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GROWTH OF RED DRAGON FRUIT (Hylocereus polyrhizus (WEBER) BRITTON & ROSE) PLANT SETTINGS AS A RESULT OF DIFFERENT SETTING LENGTH AND ROOTONE-F ZPT CONCENTRATION

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ABSTRACT

The increasing demand for red dragon fruit requires the provision of quality seeds. The aim of the study was to examine whether there was an interaction between the length of the cuttings and the concentration of ZPT Rootone-F which affected the growth of the cuttings and to determine the concentration of ZPT Rootone-F at each length of cuttings which produced the best dry weight of cuttings. Experiments using factorial RAK consisted of two factors repeated 2 times. Factor 1: cutting length (p) consisted of 4 levels: 5cm (p1)15cm (p2) 25 cm (p3)35 cm (p4) and the second factor was the concentration of Rootone-F (k): 500 gL-1 water (k1) 700 gL-1 water (k2) 900 gL-1 water (k3) 1100 gL-1 water (k4) Each treatment combination consisted of 6 samples with a total population of 192 cuttings. Cutting lengths of 15cm 25cm and 35cm produced the highest percentage of living cuttings: 91.63 % 97.88 % 97.88% compared to 5cm length: 45.75 %. Fastest shoot emergence time. Length of cuttings 35 cm: 27.19 dap. The highest number of shoots was produced by cuttings lengths of 35 cm and 25 cm, namely 2.2 and 2 shoots. Cutting length of 35 cm produced the longest shoot: 18.77 cm, the highest root volume: 30 cm3, the heaviest shoot fresh weight: 190.75 g and the heaviest shoot dry weight: 148.66 g. Rootone-F concentrations at various levels did not affect all observations. No interactions occurred. between the length of the cuttings and the concentration of rootone-F PGR on the growth of the cuttings, the length of the cuttings independently affected: Percentage of living cuttings (%), time of emergence of shoots (by date), number of shoots (strands), length of cuttings (cm), root volume (cm3)), shoot fresh weight (g) and shoot dry weight (g). The dry weight of shoots will increase by 4.77 units for each increase in cutting length. Cutting length of 35 cm resulted in the best growth of cuttings, namely time of emergence of shoots (DAP), number of shoots (strands), length of cuttings (cm), root volume (cm3), fresh weight of shoots (grams) and dry weight of shoots (grams).

Keywords : Length, cuttings, concentration, IAA, IBA, Auxine

INTRODUCTION

Increasing consumer demand in the market for dragon fruit (Hylocereus polyrhizus) as well as Indonesia as a supplier of dragon fruit, need to provide sufficient varieties, quality, suitable for production and dragon fruit to meet demand, to meet demand. Shofiana et al., (2013) cited by Sarawa et al. (2020) said that in order for seeds to remain available, it is necessary to take action to propagate or cultivate plants.

Generative plant propagation, the seeds produced are relatively long-lived and the percentage of success is quite low where many seeds fail to germinate (Marina, I. 2022).. This resulted in vegetative propagation, namely cuttings, which were chosen for the process of meeting seed needs, besides that propagating with cuttings can obtain the same characteristics as the parent, including disease resistance, fruit taste, etc. (Sapri, 2019).

The length of the cuttings will affect the growth of dragon fruit plant seeds, therefore cuttings must be taken from healthy and fruiting stems with a cut length of 20-30 cm (Rianto et al., 2016; Trisnaningsih et al., 2021). The treatment of cuttings length of 20 cm gave a significant effect on the time of bud emergence, root volume, root volume and root length of dragon fruit cuttings (Yustisia et al., 2019).

The treatment of the shortest cuttings length with the lowest Rootone-F concentration will have an impact on the growth of plant cuttings that are not good, on the other hand, with a cuttings length that is too long and a higher Rootone-F concentration, the growth is not necessarily high so it is

necessary to find the optimum cuttings length and Rootone-F concentration that produces maximum cuttings dry weight (Silviana et al., 2022).

