Chrysanthemum Sp. Plant Growth and Development Response Due To Application of Plant Growth Regulator (PGR) and Covering in Plantlet Acclimatization

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Abstract: **-** The research was conducted at the BIH Kutagadung Berastagi Experimental Garden, Karo Regency, April-June 2021. The research aim was to determine the function of providing shelter and PGR concentration on the growth and development of chrysanthemum plantlet acclimatization. This study used a factorial randomized block design (RBD) with two treatment factors: first, containment consisted of 2 treatment levels, namely: without a cover (S0), using a plastic covers (S1). The second factor was the use of soaking time with ZPT which consisted of 4 treatment levels, namely: concentrations of 0 ml/l water (Z0), 3 cc/1 water (Z1), 6 cc/1 water (Z3), and 6 cc/l water (Z). The results showed that containment gave no significant difference ($p < 0.05$) in plant growth from 14 days after planting (dap) to 49 dap, stem diameter while the use of immersion time with PGR had a significantly different effect ($p > 0.05$) on plant height growth (56 dap and 63 dap), number of tillers and production (number of flowers per sample and flower per plot) were better than organic fertilizers. The use of long immersion with a plant growth regulator (PGR) with 6 ml/l water (Z2) was able to increase the optimum growth and production of chrysanthemum plants. The combination of the two factors tested showed no significant differences in each of the parameters observed.

Keywords: Chrysanthemum flower, PGR, cover, acclimatization, immersion
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1. Introduction

Chrysanthemum sp. is one of the cut flowers and potted plants that are favoured by the wider community, especially the upper middle class. Not surprisingly, chrysanthemum is very popular and traded internationally (Hayati et al. 2018; Pratiwi, 2022). Chrysanthemum is included in the top 10 ornamental plants traded in more than 150 countries (Handajaningsih & Wibisono 2009). Therefore, the chrysanthemum is an ornamental plant that has quite a high economic value (Afandi & Sulistyo, 2019). Chrysanthemum flowers (Chrysanthemum sp.) have various advantages including having a character that does not fade easily and the color variations and flower shapes are very diverse with beautiful color combinations (Hayati et al. 2018). These various advantages make chrysanthemum a mainstay commodity in the horticulture industry which has very promising market prospects. That is why the market demand for chrysanthemum flowers continues to increase both in the domestic and internationally (Pratama Y. 2020).

In terms of the advantages of farming, chrysanthemum plants are easy to cultivate, harvest time is relatively short, flowers can be harvested simultaneously, flowering time and harvest time can be adjusted according to market needs (Hayati et al. 2018). Efforts to increase the production and quality of chrysanthemum flowers to meet national needs are still hampered by the low level of technological capability mastered by farmers, while the export market still encounters obstacles, namely the quality of the flowers produced cannot compete with products from abroad, the low level of production efficiency, government policies that have not been much supportive, the ability to access international markets is lacking, and do not have a license to grow chrysanthemums from the country of origin of chrysanthemums (Budiarto et al. 2006; Budiarto & Marwoto 2009). To improve the quality of the flowers produced, one of the issues that have not been reported is the use of PGR and hoods in the production process. In this study, we address to one research question, does the use of PGR and covering affect the growth and yield of chrysanthemum plants?

Plant growth regulator (PGR) functions to stimulate growth, development and movement of plant taxis by stimulating, inhibiting or changing them. PGR does not include nutrients, differences in function, form or constituent compounds. Plants are able to produce their own PGR (endogenous) to influence its growth. PGR have a very important role for plant growth and development. Plant Growth Regulatory Substances or hormones (phytohormones) are organic compounds that are not nutrients, PGR in small amounts can stimulate, inhibit and can change plant physiological processes. Plant hormones (phytohormones) are a group of organic compounds, both naturally occurring and man-made. PGR in very small levels are able to provide effects or reactions biochemically, physiologically and morphologically. PGR functions to influence The cultivation of chrysanthemums has long been known in mountainous areas, for Cipanas since the Dutch colonial era (Soekartawi, 1996). Potted chrysanthemums have the advantage of being easy to carry and set up for decoration purposes as well as being durable. Potted chrysanthemums have the advantage of being easy to carry and set up for decoration purposes as well as being durable. Potted chrysanthemum flowers can stay fresh for 10 days (Prihatman, 2000). The ideal potted chrysanthemum plant height is about 2 to 2.5 times the height of the pot (Gayatri, 2011). The quality of the potted chrysanthemum is mainly seen from plant height, flowering synchrony, and the balance between the crown and flowers with plant height (Anonymous, 2011). This is in line with the increasing demand for Chrysanthemum cut the growth, development and movement of plant taxis by stimulating, inhibiting or changing them. PGR does not include nutrients or nutrition, differences in function, form or constituent compounds (Hariyadi aqua,, 2019). PGR Gibgro is a plant growth regulator that can be used on various types of plants and at various levels of plant growth. Gibgro contains GA3 which is the biggest contributor to the activity of plant growth regulators. Gibgro is formulated in the form of flour which dissolves properly in the spray solution without leaving residue, can be applied to plant types and at various growth stages, especially at the stages of vegetative and generative development. Gibgro made by Nuafarm America which is completed to high quality standards for easy use and the right dose size (Brochure Gibgro Nufarm, 2013).

