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Growth Response of Rose (*Rosa damascena* Mill.) Cuttings Due to the Concentration and Soaking Duration of the Plant Growth Regulator (PGR)

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ABSTRACT

This study aims to determine the effect of concentration and soaking duration of Plant Growth Regulator (PGR) Growntone on rose (*Rosa damascena* Mill.) cutting growth. This research was conducted at the Experimental Garden of the Faculty of Agriculture, University of Amir Hamzah, Medan, Medan Estate Village, Percut Sei Tuan District with an altitude of ±25 meters above sea level, which was conducted from March to May 2020. This study used a factorial randomized block design (RBD) with two factors studied, namely the first factor was the PGR Growtone concentration, which consisted of 4 levels, namely K_0 (0 mg/10 ml water), K_1 (3 mg/10 ml water), K_2 (6 mg/10 ml water), K_3 (9 mg/10 ml water),and the second factor is the soaking duration for PGR Growtone (L) which consists of 4 levels, namely L_0 (0 minute), L_1 (30 minutes), L_2 (45 minutes), and L_3 (60 minutes). Parameters observed included shoot emergence time (days), shoot length (cm), number of shoots, and root length (cm). The results showed that the PGR Growtone concentration had a very significant effect on shoot emergence time, shoot length, and root length, but did not significantly affect the number of shoots. The best concentration is obtained in the treatment K_3 (9 mg/10 ml water). The soaking duration for PGR Growtone had a very significant effect on shoot emergence time, shoot length at 60 days after planting, and root length. The best soaking duration was obtained in the treatment L_1 (soaking duration 30 minutes). The interaction between the concentration and soaking duration of PGR Growtone only had a significant effect on shoot emergence time, where the best treatment combination was obtained in the treatment K_3L_1 (concentration 9 mg/10 ml water and soaking duration 30 minutes).

Keywords: Plant growth regulator, concentration, soaking duration, rose cutting

INTRODUCTION

Rose (*Rosa damascena* Mill.) is one of the ornamental plants that is proud of Indonesia and highly popular in the world because it has beautiful and attractive flowers. Besides that, it also has high economic and social value to be used as a trading and commercial commodity. The demand for roses continues to increase along with the increasing public demand. Roses can be cultivated as cut flowers, garden decoration plants, and as potted flowers (Fitriani, 2017).

Given the many benefits and functions, roses experience an increasing demand from year to year, therefore it is important to make efforts so that rose cultivation can produce good growth so that it will produce rose plants with superior quality and quantity and can compete in the international market. To get superior quality roses that have high economic value, it is important to prepare roses as early as possible by preparing rose cutting properly.

Cultivation of roses can be propagated in two ways, namely vegetative and generative. However, in general, the development of roses is mostly done by vegetative techniques, namely the use of cutting techniques. This is because the cutting method is easier to do and can provide better and more efficient results than other methods.

The cuttings are planted directly into the planting medium. The method of cutting

is preferred, because cuttings produce plants that have the same age, height, resistance to disease and produce large quantities of plant seeds (Nilawati, 2002).

Rose cuttings often fail without growing roots. One of the efforts to overcome the failure in root growth on cuttings is to provide Plant Growth Regulator (PGR). The advantages of using PGR on cuttings are improving the root system, accelerating the discharge of roots for young plants, helping plants to absorb nutrients from the soil, preventing leaf fall and increasing the photosynthesis process.

Plant growth regulator (PGR) is a substance or hormone that functions as a regulator that can affect the tissues of various organs and organ systems of the plant body and can stimulate and spur plant growth and development (Hutahayan, 2015).

According to Heddy, (2002) in Hermansyah et al., (2010) root formation is very influential on the growth of cuttings. Roots on cuttings can be accelerated with special treatment, namely by adding PGR auxin group. Auxin is a PGR that plays a role in the process of cell elongation, cell division, differentiation of vessel tissue and root initiation. Currently there are many PGR circulating in the market, including Growtone.

Growtone is a growth stimulant in the form of flour, gray in color, which contains the active ingredient and contains 3.0% acetic acid naphthalene, 0.75% acetic acetic acid, the excess of growtone is very suitable for use in various kinds of plant cuttings with its function to stimulate growth. roots faster and reduce the risk of cutting death (Panggabean, 2015).