MATERIALS AND METHODS

The research was conducted in Sindangsari Village, Cikaum Sub-district, Subang Regency which is at an altitude of 25 meters above sea level with a temperature range of 27oC - 31oC and an average rainfall of 75 mm/day. The research was conducted for 3 months from January to March 2023.

The research materials used were red-fleshed dragon fruit cuttings of various sizes, Rootone-F, soil and sand, manure, plastic bags measuring 25 cm x 25 cm and rope. The tools used included hoes, knives, measuring cups, electronic scales, paper labels, embrators, sprayers, soil media sieves, stakes, sign boards, meters and stationery. (Marina, I., Dkk. 2023)

The experiment used a Randomized Group Design (RAK) factorial pattern consisting of two factors and each treatment combination was repeated 2 times. The first factor is the length of cuttings (p) consisting of 4 levels and the second factor is Rootone-F concentration (k) consisting of 4 levels, with the following description:

Factor I: Cuttings length (p) consists of four levels:
p1 = 5 cm
p2 = 15 cm
p3 = 25 cm
p4 = 35 cm
Factor II: Rootone-F concentration (k) consists of three levels:
k1 = Concentration of 500 g L-1 water
k2 = Concentration of 700 g L-1 water
k3 = Concentration of 900 g L-1 water
k4 = Concentration of 1100 g L-1 water

Each treatment combination above consists of 6 plant samples so that the total population is 16 x 2 x 6 = 192 dragon fruit cuttings.

Data from the observations of each treatment were processed statistically using RAK factorial analysis of variance assisted by the Statistical Package for Social Science (SPSS) program. The linear model is arranged in the print of variance which can be seen in the form of table 4 through further tests carried out with the Duncan Distance Test (DMRT). Sukmawati, D., & Suryaman, S. 2024).

Data from the analysis of variance was obtained statistically based on the analysis of variance on each observation parameter measured and tested through real treatment using the Duncan Multiple Range Test at the 5% level.

To determine the optimum plant cuttings length (Y) and Rootone-F concentration (x) in order to produce optimum cuttings dry weight, the following regression model was used:

$y = \beta 0 + \beta 1x + \beta 2x2 + \varepsilon$ (4).

Based on the model, the estimated regression model is as follows:

$y = b0 + b1 + b2x2$ (5)

The optimum Rootone-F concentration to produce dry weight of dragon fruit plant cuttings used the following formula:

$Xopt = -b/2b2$

The maximum/minimum dry weight of dragon fruit cuttings is:

$Y\ max/min = b0 + b1\ (-b/2b2) + b2(-b1/2b2)2$ (6)

RESULTS AND DISCUSSION

Percentage of Live Cuttings (%)

The percentage of live cuttings (%) of Red Dragon Plants due to differences in cuttings length and Rootone-F ZPT concentration can be seen in Table 1.

Table 1. Percentage of Live Cuttings (%) of Red Dragon Plants Due to Differences in Cuttings Length and Rootone-F ZPT Concentration

Treatment	**Percentage Of Live Cuttings** (%)
Length Of Cuttings	
p_1 = 5 cm	45.75 A

p_2 = 15 cm	91.63	B
p_3 = 25 cm	97.88	B
P_4 = 35 cm	97.88	B
Concentration		
k_1 = 500 g L^{-1}	81.25	A
k_2 = 700 g L^{-1}	87.38	B
k_3 = 900 g L^{-1}	85.38	B
k_4 = 1100 g L^{-1}	79.13	B

Notes: The average number of treatments followed by the same letter in the column direction is not statistically significant according to Duncan's test at 5% real level.

Table 1 above shows that there is an independent effect between the treatment of dragon fruit cuttings length and Rootone-F concentration. The treatment of p2 = 15 cm; p3 = 25 cm and p4 = 35 cm had a better effect on the percentage of live cuttings compared to the treatment of p1 = 5 cm.

The length of cuttings with treatment p2 = 15 cm; p3 = 25 cm and p4 = 35 cm produced live dragon fruit plant cuttings with a higher percentage, namely: 91.63%; 97.88%; and 97.88% compared to the percentage of live plant cuttings produced by dragon fruit plant cuttings with a length of 5 cm (p1) which is 45.75%. Cuttings with a length of 5 cm produced the lowest percentage of live plants compared to cuttings length of 15 cm (p2); 25 cm (p3) and 35 cm (p4). However, cuttings of 15 cm (p2); 25 cm (p3) and 35 cm (p4) produced live cuttings with the same percentage.