Chrysanthemums can grow well in medium to high altitudes (600-1200 m asl). In Indonesia, several areas which are centers for the production of ornamental chrysanthemum plants include Cipanas (Cianjur), Sukabumi, Lembang (Bandung), Bandungan (Central Java), Malang (East Java), Berastagi (North Sumatra). Currently, chrysanthemum has been cultivated in other areas, such as West Nusa Tenggara, Bali, North Sulawesi, and South Sumatra (Budiarto, *et* al., 2006).

Apart from being a cut flower, the chrysanthemum is also a potted flower. The development of the potted ornamental plant industry began in the 1940s.

example in Cipanas and Cianjur. This business has been run by flower growers in flowers so agribusiness opportunities need to be continuously developed (Kurniawati, 2007).

The chrysanthemum flower is a commercial plant that is easy to develop and cultivate. Chrysanthemums also have quite high economic value (Afandi & Sulistyo, 2019). Cultivating horticultural ornamental plants such as chrysanthemum ornamental plants is a fairly profitable business. The price of these ornamental plants can also compete with other ornamental plants (Widyawati N. 2019). Chrysanthemum plants are annual plants that range from 9-12 days depending on the variety and the environment in which they are planted. Chrysanthemum plants can be maintained for several years if desired, but the flowers produced usually decrease in quality (Sanjaya and Yuniarto, 2013).

Chrysanthemum plant seeds can be obtained from tissue culture or cuttings.

A very important step in tissue culture technique is the acclimatization of plantlets grown in vitro to the screen house or directly to the field. Acclimatization is the final activity of tissue culture techniques, namely the process of moving plantlets from a controlled environment (aseptic and heterotrophic) to uncontrolled environmental conditions, both temperature, light and humidity and plants must be able to live in autotrophic conditions. If the plants (plantlets) are not acclimatized first then the plants (plantlets) cannot survive in field conditions (http://zaifbio.wordpress.com/2011/06/17/laporan-magang-tanaman-krisan).

One of the obstacles in the process of plant acclimatization is the high transpiration (evaporation) process which can cause loss of water content in plant tissues. One method that can be used to retain moisture in the media is the lid method. Cover can suppress the transpiration process so that moisture will be maintained. Some orchid practitioners have practiced the hood method for orchid acclimatization. In plain view the yield of orchid seedlings using the lid method can be successful because the survival rate reaches 98% and it saves time for watering (Sudartini *et* al., 2020.)

2. Methods

This research was conducted at the Kutagadung Berastagi Horticulture Center, Berastagi District, Karo Regency, North Sumatra, Indonesia, at an altitude of ± 1250 meters above sea level, from April to June 2022. The study used a Factorial Randomized Block Design (RBD) with 2 treatment factors, i.e. Factor I with 2 levels: use of cover (S) S0: without cover, and S1: use of cover. Factor II consists of 4 levels with long immersion (Z): Z0: control, Z1: 3 minutes in cc/1 litre of water, Z2: 6 minutes cc/1 litre of water, and Z3: 9 minutes in cc/1 1 litre of water, so the number of treatments was 32 combination treatments with 4 replications. Plant spacing 6 cm x 6 cm, number of plants per plot 15 plants, plot size 60 cm x 50 cm x 20 cm, the distance between plots 10 cm, the distance between replicates 15 cm, number of samples per plot 4 plants. Parameters observed were plant height (cm), number of tillers (buds), number of flowers per sample (flowers), and number of flowers per plot (buds)

3. Results and Discussion

Table 1: Average height of chrysanthemum plants from the outcome of containment and soaking time at 14 – 70 dap.

