marked by the increasing percentage of successful seedlings. During the vegetative period, plants need high nutrient intake. In this phase, Nitrogen (N) is a nutrient that is required by plants in large quantities; nitrogen is an essential element in the formation of chlorophyll and nucleic acids and plays a critical role in the growth and development of all living tissues such as cell division and cell elongation to increase plant growth Rosadi et al. (2019).

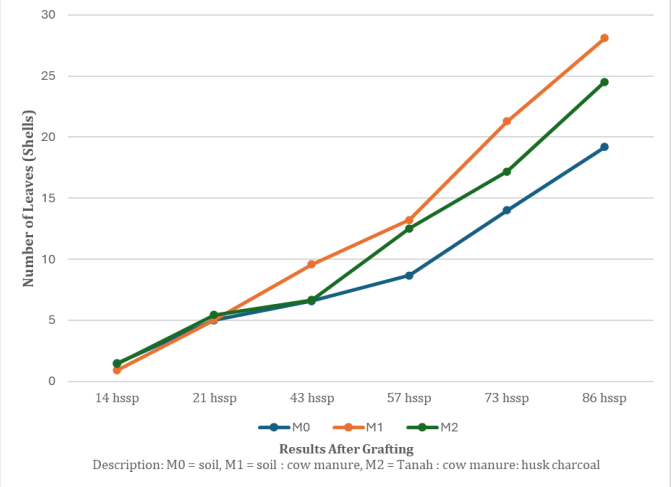

Figure 2. Graph of Results of Number of Leaves Due to Planting Media Composition Treatment.

The treatment in Figure 2. the composition of the soil planting media: cow manure (1:1) has a very significant effect on the number of leaves of water apple plants at the ages of 43, 57, 73, and 86 HSSP, giving the highest average results in the number of leaves with an average result of 28.11 strands, compared to the treatment of soil planting media composition: producing the least number of leaves of 6.59 strands. This allows plants to quickly utilize these nutrients for their growth, and providing solid cow manure with a mixture of other media can increase the number of leaves, height, and plant production (Juniyati et al., 2018). This is supported by Setyamidjaja (1986); Mebinta et al. (2020), that increasing plant leaves will produce a large leaf area and expand the surface area available for photosynthesis if the plants get a reasonably high nitrogen element.

Table 3. Percentage of Grafting to Grafting of Water Apple Plants in the Treatment of Planting Media Composition.

Treatment	Percentage of Connected Finished (%)	
Planting Media Composition		
Soil	73,30	a
Soil: cow manure	87,80	c
Soil: cow manure: husk charcoal	81,10	b
BNT 5%	0,81	
NPK Fertilizer Dosage 16:16:16		
1,3 g/plant	85,60	
2,7 g/plant	77,80	
4 g/plant	78,90	
BNT 5%	tn	

Description: Numbers followed by the same letter indicate no significant difference in the 5% BNT test; tn = not substantial.

Based on Table 3. the average shows that the percentage of grafting is in Table 3. The treatment of soil planting media composition: cow manure (M1) has a significant effect, with the highest average value of 87.80%. The lowest average was obtained from the provision of soil planting media composition, with a result of 73.30%. NPK fertilizer doses of 16-16-16 did not significantly affect the grafting percentage of water apple plants.

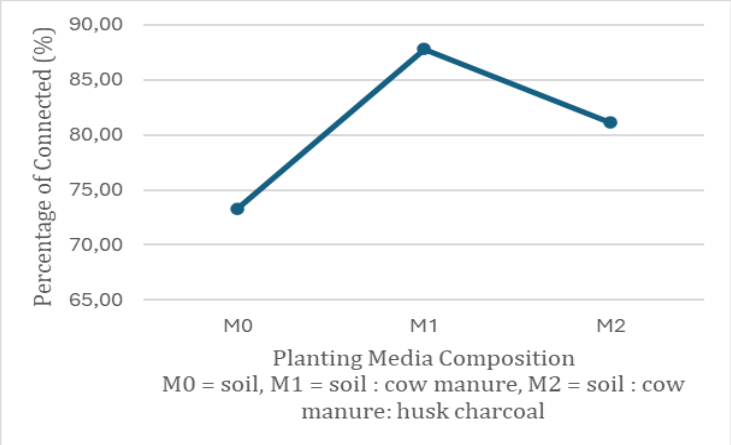

Figure 3. Graph of the Percentage of Joints Resulting from Planting Media Composition Treatment.