Cuttings with a length of 5 cm produce living plants with a percentage of this causes the ease of plant disrupting organisms contaminating the stem of the cuttings, one of which is through plant watering activities. Splashing water becomes an intermediary for the entry or attachment of plant disrupting organisms to the stem of the cuttings. This is evidenced by the attack of fusarium disease (stem wilt) which attacks the stem of cuttings measuring 5 cm when the plant is 7 hst old, but in contrast to the stem of cuttings with a longer size, the overall stem of healthy cuttings is not contaminated by the disease so that cuttings with a length above 5 cm produce live cuttings with a percentage of 91 to 97%.

Different concentrations of Rootone-F namely k1 = 500 grams L-1; k2 = 700 grams L-1; k1 = 900 grams L-1; k1 = 1100 grams L-1 did not significantly affect the percentage of live cuttings of dragon fruit plants. Giving different concentrations of Rootone-F produced live dragon fruit plant cuttings with the same percentage, namely 81.25%; 87.38%; 85.38%; and 79.13%, respectively.

Giving ZPT Rootone-F with different concentrations does not affect the percentage of living cuttings. Parmila et al (2021) stated that to increase the rate of plant growth, ZPT administration needs to pay attention to the right concentration. This view is supported by Wattimena (1987) that the response of plants or plant parts to the hormones given will vary depending on the type of plant, age, environmental conditions, and the degree of reproductive growth. nutrition.

Shoot Emergence Time (HST)

The results of statistical analysis showed that there was no relationship that influenced each other (interaction) between the treatment of dragon fruit cuttings length and Rootone-F concentration on the time of bud emergence (hst) of dragon fruit plants (Appendix 8). The time of bud emergence (hst) of Red Dragon Fruit plants due to differences in the length of cuttings and Rootone-F ZPT concentration can be seen in Table 2.

Table 2. Time of Shoots Emergence (HST) of Red Dragon Fruit Plants Due to Different Lengths of Cuttings and Concentration of ZPT Rootone-F

Treatment	time buds emerge (HST)
length of cuttings	
p_1 = 5 cm	40.85 a
p_2 = 15 cm	29.72 ab
P_3 = 25 cm	31.51 b
P_4 = 35 cm	27.19 c
Concentration	
k_1 = 500 g L^{-1}	31.86 a
k_2 = 700 g L^{-1}	32.95 a
k_3 = 900 g L^{-1}	32.04 a
k_4 = 1100 g L^{-1}	32.42 a

Notes: The average number of treatments followed by the same letter in the column direction is not statistically significant according to Duncan's test at 5% real level.

Data table 2 above shows that there is an independent effect between the treatment of dragon fruit cuttings length and Rootone-F concentration. The different lengths of dragon fruit cuttings had a significant effect on the time of bud emergence (hst) of dragon fruit plants. The length of cuttings 35 cm (p4) produced shoots in a faster time of 27.19 HST compared to the treatment of p1 = 5 cm; p2 = 15 cm and p3 = 25 cm, namely: 40.85 HST; 29.72 HST; and 37.51 HST.

Cuttings length of 5 cm (p1) produced shoots with the longest time compared to the length of cuttings p3 = 25 cm and p4 = 35 cm. However, the 15 cm cuttings length treatment (p4) produced shoots in the same time. Giving different concentrations of Rootone-F, namely k1 = 500 grams L-1; k2 = 700 grams L-1; k1 = 900 grams L-1; and k1 = 1100 grams L-1 produced shoots in the same time, namely 31.86 HST; 32.95 HST; 32.04 HST and 32.42 HST respectively.

The longer the size of the cuttings, the more food reserves will be. Cuttings with a length of 35 cm (p4) are thought to have more food reserves than other lengths of cuttings so that in a relatively fast time the cuttings have been able to support the formation of buds. Silawati et al. (2021) determined that carbohydrates available in sufficient quantities have a very important role in root formation and rooting is one of the parameters that determine the success of cuttings growth in order to increase the time to grow shoots.