Treatments	Days after planting								
	14	21	28	35	42	49	56	63	70
S_0	7,63a	8,86a	11,76a	14,35a	17,32a	23,02b	34,25	45.06b	51,76b
S_1	6,13a	8,30a	11,87a	15,47a	18,37a	25,29a	36,63	47,64a	54,60
Z_0	7,62a	8,16	11,09a	14,03a	16,62a	22,63b	33,77c	44,21c	50,92c
Z_1	6,33a	8,46a	11,93a	14,57a	17,56a	23,94ab	35,27bc	46,02bc	52,72b
Z_2	7,18a	9,18a	12,08a	15,35a	18,15a	24,48a	35,21ab	46,56ab	53,77ab
Z_3	6,39	8,52a	12,15a	15,71a	18,83a	25,58a	36,91a	48,61a	55,31a

Note: The same letters in the same average column are not significantly different at the 5% level.

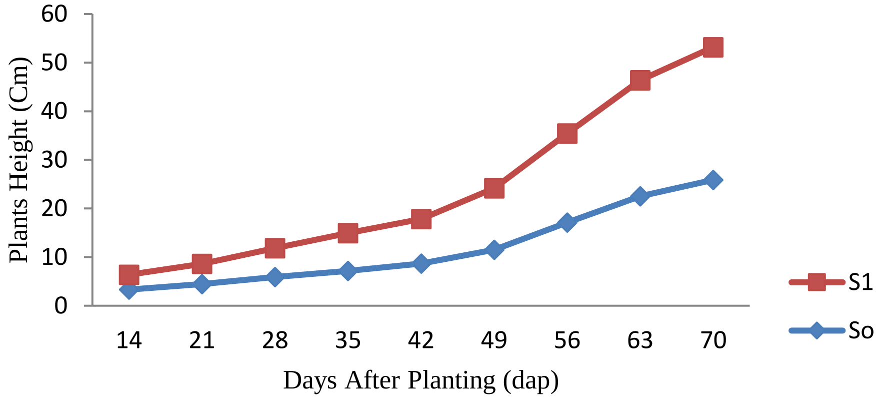

Fig.1. Plant Height Growth From the Effect of covering from 14 to 70 dap

Plants height (cm)

Data on the height of chrysanthemum flower plants were measured 21 days after planting (dap) to 81 dap with an interval of 7 days with the results listed in Table 1.

Table 1 shows the growth of plant height due to the effect of covering at 14 days after planting (dap) increasing slowly up to 70 dap. At 14 to 42 dap there was no effect of containment and immersion time. The effect of supplementation was significantly different ($p < 0.05$) from 49 dap to 70 dap. The development of plant height from the influence of the lid (S) of observation to 70 dap was stronger the effect of the lid can be seen in Fig. 1.

Coverage (S1) at 70 dap resulted in the highest growth in plant in an average of 54.60 cm, while without containment (S0) the plant height was lower of 51.76 cm. However, the effect of the two treatments on plant height was better than that without containment. Furthermore, the effect of soaking time using PGR on plant height of chrysanthemum plantlets at 70 dap showed that using soaking time resulted in better plant height. Plant height growth from 14 to 70 dap can be seen in Fig.2.