The results of the research by Hermansyah et al., (2010) showed that PGR Growtone with a concentration of 6 gr / 10 ml had an effect on the growth of dragon fruit cuttings. The success of using PGR in the propagation of cuttings is influenced by the concentration and duration of soaking the cuttings in the solution. Soaking duration must be adjusted to the concentration used. At high concentrations, the immersion is carried out for a short time, but at lower concentrations it takes a longer time. The results of Hendriyanto's (2007) research in Pasetriani (2012) show that the length of immersion in growtone with a concentration of 0.8 g/l of water for 45 minutes has a positive effect on the growth of Jatropha shoots.

MATERIALS AND METHODS

This research was conducted at the Experimental Garden of the Faculty of Agriculture, Amir Hamzah University, Medan with a height of ±25 m above sea level with flat topography. The research time was from March to May 2020.

The materials used in this study were: rose cuttings, PGR Growtone produced by PT Deltagro, topsoil, sand, rice husks, black polybags measuring 18 x 25 cm, Urea fertilizer, TSP and KCl, raffia rope, nails, spray paint, nameplate, treatment board and plot nameplate.The tools used are: knife, cuttings, hoe, hands prayer, aqua glass, earth sieve, calipers, nails, paint, hammer, plywood, tape measure, handspayer scales, paint brushes, writing instruments, calculators and supporting tools of research.

The design used in this study was a factorial randomized block design (RBD) consisting of 2 factors, namely:

The concentration factor of PGR Growtone (K) which consists of 4 levels, namely:

K_0 = 0 mg/10 ml water (Control)
K_1 = 3 mg/10 ml water
K_2 = 6 mg/10 ml water
K_3 = 9 mg/10 ml water

Factor of soaking duration in PGR Gowtone (L) which consists of 4 levels, namely:

L_0 =0 minute (Control)
L_1 =30 minutes
L_2 =45 minutes
L_3 =60 minutes

Thus, 16 treatment combinations were obtained and repeated 2 times to obtain 32 experimental units. In each experimental unit consisted of 3 polybags

which were all observed and 1 seed as descriptive sample.

The mathematical model used in this study (Adji, 2007) is:

$Y_{ijk} = \mu + \beta_i + K_j + L_k + (KL)_{jk} + \varepsilon_{ijk}$

Where :

Y_{ijk} = The observation results obtained from the treatment of the concentration of PGR Growtone at j level and soaking duration factor at k level on i block

μ = Mean

β_i = Effect i block (i = 1 and 2)

K_j = Effect of concentration of PGR Growtone at the j level (j = 1, 2, 3 and 4)

L_k = Effect of soaking duration at k level (k = 1, 2, 3 and 4)

$(KL)_{jk}$ = Effect of interactions between concentrations of PGR Growtone at j level and the soaking duration at k level.

ε_{ijk} = Effect of error from treatment concentration of PGR Growtone j level and k soaking duration, on i block

The results of the Variance Analysis which had a very real or significant effect on the observed parameters were followed by the Least Significant Difference (LSD) test at 5% level.

Parameters observed included shoot emergence time (days), shoot length (cm), number of shoots, and root length (cm).

RESULTS AND DISCUSSION

Effect of PGR Growtone Concentration

1. Shoot Emergence Time

The results of the analysis of variance showed that the concentration of PGR growtone had a very significant effect on shoot emergence time.The mean shoot emergence time due to concentration of PGR growtone is presented in Table 1 below.

Table 1. Average Shoot Emergence Time Due to the Concentration of PGR Growtone

Concentration of PGR Growtone	Shoot Emergence Time(day)
K_0	19.79 d
K_1	17.25 c
K_2	15.50 b
K_3	13.67 a

Note : The numbers followed by the same letter in the same column are not significantly different in the 5% LSD test

Table 1 shows that the average of the shoot emergence time due to concentration treatment of PGR growtone with the fastest growth was obtained in the K_3 treatment followed by K_2, K_1 and K_0. From the results of the LSD test at the 0.05 level, it is known that the shoot emergence time in the K_3 treatment (9 mg/10 ml water) was significantly different from all treatments. This is because giving growtone at a dose of 9 mg/10 ml of water is the optimal dose so that it can accelerate the physiological processes in the plant so that cell division occurs more rapidly, which has an impact on the rapid growth of buds. Nilawati (2002) stated that auxin administration had a significant effect on the initiation time of rose cuttings. This is said because giving exogenous auxins (from outside) will increase the activity of endogenous auxins that are already present in the cuttings, thus encouraging cell division and causing shoots to emergence earlier.