According to Winten, et al., (2017) there are several factors that affect the success of cuttings, namely the origin of the cuttings (the position of the cuttings on the parent plant), the length of the cuttings and the lip of the cuttings cuttings environment (medium rooting, temperature and humidity, light). In addition to sufficient food ingredients for the growth of cuttings, it is suspected that environmental conditions (rooting media, temperature and light humidity) and the selection of good cutting materials are also factors in the successful growth of cuttings (Pratama et al., 2020).

The application of ZPT Rootone-F with different concentrations did not give a significant effect on the time of bud emergence. Wareing and Philips (1978) in Parmila et al. (2021), each type of plant requires the right concentration that is suitable for its growth. ZPT Rootone-F at all concentration levels has no effect on the time of bud emergence, presumably endogenous auxins (phytohormones) contained in plants still have the ability to support the growth of cuttings, so cuttings do not need exogenous auxins. Febrina (2009) cited by Lutfia (2018) said that the formation of buds is important because it is the initial stage of primitive leaf formation, where leaves are plant organs with the largest amount of chlorophyll which functions as a place for photosynthesis.

Number of Buds (Helai)

Based on the analysis of variance, it shows that there is no relationship that affects each other (interaction) between the treatment of dragon fruit cuttings length and Rootone-F concentration on the number of buds per stem of dragon fruit plant cuttings (Appendix 9). The average number of shoots per stem of red dragon fruit cuttings due to different length of cuttings and concentration of ZPT Rootone-F can be seen in Table 3.

Table 3. Number of Shoots (strands) of Red Dragon Fruit Plants due to Different Lengths of Cuttings and Concentration of ZPT Rootone-F

Treatment	Number Of Buds (Helai)
Length Of Cuttings	
p_1 = 5 cm	1.10 a
p_2 = 15 cm	1.62 b
P_3 = 25 cm	2.00 bc
P_4 = 35 cm	2.21 c
Concentration	
k_1 = 500 g L^{-1}	1.63 a
k_2 = 700 g L^{-1}	1.73 a
k_3 = 900 g L^{-1}	1.97 a
k_4 = 1100 g L^{-1}	1.62 a

Notes: The average number of treatments followed by the same letter in the column direction is not statistically significant according to Duncan's test at the 5% real level.

Data table 3. shows that there is an independent effect between the treatment of cuttings length and concentration of ZPT Rootone-F on the number of buds (strands) per stem of the cuttings. The

length of the cuttings that increased was directly proportional to the increase in the number of buds per stem of dragon fruit plant cuttings, although in the treatment of 25 cm cuttings length (p3), the number of buds per stem of cuttings was not significantly different (the same) with the number of buds produced by cuttings with a length of 15 cm (p3) and 35 cm (p4).

Cuttings length of 5 cm (p1) produced the lowest average number of buds per cuttings compared to other treatments, namely 1.10 strands. The average number of shoots produced by cuttings with a length of 35 cm (p4) is 2.21 shoots, although it is not significantly different from the treatment of 25 cm cuttings length (p3) which produces the number of shoots per cuttings of 2 shoots.

The cuttings length of 35 cm (p4) produced the highest number of cuttings, namely 2.21 buds. Cuttings with a length of 35 cm are thought to have more food reserves than other cuttings with a shorter size so that the cuttings have more energy for growth, both as the formation of buds or other organs.

Seeds in good dragon fruit plants are seeds that have a minimum of four or more buds so that plants quickly produce productive branches (Sapri, 2019). High carbohydrate content makes it easier for cuttings to form roots, due to the rate of cell division and extension and growth (Pratama et al, 2020). The green stem of dragon fruit cuttings also functions as a leaf in the assimilation process so it is assumed that the longer the stem of the cuttings, the more green leaf substance so that the assimilation results will be higher (Kristanto, 2014).

Febriana, 2009 cited by (Silawati, 2021) that shoots are formed due to morphogenesis and differentiation by several cells that spur the formation of new organs.