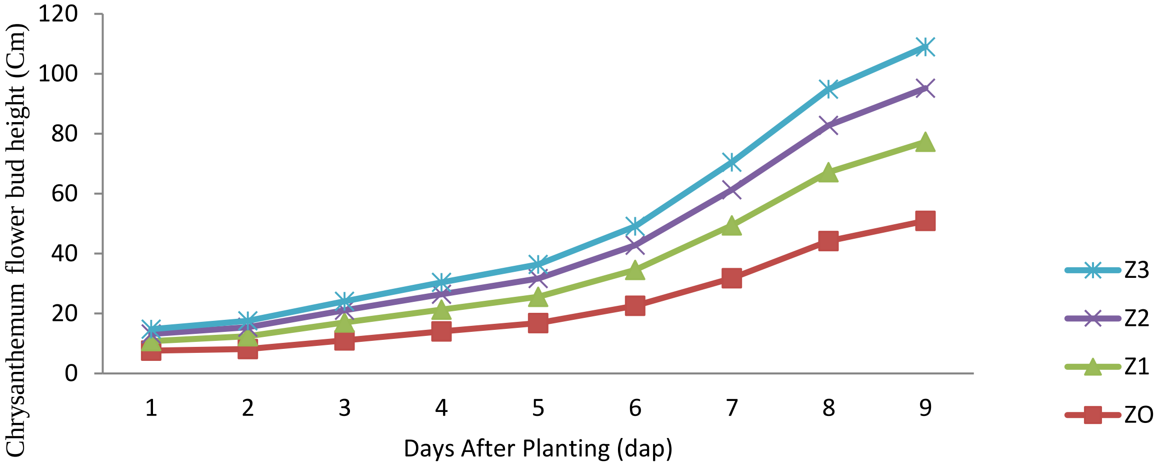

Fig. 2. Plant Height Growth From old influences Immersion with PGR from 14 to 70 dap

The effect of soaking time with PGR (Z) on chrysanthemum plant height from plantlet transfer to 72 dap was significantly different ($p < 0.05$) i.e. Z3 treatment (9 minutes of immersion) was the highest with an average of 55.31 cm. These results were not significantly different from 6 minutes of immersion (Z2) 53.77 cm. However, the growth in plant height from treatment without immersion with PGR (Z0) only resulted in an average plant height of 51.76 cm, almost the same as 3 minutes of immersion (Z1). Thus, the recommended treatment from the results of this study was to use 6 minutes of immersion (Z2)

The effect of soaking time responds to plant height growth, namely there is a positive correlation, the longer the soaking the faster the plant height growth. Based on the response curve, a linear equation is obtained $\hat{Y} = 0.474 Z + 51.04$, and $r = 0.99$, shown in Fig. 3 .

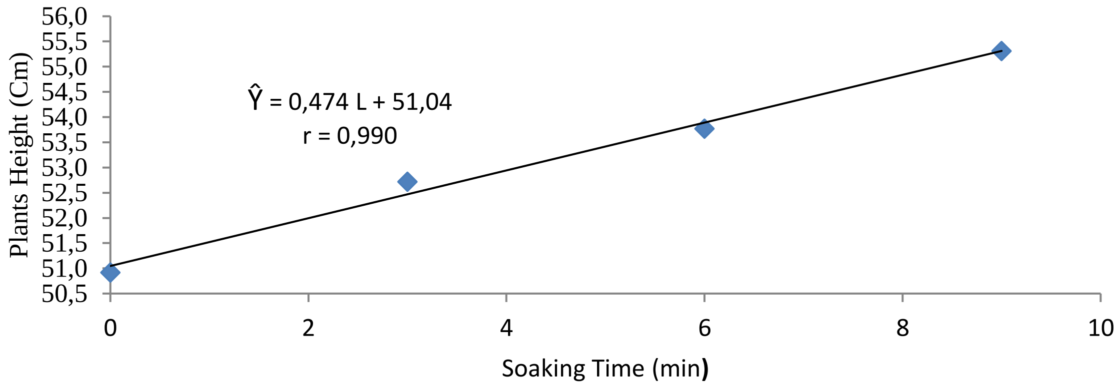

Fig.3. Response curve for the effect of immersion time with PGR on plant height of chrysanthemum

The result of the combination treatment between the use of the cover (S) and the length of immersion with different PGR was not significant. However, to obtain the best plant height, the use of cover (S) with 6 minutes of immersion (Z2) was using PGR (S, Z2).

Number of tillers (shoots)

The number of chrysanthemum tillers was influenced by the absorption (S) and soaking time (Z). The results of observing the increase in the number of tillers of the chrysanthemum plant were carried out once, namely when the chrysanthemum plant was 70 dap. The results of observing the number of tillers from the effect of enclosing and soaking time on the growth of chrysanthemum flowers are shown in Table 2

The highest number of tillers was found in cover (S1) with an average of 8.75 shoots compared to 6.77 shoots without cover (S0). The results of data analysis showed that the coverage factor between S0 and S1 was significantly different ($p < 0.05$). The number of tillers of the chrysanthemum plants (Table 2) was found to be significantly different from the effect of soaking time ($p < 0.05$). The average number of shoots found in the 6-minute long immersion (Z2) treatment was 8.20 shoots, not significantly different from the 9-minute soaking time (Z3) of 9.0 shoots. The same thing was found at 3 minutes of immersion (Z1) 7.20 shoots, not significantly different from Z2, 8.20 shoots (Table 2).