The treatment in Figure 3. gives the composition of soil planting media: cow manure has a very significant effect on the percentage parameter of grafting, giving the highest average result of 87.80%, compared to the treatment of soil planting media composition of 73.30%. According to Novizan (2007) and Mihora (2019), adding manure to the soil planting media can provide sufficient nutrients to grow rose apple grafts. Providing cow manure and better nutrient availability can also improve the soil's chemical, physical, and biological properties

so that the roots develop well and can absorb nutrients and water optimally for plant needs. Plant needs for each nutrient depend on the availability of all nutrients in the soil.

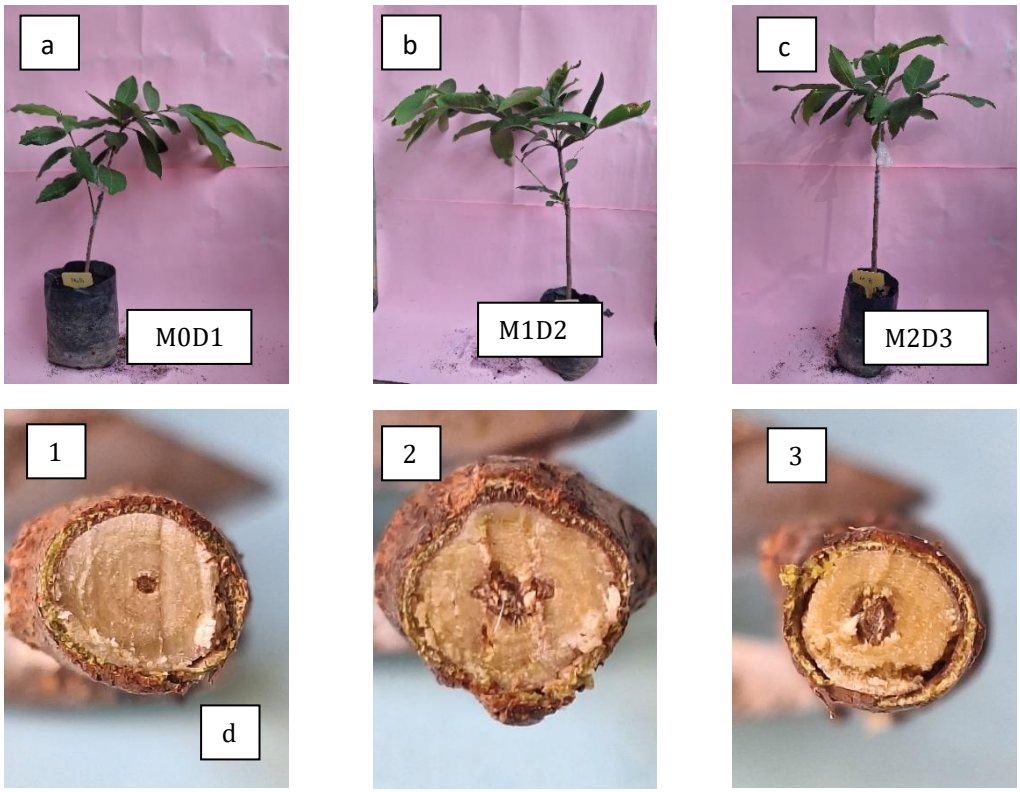

Figure 4. The Effect of Planting Media Composition and NPK 16-16-16 Fertilizer Dosage on Seedlings from Water Apple Plant Grafting a) soil with a fertilizer dose of 1.3 g b) soil: cow manure with 2.7 g fertilizer, c) soil: cow manure: rice husk charcoal with 4 g, d) morphology of the combination of grafted stems: 1) upper stem; 2) middle stem of the graft; 3) lower stem