The administration of ZPT Rootone-F independently has no effect on the number of shoots that appear on dragon fruit plant cuttings. Increasing the concentration of ZPT Rootone-F given to dragon fruit plant cuttings produces the same number of buds (strands).

Arifin and Ismail (2015) stated that the high and low results of using ZPT Rootone-F depend on several factors, one of which is the length of time the cuttings are soaked in a solution. The longer the cuttings are in the solution, the more the solution increases in the cuttings.

Shoot Length (cm)

Based on the analysis of variance, it shows that there is no relationship that affects each other (interaction) between the treatment of cuttings length and Rootone-F concentration on the shoot length of cuttings. The average shoot length per cuttings due to differences in cuttings length and ZPT Rootone-F concentration can be seen in Table 4.

Table 4. Shoot Length (cm) of Red Dragon Plants due to different lengths of cuttings and Rootone-F ZPT Concentration

Treatment	Bud Length (Cm)
Length Of Cuttings	
P_1 = 5 Cm	4.25 a
P_2 = 15 Cm	11.32 b
P_3 = 25 Cm	13.26 b
P_4 = 35 Cm	18.77 c
Concentration	
K_1 = 500 G L^{-1}	12.55 a
K_2 = 700 G L^{-1}	11.76 a
K_3 = 900 G L^{-1}	10.70 a
K_4 = 1100 G L^{-1}	12.60 a

Notes: The average number of treatments followed by the same letter in the column direction is not statistically significant according to Duncan's test at 5% real level.

Data Table 4. shows that there is an independent effect between the treatment of cuttings length and the concentration of ZPT Rootone-F on the length of shoots per cutting. The longer cuttings length is directly proportional to the increase in shoot length per cuttings, although the 15 cm (p2) and 25 cm (p3) cuttings length treatments produce the same shoot length of 11.32 cm and 13.26 cm.

The length of 5 cm cuttings (p1) produced the shortest average shoot length compared to the other 15 cm cuttings (p2); 25 cm (p3) and 35 cm (p4), namely 4.25 cm. Cuttings length of 35 cm (p4) produced the longest shoot length per stem compared to other treatments, namely 18.77 cm. Cuttings measuring 35 cm (p4) have sufficient food reserves to support shoot elongation. Planted stem cuttings require energy supply to form new vegetative organs. The process of cell division, elongation and differentiation depends on the amount of carbohydrates. If the rate of cell division and elongation, as well as tissue formation runs fast, the growth of roots, stems and leaves will also be fast (Silawati, 2021).

Trisnaningsih et al. (2015) stated that the content of cutting materials, especially carbohydrates and nitrogen, determines the growth of roots and shoots of cuttings. Carbohydrates that are available in sufficient quantities have a very important role to form roots and rooting which is one of the parameters for the success of cuttings growth so as to increase the length of the cuttings. According to Hafizah (2014), cell growth and development depends on the supply of nutrients provided by the roots for metabolism and protein synthesis, causing an increase in shoot length, thereby increasing the percentage of seeds.

According to Ramadan, et al (2016) 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. The use of growth regulators needs to pay attention to the concentration, the carrier, the time of use and the required plant parts. ZPT Rootone-F with different concentrations of 500 g L-1 (k1); 700 g L-1 (k2); 900 g L-1 (k3); and 1100 g L-1 (k4) independently had no effect on the length of shoots per cuttings of dragon fruit plants. Dragon fruit stem cuttings treated with ZPT Rootone-F with different concentrations produced the same length of shoots per cuttings of dragon fruit plants, respectively, namely: 12.55 cm; 11.76 cm; 10.70 cm; and 12.60 cm.

The content of Rootone-F consists of NAA and IBA which are auxin type hormones that when given at optimal concentrations and when supported by environmental conditions such as the availability of sufficient water in the planting medium and the fulfillment of light needs will accelerate the occurrence of physical processes that cause cell division to be faster so that the growth of shoots on cuttings develops optimally.