Without immersion (Z0) was the least growth in the number of tillers of chrysanthemum flower plants with an average of 6.53 shoots, not significantly different ($p > 0.05$) to the use of 3 minutes immersion treatment (Z1), but significantly different to 6 and 9 minutes of immersion (Z2 and Z3). The effect of soaking time responds to the number of chrysanthemum tillers. Based on the analysis, a positive correlation was obtained i.e. the longer the immersion, the faster and more growth in the number of tillers. Based on the response curve, a linear equation obtained $Y = 0.29\ Z + 6.453$, and $r = 0.99$ (Fig. 4).

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Table 2. The average number of chrysanthemum flower tillers from the influence of the lid and the length of immersion with PGR.

Treatments	Z_0	Z_1	Z_2	Z_3	Average
S_0	5.93	6.40	6.87	7.87	6.77 b
S_1	7.13	8.99	9.53	10.33	8.75 a
Average	6.53 c	7.20 bc	8.20 ab	9.10 a	

Note: Letters in the same column and row are not significantly different at the 5% level.

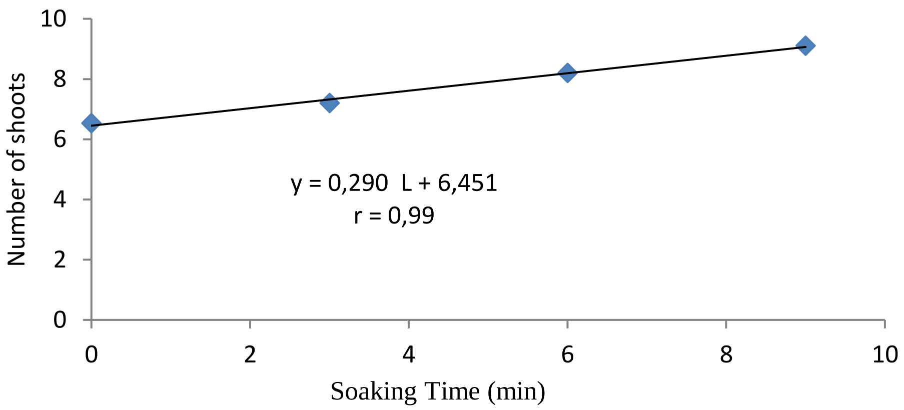

Fig. 4. Response curve for the effect of soaking time on the number of chrysanthemum flower tillers

Fig.4. Response curve of soaking time on the number of tillers on the growth of chrysanthemum flowers due to the effect of the combination treatment between the use of a lid (S) and the duration of immersion with PGR which had no significant effected ($p > 0.05$). Table 2 shows the interaction effect of using a cover (S) with 6 minutes of immersion (Z2) using PGR (S, Z2). If one of the factors, whether used or without a cover, followed by a reduction in soaking time results in a change in plant height growth.

Amount of Bud per Sample

By calculating the number of flowers present in each sample of the chrysanthemum plant, it was shown that the PGR (Z) soaking time had a significant effect ($p <0.05$), as presented in Table 3 below. The effect of cover-up (S) on the number of flowers and the number of shoots was higher with cover-up (S1) with an average of 13.83 flowers. Compared to no cover (S0), the number of chrysanthemum shoots was lower, namely only 12.55 flowers. So in order to produce a lot of flowers it is necessary to cover it.

The results of statistical analysis of the number of chrysanthemum flowers produced (Table 3) showed the effect of soaking time using PGR ($p > 0.05$) at 6 minutes of immersion (Z2), the average number of flowers produced was 13.77, and at 9 minutes of immersion (Z3) is 13.83. However, the interest amount on Z1 is 12.93. Soaking with PGR for 6 minutes (Z2) is the recommended treatment for the growth of chrysanthemum cuttings in the field.

The least growth in the number of flowers of the chrysanthemum plant was Z0 (control), 12.23 flowers, not significantly different from the 3 minute immersion treatment (Z1), but significantly different from the 6 and 9 minute immersion time (Z2 and Z3). The effect of soaking time responds to the production of the number of flowers on chrysanthemum plants. Based on the analysis, a positive correlation is obtained i.e. the longer the soaking the faster and the greater the number of tillers. Based on the response curve, a linear equation is obtained $\hat{Y} = 0.187\ Z + 12.34$, and $r = 0.95$, as shown in Fig. 5

Table 3. The average number of flowers per sample of chrysanthemum is affected by the lid and soaking time with PGR.