2. Shoot Length

The results of the analysis of variance showed that the concentration of PGR growtone had a very significant effect on shoot lengths aged 30 Days After Planting, 45 Days After Planting and 60 Days After Planting. The average shoot lengths at the age of 30 Days After Planting, 45 Days After Planting and 60 Days After Planting due to concentrations PGR growtone are presented in Table 2 below.

Table 2. Average Shoot Length at 30 Days After Planting, 45 Days After Planting and 60 Days After Planting due to the Concentration of PGR Growtone

Concentration of PGR Growtone	Shoot Length (cm)		
	30 Days After Planting	45 Days After Planting	60 Days After Planting
K_0	2.05 a	5.29 a	8.31 a
K_1	2.56 b	6.05 b	9.43 b
K_2	2.65 b	6.28 b	9.47 b
K_3	3.07 c	6.97 c	10.26 c

Note : The numbers followed by the same letter in the same column are not significantly different in the 5% LSD test

Table 2 shows that the average data of shoot length at 60 Days after planting due to concentration treatmentof ZPT growtone the highest was obtained in the K_3 treatment followed by K_1, K_2 and K_0. From the results of the LSD test at 0.05, it was known that the shoot length in the K3 treatment (9 mg/10 ml water) was significantly different from all treatments. This is suspected by giving growtone containing auxin PGR at a dose of 9 mg/10 ml of water as the best dose to increase shoot length. According to Febriana, (2009) auxin is able to increase cell pressure and increase protein synthesis, so that the cells will expand, elongate shoots and absorb water. Gunawan (1992) states that one of the auxin (IBA) functions is to extend plant cells. Auxins play a role in cell development (cell extension).

3. Number of Shoots

The results of the analysis of variance showed that the concentration of PGR growtone had no significant effect on the number of shoots aged 30 days after planting, 45 days after planting and 60 days after planting. The average length of shoots at the age of 30 DAS, 45 days after planting and 60 days after planting due to the concentration of PGR growtone are presented in Table 3 below.

Table 3. Average Number of Shoots at Age 30 days after planting, 45 days after planting and 60 days after planting due to the Concentration of PGR Growtone

Concentration of PGR Growtone	Number of Shoots		
	30 Days After Planting	45 Days After Planting	60 Days After Planting
K_0	1.00	1.04	1.96
K_1	1.08	1.17	2.17
K_2	1.08	1.25	2.25
K_3	1.21	1.42	2.38

The insignificant difference from the treatment of the concentration of PGR on the parameter of the number of shoots, it was assumed that the concentration was not able to increase the number of shoots produced, this was due to the influence of genetic factors and environmental factors that were more dominant so that there was no significant effect on the number of shoots parameters. Lakit (2006) states that the increase in shoot length is the result of cell growth and development which depends on the supply of nutrients provided by the roots for metabolism and protein synthesis.

4. Root Length

The results of the analysis of variance showed that the concentration of PGR growtone had a very significant effect on root length. The average root length due to the concentration of PGR growtone is presented in Table 4.

Table 4. Average Root Length due to Concentration of PGR Growtone

Concentration of PGR Growtone	Root Length (cm)
K_1	2.74 a
K_2	3.20 ab
K_3	3.45 b
K_4	4.33 c

Note : The numbers followed by the same letter in the same column are not significantly different in the 5% LSD test

Table 4 shows that the average root length data due to the concentration of PGR growtone the highest was obtained in the K_3 treatment followed by K_2, K_1 and K_0. From the results of the LSD test at the 0.05 level, it was known that the root length in the K_3 treatment (9 mg/10 ml water) was significantly different from all treatments. It is suspected that by giving a dose of 9 mg/10 ml of water is a sufficient dose to increase the length of rose roots. According to Panggabean, (2015) Growtone contains active ingredients (NAA) and contains 3.0% naphthalene acetic acid, 0.75% amid acetic acid, 0.75% of excess growtone is suitable for use in various kinds of plant cuttings with its function to stimulate root growth faster and reduce the risk of death of

cuttings. This was also stated by Suprapto (2004) that auxin is a plant growth regulator that has an influence on cell development, phototropism, geotropime, apical dominance, parthenocarp root growth, absorption, callus formation and respiration.

Effect of Soaking Duration of PGR Growtone

1. Time of Shoots Emergence

The results of analysis of variance showed that the soaking duration of PGR growtone had a very significant effect on the emergence of shoots. The mean shoot emergence time due to the soaking duration of PGR growtone is presented in Table 5.