Rootone-F concentration when given at high and excessive concentrations, will cause the growth of shoot length to be inhibited (Mulyani and Ismail, 2015). This is in accordance with the opinion of Wirawan (1988) in putra., et al 2014) states that the content of Rootone-F is a compound of IBA and NAA which is a compound that has the working power like auxin (IAA), which at the right concentration will increase division, cell elongation and differentiation in the form of internode extension.

Root Volume (cm3)

The average root volume per cuttings of red dragon fruit plants due to differences in cuttings length and concentration of ZPT Rootone-F can be seen in Table 5.

Table 5. Root Volume (cm3) of Red Dragon Fruit Plant due to different length of cuttings and concentration of ZPT Rootone-F

Treatment	Root Volume (Cm^3)
Length Of Cuttings	
P_1 = 5 Cm	1.06 a
P_2 = 15 Cm	7.79 b
P_3 = 25 Cm	18.75 c
P_4 = 35 Cm	30.00 d
Concentration	
K_1 = 500 G L^{-1}	14.00 a
K_2 = 700 G L^{-1}	15.89 a
K_3 = 900 G L^{-1}	15.13 a
K_4 = 1100 G L^{-1}	12.58 a

Notes: The average number of treatments followed by the same letter in the column direction is not statistically significant according to Duncan's test at 5% real level.

Data Table 5, shows that there is an independent effect between the length of cuttings and the concentration of ZPT Rootone-F on the volume of roots per stem cuttings. The different length of dragon fruit cuttings independently significantly influenced the root volume (cm3) per cutting. The longer length of cuttings was directly proportional to the increase in root volume (cm3) per cutting.

Cuttings length of 5 cm (p1) produced the lowest average root volume compared to other treatments, while the highest average root volume was produced by cuttings length of 35 cm (p4). The average root volume of each treatment was: 1.06 cm3 (p1); 7.79 cm3 (p2); 18.75 cm3 (p3); and 30 cm3 (p4). Cuttings with a length of 35 cm (p4) in Table 9, shows that the root volume increases with the increase in the length of the cuttings. The longer the size of the cuttings, the greater the root volume. Root volume is influenced by the development of root length because the longer the roots of a plant, the root volume also increases.

Sarawa et al., 2021 stated that roots are the main vegetative organ that provides water, minerals and materials essential for plant growth and development (Gardner et al., 1991). The absorption of nutrients and water by the roots determines the growth of plants both on the upper surface and in the soil (Islami, 1995). Yunanda's opinion, et al (2015), that the ability of roots to absorb nutrients is higher, the photosynthesis process will run well so that the photosynthate produced will be allocated to all roots.

Rootone-F given with different concentrations independently had no effect on root volume per cutting. The cuttings treated with Rootone-F with different concentrations produced the same average volume of roots per cuttings of dragon fruit plants, namely: 14 cm3; 15.89 cm3; 15.13 cm3; 12.58 cm3. According to Swarup & Bhosale (2019) shoots that grow with sufficient carbohydrates can produce endogenous auxin which then auxin moves down or basipetal along with food reserves in the form of carbohydrates synthesized at the top of the plant and leaves so that it collects at the base of the cuttings to the root tissue to form roots (Silviana et al., 2022).

Fresh Weight of Shoots (g)

Based on the analysis of variance, it shows that the treatment of dragon fruit cuttings length and Rootone-F ZPT concentration do not affect each other on the average fresh weight per stem of dragon fruit plant cuttings). The average fresh weight (g) per stem of red dragon fruit plant cuttings due to differences in the length of cuttings and the concentration of ZPT Rootone-F can be seen in Table 6.
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Table 6. Fresh Weight of Shoots (g) of Red Dragon Fruit Plants due to different lengths of cuttings and concentration of ZPT Rootone-F.

Treatment	Sugar Bud Weight (Gram)	
Length Of Cuttings		
P_1 = 5 Cm	3.47	a
P_2 = 15 Cm	58.00	b
P_3 = 25 Cm	106.13	c
P_4 = 35 Cm	190.75	d
Concentration		
K_1 = 500 G L^{-1}	87.50	a
K_2 = 700 G L^{-1}	96.75	a
K_3 = 900 G L^{-1}	85.23	a
K_4 = 1100 G L^{-1}	88.88	a

Notes: The average number of treatments followed by the same letter in the column direction is not statistically significant according to Duncan's test at the 5% real level.