Treatments	Z_0	Z_1	Z_2	Z_3	Average
S_0	11.07	12.60	12.87	13.67	12.55 b
S_1	13.40	13.27	14.67	14.00	13.83 a
Average	12.23 c	12.93 bc	13.77 ab	13.83 a	

Note: The same letters in the mean column are not significantly different at the 5% level.

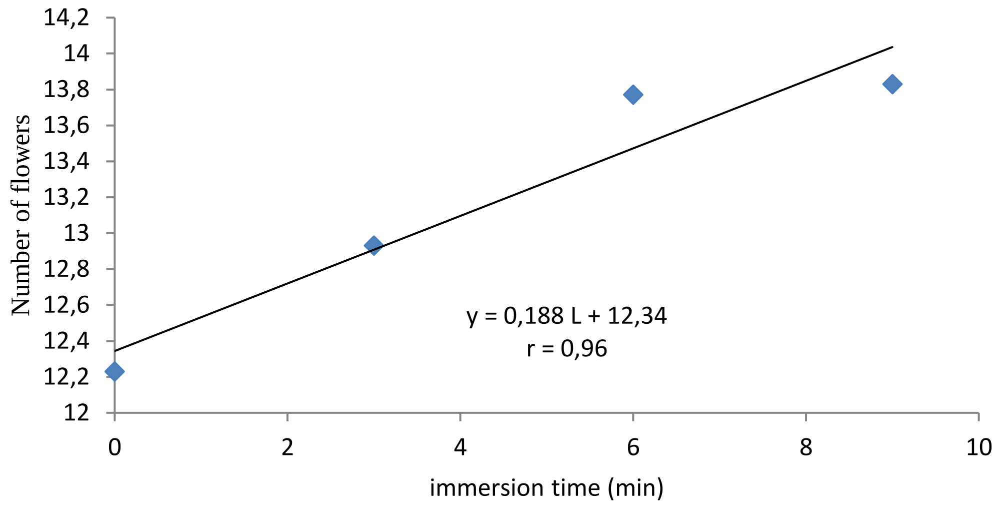

Figure 5. Response to the effect of soaking time on the number of chrysanthemum flowers

The effect of the combination treatment between the use of the cover (S) and the length of immersion with PGR was not significantly different (p> 0.05). However, to obtain the highest number of plant flowers produced by using a lid (S) with 6 minutes of immersion (Z2) using PGR (S, Z2).

Number of Flowers per Plot

The results of observations by calculating the number of flowers per plot produced by chrysanthemum plants were affected by the covering (S) and PGR soaking time (Z) which had significantly different effects (p <0.05) Table 4.

Table 4. The average number of flowers per plot of chrysanthemum from the influence of the lid and the soaking time with PGR

Treatments	Z_0	Z_1	Z_2	Z_3	Average
S_0	33.80	35.20	36.60	39.60	36.30 b
S_1	37.40	40.00	44.60	47.00	42.25 a
Average	35.60 c	37.60 bc	40.60 ab	43.30 a	

Note: The same letter in the average column shows no significant difference at the 5% level.

The effect of covering for chrysanthemum growth (S) and the number of flowers/plot was significantly different ($p<0.05$) namely, the installation of the lid (S1) resulted in the number of flowers/plot with an average of 42.25 flowers. Meanwhile, without containment (S0), the number of flowers/plot looks less, namely an average of 36.30 flowers per plot. Therefore to produce flowers in growing cuttings, it is better to use cover. The results of statistical analysis of the number of flowers per plot of chrysanthemum plants that can be produced (Table 4) from the effect of soaking time using PGR showed a significant difference ($p> 0.05$) i.e. 6 minutes of immersion (Z2) produced an average number of flowers of 40.60 flowers /plot. Soaking time of 9 minutes (Z3) resulted in an average of 43.30 flowers per plot and Z1 (3 minutes immersion) 37.60 flowers/plot, not significantly different from Z2. Therefore, immersion treatment with PGR for 6 minutes (Z2) is recommended for the growth of chrysanthemum cuttings in the field.

Treatment without immersion (Z0) resulted in the growth of the least number of chrysanthemum flowers, namely 35.60 flowers/plot, not significantly different ($p > 0.05$) to the 3 minutes immersion treatment (Z1), but significantly different to the 6 and 9 minute immersion time (Z2), and (Z3). The effect of soaking time responds to the number of tillers of the chrysanthemum plant and a positive correlation is obtained, namely the longer the soaking the faster and the more the number of flowers per plot grows. Based on the response curve, a linear equation is obtained $Y = 0.87 Z + 35.36$, and $r = 0.99$, as depicted in Fig. 6.