Figure 4. shows at the age of 86 HSSP, the grafted water apple seedlings are compatible (vascular tissue of xylem and phloem between the lower stem and upper stem are connected) to the joint plane is more integrated between the lower stem and upper stem shown in Figure 4. part B the integration between the lower stem and upper stem. Giving the composition of the planting medium soil: cow manure can combine between the lower stem and upper stem, indicated if the xylem and phloem vessels from both parts of the plant have been integrated and can function as a means of transporting nutrients from the soil and photosynthates so that it is called a connection (Handayani et al. 2013). The formation of shoot buds on new branches is also directly related to the production and transportation of auxin in the whole plant. Shoot buds are the site of endogenous auxin synthesis, which can be translocated to the root part and then induce root development. A well-developed root system will be the site of endogenous cytokinin production, then translocated acropetally to the top of the plant. Cytokinins in the top of the plant will encourage crown development. The connection that occurs in Figure 4. Part D shows that in 3-month-old grafted seedlings, the attachment between the rootstock and the upper stock is already seen to be united, so the percentage of success rate will increase. A good connection will result in the transportation of water, nutrients, substances, growth regulators, and carbohydrates from the rootstock to the upper stock and vice versa, running smoothly. Good compatibility will connect the rootstock tissue with the upper stock tissue so photosynthesis and nutrients can be translocated to support plant growth and development. If the scion used quickly adapts to the rootstock, the supply of nutrients and photosynthesis results will run smoothly to optimize plant growth. The selection of the rootstock's age greatly determines the grafting activity's success, so it is the primary consideration because the rootstock has a significant

influence when the grafted plant is finished. The age of the rootstock of the water apple plant is still in the vegetative phase, which has a higher chance of success than the rootstock that has entered the generative phase (Rohman et al. 2018). Effect of Giving NPK Fertilizer Dosage 16-16-16 on the Growth of Seedlings from Grafting of Water Apple Plants

The results of the study stated that giving NPK fertilizer dosage 16-16-16 had a significant effect on the time of emergence of shoots and the length of shoots. The average value of the time of emergence of shoots and the length of shoots of the Water Apple plant grafted due to the NPK Mutiara 16:16:16 fertilizer dose treatment is presented in Table 4.

Table 4. Time of Emergence of Shoots from Grafting of Water Apple Plants Due to the NPK Fertilizer Dosage Treatment 16-16-16

Treatment	Time of Emergence of Shoots (HSSP)	
Planting Media Composition		
Soil	10,81	
Soil: cow manure	12,22	
Soil: cow manure: husk charcoal	12,04	
BNT 5%	tn	
NPK Fertilizer Dosage 16:16:16		
1,3 g/plant	9,96	a
2,7 g/plant	12,93	b
4 g/plant	12,19	b
BNT 5%	1,92	

Description: Numbers followed by the same letter indicate no significant difference in the 5% BNT test; tn = insignificant; HSSP = Days After Grafting.

Table 4. shows that the treatment of the composition of the planting media does not significantly affect the time of emergence of shoots of rose apple plants resulting from grafting. Still, the NPK 16-16-16 fertilizer dose treatment significantly affects the time of shoot emergence. The fastest average was obtained from administering a dose of NPK 16:16:16 1.3 g fertilizer of 9.96 hssp. The longest average was obtained from administering a dose of NPK 16:16:16 2.7 g fertilizer of 12.93 hssp. The administration of NPK fertilizer directly affects the increase in plant growth and development because it contains macronutrients that plants very much need. This is in line with the research results by Ichsan et al. (2021) growth is influenced by the accumulation of carbon in the sink section, which is proportional to the plant's source capacity. Plants that are balanced between sink and source will grow better.