The data in table 10 above shows that different lengths of cuttings independently have a very significant effect on the average fresh weight of shoots (g) per cutting. The longer the size of the cuttings, the heavier the fresh weight of the shoots produced. Cuttings length of 5 cm (p1) produced the lowest bud fresh weight compared to other treatments, which was 3.47 grams. The length of 15 cm cuttings (p2) produced a higher bud fresh weight than the length of 5 cm cuttings but lighter than the 25 cm (p3) and 35 cm (p4) cuttings length treatments, namely 58 grams and 106.13 grams, respectively. The heaviest fresh shoot weight was produced by cuttings with a length of 35 cm (p4) which amounted to 190.75 grams.

The length of the cuttings increased followed by an increase in the fresh weight of the shoots produced. The longer the size of the cuttings, the more green leaf substance, the wider the area of photosynthesis process. The stem of dragon fruit cuttings functions as a leaf because it has a green color where this stem plays a role in the assimilation process besides that this stem contains a lot of cambium which functions in the process of plant growth (Kristanto, 2014).

Trisnaningsih (2015) in Pratama, et al., 2020, states that carbohydrates available in sufficient quantities have a very important role to form roots and rooting which is one of the parameters of successful growth of cuttings so as to increase the fresh weight of cuttings buds. According to Hafizah (2014), cell growth and development depends on the supply of nutrients provided by the roots for metabolism and protein synthesis.

The average fresh weight of shoots per cuttings of dragon fruit plants is not independently influenced by the application of ZPT Rootone-F at various concentration levels. Giving ZPT Rootone-F at various concentrations produces the same fresh weight of shoots per cuttings of dragon fruit plants. Wattimena (1987) states that the response of plants or plant parts to hormones given will vary depending on the

type of plant, age, environmental conditions, level of physiological development, especially the content of endogenous hormones and nutrients (Parmila, 2018).

Bud Dry Weight (g)

The results of statistical analysis of the average shoot dry weight (g) per stem can be seen in Appendix 13. Based on the analysis of variance, it shows that there is no interaction between the length of the stem of the cuttings with ZPT Rootone-F on the average dry weight of shoots per stem of dragon fruit plant cuttings (Appendix 13). The average dry weight of shoots (g) per stem of red dragon fruit plant cuttings due to different length of cuttings and concentration of ZPT Rootone-F can be seen in Table 7.

Table 7. Dry Weight of Shoots (g) of Red Dragon Fruit Plant due to different length of cuttings and concentration of ZPT Rootone-F

Treatment	Shoot Dry Weight (Gram)
Length Of Cuttings	
P_1 = 5 Cm	3.02 a
P_2 = 15 Cm	39.54 b
P_3 = 25 Cm	79.82 c
P_4 = 35 Cm	148.66 d
Concentration	
K_1 = 500 G L^{-1}	64.01 a
K_2 = 700 G L^{-1}	66.43 a
K_3 = 900 G L^{-1}	67.53 a
K_4 = 1100 G L^{-1}	73.05 a

Notes: The average number of treatments followed by the same letter in the column direction is not statistically significant according to Duncan's test at the 5% real level.

Table 7. shows that different lengths of cuttings independently have a very significant effect on the average dry weight of shoots (g) per cuttings of dragon fruit plants, in contrast to the treatment of different concentrations of ZPT Rootone-F, independently has no effect on the dry weight of shoots (g). The longer the size of the cuttings, the heavier the shoot dry weight. Cuttings length of 5 cm (p1) produced the lowest shoot dry weight compared to other treatments, namely 3.02 grams.

The cuttings length of 15 cm (p2) produced a higher shoot dry weight than the 5 cm cuttings length but lighter than the 25 cm (p3) and 35 cm (p4) cuttings length treatments which were 39.54 grams; 79.82 grams and 148.66 grams respectively. The heaviest shoot dry weight was produced by cuttings with a length of 35 cm which amounted to 148.66 grams.