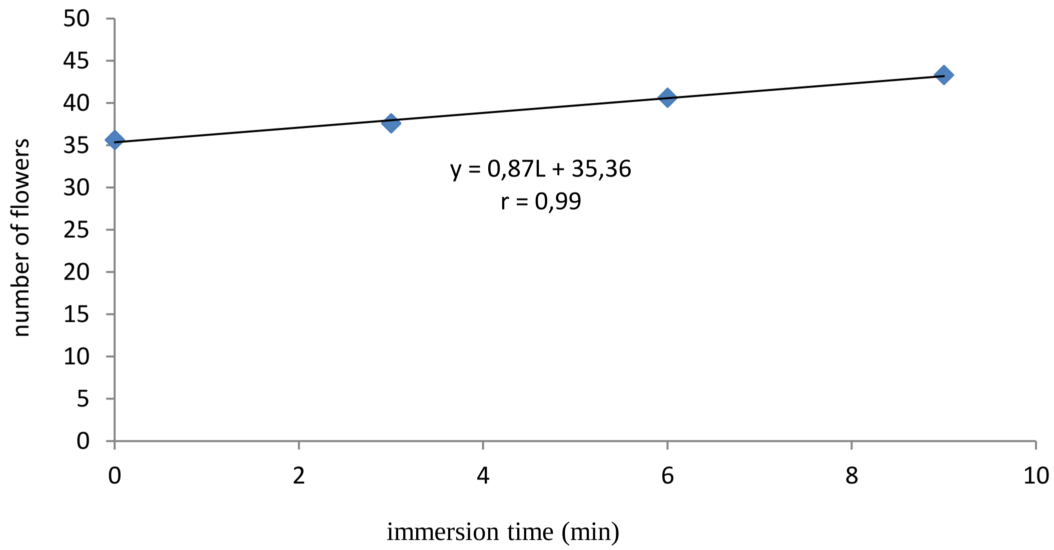

Figure 6. Response curve for the effect of soaking time with PGR on the number of flowers per plot

The effect of the combination treatment between the use of the cover (S) and the length of immersion with PGR had no significant different effect ($p > 0.05$). However, the highest number of tillers was produced by using a cover (S) with 6 minutes of immersion (Z2) using PGR (S, Z2). If one of the factors is removed, either the use of a cover or a reduction in soaking time or even both, it can result in a change in plant height growth.

4. Discussion

The effect of covering for chrysanthemum growth (S) and the number of flowers/plot was significantly different ($p<0.05$), namely, the installation of the lid (S1) resulted in the number of flowers/plot with an average of 42.25 Data from observations obtained from the field and the results of the statistical analysis found that the effect of using a hood (S) had a significant effect ($p <0.05$) on the vegetative and generative growth of chrysanthemum (Chrysanthemum indicum L). Tests based on covering chrysanthemum flowers in plant propagation show that coverage is an important factor in propagating chrysanthemum cultivation. These results are in accordance with the results of the study (Sintya et al, 2017), which was tested on Kastuba plants (Euphorbia pulcherrima Wild.). This is because the cover is a light-limiting tool for plants as well as controls the evaporation system of plants, especially during the growth and development of cells (Devy, et al 2015). There are three factors for solar radiation on seedlings, namely the intensity of sunlight, quality, and duration of irradiation (Sulistyaningsih, 2005).

Several factors in the successful growth of chrysanthemum plantlet seedlings in the presence of a lid include regulating the entry of light to determine the growth of chrysanthemums, regulating humidity which plays an important role in growth and humidity which affects chrysanthemum flower production (Rahayu. N. 2022). Chrysanthemum plants need 90-95% humidity at the start of growth for root growth; whereas in mature plants, optimal growth is achieved at humidity around 70-85% (Anonymous, 2021).

The parameters observed and the results of the analysis (Tables 1, 2, 3, and 4) can be seen as the effect of coverage on the growth and flower production of chrysanthemum plants in the field. Two different cover treatments obtained significant differences ($p > 0.05$) for all parameters used. Transferring seedlings through plantlets is a fast multiplication that produces both quantity and quality. Therefore, another reason for using plantlets by means of coverage can be used as a method in cultivating chrysanthemum plants, especially because the method is very simple, does not require complicated techniques, and can be done by anyone (Wiraatmaja, 2017).