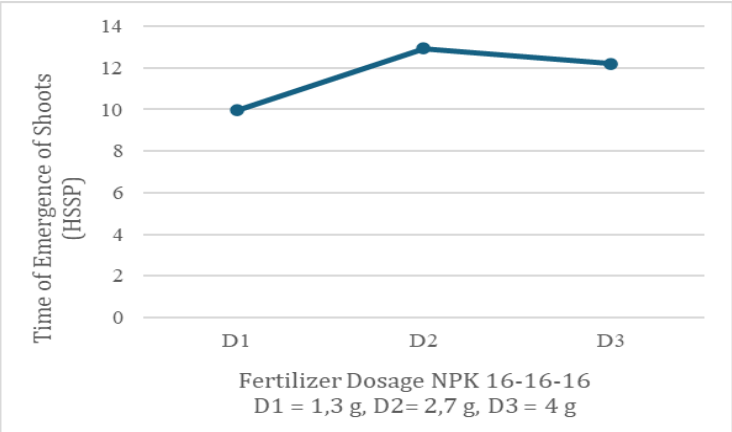

Figure 5. Graph of Results of Shoot Emergence Time Due to NPK 16-16-16 Fertilizer Dose Treatment

Treatment in Figure 5. giving a dose of NPK fertilizer 16:16:16 significantly affects the parameter of the time of emergence of shoots, showing the fastest results, namely in the treatment of NPK fertilizer dose 1.3 g of 9.96 hssp. In comparison, the treatment of NPK fertilizer dose 16:16:16 2.7 g gave the longest time of 12.93 hssp. A dose of NPK fertilizer

contains nutrients needed for grafting water apple plants. NPK fertilizer contains macronutrients such as nitrogen, phosphate, and potassium, which plants need in sufficient and balanced amounts because they play an essential role in the vegetative growth of plants. The role of NPK as a macromolecular material, namely protein, is the main component of rubisco, which plays a role in photosynthesis so that there is an increase in protein in photosynthesis, the results of which can be converted into various other macromolecules. These materials are components of cells that are part of the formation of shoot branches and leaf length.

Table 5. The length of shoots connecting water guava plants was determined after treatment with NPK 16-16-16 fertilizer dosage.

Treatment	Length of Shoots (cm)				
Composition of Planting Media	14	21	43	57	73
	----------HSSP----------				
Soil	0,32	0,54	0,80	1,12	2,12
Soil: cow manure	0,31	0,49	0,72	1,20	2,39
Soil: cow manure: husk charcoal	0,32	0,55	0,74	1,22	1,73
BNT 5%	tn	tn	tn	tn	tn
NPK Fertilizer Dosage 16:16:16					
1,3 g/plant	0,24	0,49	0,67 a	1,12	1,78
2,7 g/plant	0,32	0,47	0,76 ab	1,20	2,27
4 g/plant	0,39	0,62	0,83 b	1,48	2,54
BNT 5%	tn	tn	0,12	tn	tn

Description: Numbers followed by the same letter in the column and each of the same treatments and different observation ages show no significant difference in the 5% BNT test; tn = not significant; HSSP = days after grafting.

The average shoot length results in Table 5. shows that the treatment of planting media composition has no significant effect on shoot length at 14 to 73 hssp. The treatment of NPK fertilizer dose 16:16:16 4 g significantly affects the age of 43 hssp with the highest average value of 0.81 cm. The lowest average was obtained from the treatment of NPK fertilizer dose 1.3 g of 0.66 cm. Mutiara 16-16-16 NPK fertilizer is a type of agricultural inorganic fertilizer that contains the primary nutrients in the form of nitrogen (N), phosphorus (P), and potassium (K). The number 16-16-16 indicates the percentage of nutrient content, which means 16% nitrogen, 16% phosphorus, and 16% potassium in the fertilizer. These three nutrients play an essential role in the vegetative growth of plants, especially in the length of shoots. This NPK fertilizer is easily soluble or absorbed by plants (Hidayatullah, 2020).