Productivity or a measure of plant growth is more relevant using the dry weight of the stems or plant parts (Nyakpa et al., 1988 in Lutfia et al., 2017; Salisbury and Ros, 1995).

Sarawa et al (2021) stated that photosynthesis results in an increase in dry weight due to carbon dioxide uptake, while respiration causes carbon dioxide release, thereby reducing dry weight. The length of the cuttings affects the distribution of photosynthates, thus affecting the dry weight of the plant. Dry weight is an important variable to determine the accumulation of biomass and photosynthetic balance in each plant organ (Mahmud et al., 2002; Gardner et al., 1991). Shoot dry weight is related to root volume. The greater the root volume, the greater the ability of plants to absorb water, nutrients and other minerals that are important in physiological processes and plant growth will be more fulfilled. The more nutrients and important minerals contained in the plant will be able to increase the growth of oven dry weight of shoots per cutting (Parmila et al., 2017).

The average dry weight of shoots per cuttings of dragon fruit plants is not independently influenced by the administration of ZPT Rootone-F at various concentration levels. The application of ZPT Rootone-F at various concentrations produces the same shoot dry weight per cuttings of dragon fruit plants.

Regression of Fresh Weight of Shoots (g)

Regression data of the length of red dragon fruit plant cuttings with fresh weight of shoots and statistical analysis can be seen in Appendix 13. The curve picture of the linear relationship between the length of red dragon fruit cuttings and the fresh weight of the shoots of red dragon fruit cuttings as shown below:

In both regression models (linear and quadratic), the length of cuttings significantly affects the fresh weight of shoots [sig. value in ANOVA table <0.05%] with a determination level of >85% [Model

Summary table]. Linear regression model is the right model because the significance value of each coefficient is significant in the linear model so that the regression equation is obtained:

Linear Regression Equation

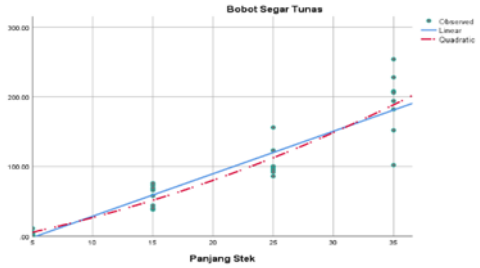
Y = a + bx

Y = -32.403 + 6.1 x

= 6.1x - 32.403

Based on the above calculations, it shows that every increase in the length of the cuttings will be followed by an increase of 6.1 units of fresh weight of the cuttings of red dragon fruit plants.

Regression of Bud Dry Weight (g)



Picture 1. Regression of shoot dry weight

Regression data of the length of red dragon fruit cuttings with shoot dry weight and statistical analysis can be seen in Appendix 13. The curve image of the linear relationship between the length of red dragon fruit cuttings and shoot dry weight of red dragon fruit cuttings as shown below:

In both regression models (linear and quadratic), the length of cuttings significantly affects the shoot dry weight of red dragon fruit cuttings [sig. value in ANOVA table <0.05%] with a determination level of >85% [Model Summary table]. Linear regression model is the right model because the significance value of each coefficient is significant in the linear model so that the regression equation is obtained:

Linear Regression Equation

Y = a + bx

Y = -27.625 + 4.772 x

= 4.772 x - 27.625

Based on the above calculations, it shows that any increase in the length of the cuttings will be followed by an increase of 4.772 units of dry weight of the cuttings of red dragon fruit plants.

CONCLUSIONS

Conclusion

Based on the results and discussion, the following conclusions can be drawn:

1. There is no interaction between the length of cuttings and the concentration of ZPT Rootone-F on the growth of red dragon fruit cuttings. Independently, the length of 35 cm cuttings has the best effect on the emergence time of new shoots, the number of new shoots, the length of new shoots, root volume, fresh weight of new shoots and dry weight of new shoots.
2. Fresh weight of cuttings of red dragon fruit plants will increase by 6.1 units at each increase in the length of cuttings used. Similarly, the dry weight of the cuttings of red dragon fruit plant cuttings produced will increase by 4.77 units at each increase in the length of the cuttings used.

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