The results of the study were influenced by the use of a cover on the growth of chrysanthemums. In accordance with the results of research on Caisin (Brassica chinensis) showed that the provision of a plastic cover causes better growth and yield of casein compared to treatment without a cover. The effect of giving cover was seen in the increase in plant height, leaf area, leaf area index, crown-root ratio, harvest index, and shoot fresh weight 2 weeks after planting. However, the application of a plastic cover caused a decrease in the net assimilation rate, root fresh weight, and root dry weight (Shintia et al. 2017). The clear lid was able to increase the number of leaves, leaf area, net assimilation rate, leaf area index, plant growth rate, and fresh and dry weight of shoots and roots (Lewu, L.D., Y.M Killa. 2020). While the red cover had a good effect on plant height, leaf area, net assimilation rate, leaf area index, and shoot fresh weight. Growth. and the yield of casein in a cover is better than casein that is not covered (Sulistyaningsih E et al., 2005).

Furthermore, data from observations obtained from the field and statistical analysis found that the effect of using the soaking time had a significant effect ($p > 0.05$) on the vegetative and generative growth of chrysanthemums both in terms of quality and quantity of planting. The results obtained showed the growth of plant height, number of shoots, number of flowers/samples, and flowers per plot. A soaking time of 6 minutes (72) applied to plantlets gave good results. Furthermore, 9 minutes of immersion (Z3) resulted in slightly better growth but took a long time in plantlet immersion, and Z1 and Z0, did not have a significantly different effect, so Z2 is the recommended immersion time in plantlet nurseries in the field.

The growth regulators play a role in the growth and development of the survival of chrysanthemum plantlets (Purnomosidhi, 2002). Abidin (1985) mentions that without growth regulators, there is no plant growth. Holmes et al (1970) said that Gibberellin (GA)) is a growth regulator which has a physiological effect in the form of reducing apical dominance. The speed of growth is also affected by the availability of nutrients (Rinaningsih, 2019). The availability of nutrients responds to the absorption of nutrients by plant roots thereby increasing growth and production. Novizan (2002) and Sutejo (2002) stated that if a plant is deficient in an element it will result in stunted root formation. The results of this study indicate that soaking time affects the growth and production of chrysanthemum plants. These results are consistent with the results of other studies that immersion in Rhizobakteri culture supercharged had an effect on increasing the growth of J. curcas L cuttings. The concentration factor had an effect on increasing root weight, while the immersion time factor had an effect on increasing the number of leaves and root length (Pamungkas, 2009). Meanwhile, the results of observations and analysis of variance showed that there was no significantly different interaction ($p < 0.05$) between the treatment using the cover and the length of immersion of the plantlets on the growth of chrysanthemum plants. This situation is caused by the formation of roots in plants supported by appropriate environmental conditions. Unfavourable conditions in plant growth can be stimulated by providing a lid. This shows that success in growth and flower production can be obtained higher and more are obtained by using a lid and accompanied by a long soaking time of 6 minutes.

After experiencing root growth in the plant cover, the plant roots can continue to extract nutrients from the soil, along with the nutrient content in the soil that supports growth. The two factors that were tested, both containment and immersion time using ZPT, gave positive responses to each other in increasing both vegetative and generative growth (Shahrul Arifin *et* al, 2020). Syofia (2015) states that if one of the factors has a stronger influence than the other factors, then the influence of these factors is covered and if each factor has a very different nature of influence and nature of work it will produce a relationship that has no significant effect in supporting growth and production of plants. Fitriyatno (2012) states that plant growth will be better if the factors affecting growth are balanced and provide benefits. If this factor cannot be controlled, the expected growth cannot be obtained to the maximum.

5. Conclusions

Based on the results of this study, the following conclusions can be drawn: The use of a hood (S1) can regulate environmental conditions so that it can give the best response to the growth and production of chrysanthemum plants; Soaking for 6 minutes (Z) was the best immersion time for plantlets in planting chrysanthemums; and the best combination treatment in planting chrysanthemums is by using a lid and soaking it for 6 minutes (S, Z2). This study used a white lid and a soaking time of 6 minutes was the appropriate one, suitable for the growth of chrysanthemum plants. Therefore, it can be tried using different colours and thicknesses of the cover as well as the exchange of different types of ZPT.

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