Table 5. Average shoot emergence time due to the soaking duration of PGR growtone

Soaking duration of PGR Growtone	Shoot Emergence Time (day)
L_0	18.42 c
L_1	14.63 a
L_2	16.46 b
L_3	16.71 b

Note : The numbers followed by the same letter in the same column are not significantly different in the 5% LSD test.

Table 5 shows that the data on the average time to shoots emergence due to the soaking duration of PGR growtone treatment with the fastest growth was obtained in L1 treatment followed by L_2, L_3 and L_0. From the results of the LSD test at the 0.05 level, it was known that the emergence time of shoots in L1 treatment (soaking duration 30 minutes) was significantly different from all treatments.It is assumed that the soaking time for 30 minutes is the optimal soaking time to accelerate the growth of rose cuttings. This is because the longer the cuttings are soaked, the growtone can act as an inhibitor because the enzyme cannot capture this concentration so it tends to inhibit growth. According to Pamungkas (2009), giving plant growth regulators with high immersion time causes cell division activity to slow down, so that it has little effect on increasing plant growth. The effect of auxin concentrations on growth will increase at a certain time until growth reaches optimal growth, then growth will decrease. Soaking too long causes cell division to slow down.

2. Shoot Length

The results of analysis of variance showed that the soaking durationof PGR growtone had a very significant effect on the shoot length of 60 Days After Planting. But it had no significant effect on shoot length at 30 and 45 Days After Planting. The average shoot lengths at the age of 30 Days After Planting, 45 Days After Planting and 60 Days After Planting due to the soaking duration of PGR growtone are presented in Table 6.

Table 6. Average Length of Shoots at 30 Days After Planting, 45 Days After Planting and 60 Days After Planting due to Soaking duration of PGR Growtone

Soaking duration of PGR Growtone	Shoot Length (cm)		
	30 Days After Planting	45 Days After Planting	60 Days After Planting
L_0	2.31	5.78	8.90 a
L_1	2.69	6.62	10.18 b
L_2	2.68	6.09	9.25 a
L_3	2.65	6.08	9.15 a

Note : The numbers followed by the same letter in the same column are not significantly different in the 5% LSD test.

Table 6 shows that the average length of shoots due to the soaking duration of PGR growtone with the fastest growth was obtained in L_1 treatment followed by L_2, L_3 and L_0. From the results of the LSD test at 0.05 level, it was known that the shoot length in L1 treatment (soaking duration 30 minutes) was significantly different from all treatments. It is assumed that the soaking duration for 30 minutes is the right soaking time to accelerate the growth of rose cuttings if the cuttings are soaked for too long it will damage the cuttings.The success of using PGR in the propagation of cuttings is influenced by the concentration and duration of soaking the cuttings in the solution. The longer soaking tends to inhibit the growth of cuttings. According to Sari (2009) the longer the soaking is, the longer the cuttings are in

contact with the solution so that it can cause tissue damage in plants. The results of the research by Pasetriani (2012) that soaking duration in growtone for 45 minutes had a positive effect on the growth of Jatropha shoots.

3. Number of Shoots

The analysis of variance showed that the soaking duration of PGR growtone had no significant effect on the number of shoots aged 30 days after planting,45 Days After Planting dan 60 Days After Planting. The average length of shoots at the age of 30 days after planting, 45 days after planting and 60 days after planting due to soaking duration of ZPT growtone is presented in Table 7.

Table 7. Average Number of Shoots at the Age of 30 Days After Planting, 45 Days After Planting and 60 Days After Planting due to Soaking duration of PGR Growtone

Soaking duration of PGR Growtone	Number of Shoots		
	30 Days After Planting	45 Days After Planting	60 Days After Planting
L_0	1.00	1.04	2.04
L_1	1.21	1.46	2.38
L_2	1.13	1.21	2.21
L_3	1.04	1.17	2.13

The difference was not significant from the treatment of soaking duration combination of PGR on the parameter of the number of shoots, it is assumed that the immersion time is not able to increase the number of shoots produced, this is due to the influence of genetic factors and environmental factors that are more dominant so that there is no real effect on the parameter of the number of shoots. Lakitan (2007) states that the increase in shoot length is the result of cell growth and development which depends on the supply of nutrients provided by the roots for metabolism and protein synthesis.

4. Root Length

The results of analysis of variance showed that the soaking duration of PGR growtone had a very significant effect on root length. The average root length due to the soaking duration of PGR growtone is presented in Table 8.