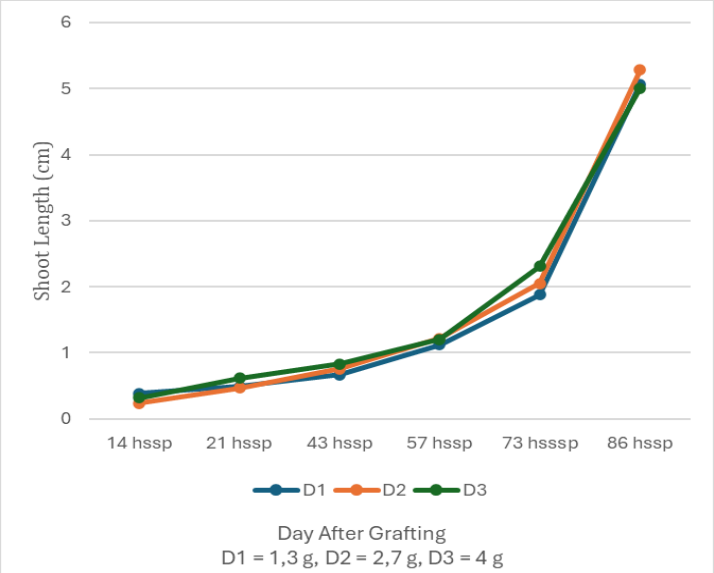

Figure 6. Graph of Shoot Length Results Due to NPK 16-16-16 Fertilizer Dose Treatment

The treatment in Figure 6 of the administration of NPK 16:16:16 fertilizer dosage has a significant effect on the age of 43 hssp on the shoot length parameter, giving the highest results in the treatment of NPK 16:16:16 4 g fertilizer dosage of 0.83 cm, while the treatment of NPK 16:16:16 1.3 g fertilizer dosage gave the lowest results of 0.67 cm. Although the administration of NPK 16:16:16 fertilizer dosage is low, the water apple plant can still grow. Suryati et al. (2014) explained that adding N, P, and K nutrients can stimulate the vegetative growth of plants, especially branches, stems, and leaves, where the N element spurs the growth of shoot and leaf length. The P element is an energy source that helps plants in the vegetative phase and increases the development of plant roots. The K element functions to increase enzyme activity and increase the ability of roots to absorb nutrients.

The N element is a primary macronutrient needed by plants and is very active in stimulating the budding and vegetative growth of plants. The N nutrient element also forms chlorophyll, which acts as an absorber of sunlight and can be used to increase plant height growth this is according to Abdillah's opinion (Abdillah, 2020). NPK fertilizer to plants must be provided correctly and according to the dose for optimal plant results. This is supported by the opinion of Rahmatika & Anggraini (2021) that fulfilling nutrient needs that are not appropriate can trigger nutrient deficiencies or excesses. The time of administration and when plants need nutrients that are not appropriate is caused by the provision of nutrients for plant needs being slower, or the provision of nutrients for plant needs being earlier. The availability of more than the plant needs results in the conversion of nutrients into unavailable forms or lost nutrients.

Conclusions

Based on the results of the research conducted, the treatment of the composition of the planting media and the dose of NPK 16-16-16 fertilizer had a natural interaction on the length of shoots in the soil planting media: cow manure with a dose of NPK fertilizer of 4 g/plant by giving the best value. The composition of the soil planting media: Manure affected the number of leaves with the dose and percentage of grafting by providing the best value. The provision of the dose of NPK 16-16-16 fertilizer affected the time of shoot emergence with a dose of 2.3 g/plant and the length of shoots with a dose of NPK fertilizer of 4 g/plant.

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Declaration statement

The authors reported no potential conflict of interest.

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