Table 8. Average length of roots due to soaking duration of PGR Growtone

Soaking duration of PGR Growtone	Root Length (cm)
L_0	2.65 a
L_1	4.25 c
L_2	3.43 b
L_3	3.39 b

Note : The numbers followed by the same letter in the same column are not significantly different in the 5% LSD test

Table 8 shows that the data from the average root length due to the soaking duration treatment of PGR growtone with the fastest growth was obtained in L_1 treatment followed by L_2, L_3 and L_0. From the results of the LSD test at the 0.05 level, it was known that the root length in L_1 treatment (immersion time 30 minutes) was significantly different from all treatments. It is suspected that the soaking growtone containing auxin for 30 minutes is the right soaking so that it can increase the root length. According to Hermansyah, et al., (2010) that giving high concentrations and soaking for too long or above normal, auxin can act as an inhibitor because the enzyme cannot capture this concentration so it tends to inhibit growth.

Effect of Interaction between Concentration and Soaking Duration of PGR Growtone

The results of the analysis of variance showed that the interaction between the concentration and soaking duration of PGR Growtone had a very significant effect on the emergence of shoots but had no significant effect on the length of shoots aged 30, 45 and 60 days after planting, the number of shoots aged 30, 45 and 60 days after planting. and root length. The average shoot emergence time is due to the interaction between concentrations of PGR growtone and

soaking duration are presented in Table 9 below.

Table 9. Average Shoot Emergence Time due to the Interaction between the Concentration and the soaking duration of PGR Growtone

Combination Treatment	Time of Shoots Emergence (Day)
K_0L_0	21.00 e
K_0L_1	17.67 d
K_0L_2	19.33 de
K_0L_3	21.17 e
K_1L_0	19.17 de
K_1L_1	17.67 d
K_1L_2	19.17 de
K_1L_3	13.00 bc
K_2L_0	19.50 de
K_2L_1	12.83 bc
K_2L_2	14.67 bc
K_2L_3	15.00 c
K_3L_0	14.00 bc
K_3L_1	10.33 a
K_3L_2	12.67 b
K_3L_3	17.67 d

Note : The numbers followed by the same letter in the same column are not significantly different in the 5% LSD test.

Table 9 shows that for the fastest shoot emergence time parameters were found in the K_3 L_1 treatment which was based on the LSD test with the 0.05 level which was significantly different from the treatment combination.K_0 L_0, K_0 L_1, K_0 L_2, K_0 L_3, K_1 L_0, K_1 L_1, K_1 L_2, K_1 L_3, K_2 L_0, K_2 L_1, K_2 L_2, K_2 L_3, K_3 L_0, K_3 L_2, K_3 L_3.The faster growth of shoots due to the administration of growtone containing auxin at a dose of 9 mg/10 ml of water with a 30 minute soaking duration is the right dose so that it can accelerate the physiological processes in the plant so that cell division occurs faster, which has an impact on the rapid growth of buds. Suprapto (2004) states that auxin is one of the growth regulators for plants that has an influence on cell development, phototropism, geotropism, apical dominance, parthenocarp root growth, absorption, callus formation and respiration. According to Suprapto (2004) that the use of plant growth regulator needs to pay attention to the concentration, the carrier substance, the time of use and the plant parts needed. Sudomo (2012) states that plant growth regulator (PGR) at the right concentration plays a major role in cell differentiation, but at concentrations above the optimum they can be toxic which can reduce the desired results.

CONCLUSION

From the results of the research and discussion above, the following conclusions can be obtained:

1. The concentration of PGR growtone had a very significant effect on the bud emergence time, 30 Days After Planting, 45 Days After Planting, 45 Days After Planting and 60 Days After Planting, and root length. 45 Days After Planting and 60 Days After Planting. The best observation results were obtained in the K_3 treatment (9 mg/10 ml water).
2. Soaking duration of growtone had a very significant effect on the emergence time of shoots, the length of shoots aged 60 days after planting, but did not significantly affect the parameters of shoot length at 30 days after planting and 45 days after planting, the number of shoots aged 30 days after planting, 45 Days After Planting and 60 Days After Planting. The best observation results were obtained in L_1 treatment (soaking duration 30 minutes).
3. The interaction between PGR concentration and soaking duration had a significant effect on shoot emergence time. The best combination was found in the K_3L_1 treatment combination (9 mg/10 ml of water with 30 minutes of soaking duration).

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