Growth and production of gladiolus (*Gladiolus hybridus* L.) by various corm diameter and concentration of growth regulator Atonik

R Amin¹, R Dermawan¹, Pratiwi¹ and M Dawapa²

¹Department of Agronomy, Universitas Hasanuddin, Makassar, Indonesia
²Department of Agribusiness, Faculty of Agriculture, Universitas Musamus, Merauke, Indonesia

Email: ndungga5@gmail.com

**Abstract.** This paper reports a field experiment in a highland of Patappang Village-Gowa of South Sulawesi aiming to determine the effect of various corm diameter and atonic concentration on the growth and production of gladiolus plants. The experiment was arranged with factorial Randomized Block Design (RBD). The first factor was the corm diameter, which consists of two levels: 2 cm and 2.5 cm. The second factor was atonic concentration consisting of 3 levels: 2 mL L⁻¹ water, 3 mL L⁻¹ water, 4 mL L⁻¹ water. There were six treatment combinations with three replications in three groups, making a total of 18 treatment units. The results showed there was an interaction between a 2.5 cm corm diameter and Atonik concentration of 3 mL L⁻¹ for plant height parameter (84.4 cm). Corm diameter of 2.5 cm gave the best results on flowering age (82.0 days), flower stalk length (23.09 cm) and the number of florets (6.2 florets). Atonic concentrations of 2 mL L⁻¹ and 3 mL L⁻¹ gave the best results on the observation of plant height (84.40 cm) and the number of leaves (32.67 strands).

1. **Introduction**

Gladiolus (*Gladiolus hybridus* L.) is a popular cut flower that has long been known in Indonesia and much preferable by people due to its attractive appearance and color and is widely used in various type of both traditional and official ceremonies [1]. One advantage of gladiolus is the flower can stay fresh for around 5 -10 days, and it flowers all the time. Gladiolus flower has the potential for development since it has been one of the ornamental plants that receive serious attention from the government [2].

Gladiolus can be propagated by seeds and corms. However, corm propagation is more common in practice [3].

The typical shape of the corm is round flat, round and slightly oval and round flat with a concave upper part. Depending on the size of the corm, there are two or more shoots on the corm. For plant propagation, the corm is split into two by leaving at least one shoot in each cut. The corm size determines the flowering; large corm will flower faster than small ones [4].

Growth regulators are artificial synthetic substances while hormones are produced naturally by the plant itself; both substances can stimulate, increase, or encourage the emergence of a biochemical activity [5]. Growth regulator is an organic compound in addition to nutrients which in small amounts can stimulate, inhibit, or alter various plant physiological processes. In propagation, it is one that has growth stimulating properties [6].
Atonik is a liquid growth regulator, thick brown and contains the active ingredient of nitro-aromatic compounds as much as 65 g L\(^{-1}\). Also, Atonik contains S, Bo, Fe, Mn, Zn, Cu, Mo, and Ca in very little amount. Atonik application at the right time and concentration can stimulate the multiplication of plant roots, making them grow long, large, resistant to bad weather and more active for nutrient absorption. Atonik can quickly enter plant tissues, influencing plasma flow in cells to provide strength for plants to stimulate growth [5]. Putting Atonik into practice, the immersion method is the first practical method and considered the most effective, especially for herbaceous plants [7].

2. Methodology

An experiment was carried out in Kampung Beru, Patappang Village, Sub-district of Tinggi Moncong of Gowa Regency, the province of South Sulawesi. The altitude of the location was 1569 m asl, which is suitable for gladiolus to grow.

This experiment was in the form of factorial design in randomized groups (RBD). The first factor was corm diameter (D), which consisted of two levels: \(d_1 = 2\) cm and \(d_2 = 2.5\) cm. The second factor was the concentration of Atonic that consisted of three levels, namely \(h_1 = 2\) mL L\(^{-1}\); \(h_2 = 3\) mL L\(^{-1}\); and \(h_3 = 4\) mL L\(^{-1}\). Each treatment combination was repeated three times, making a total of 18 treatment units.

Observation components are plant height (cm), number of leaves (strands), number of florets per stalk, age of 50% flowering (days), length of pedicels (cm), the diameter of flower (cm).

3. Results and discussion

The results of variance showed that the treatment of corm diameter had a very significant effect on plant height, number of leaves, and pedicels length, and significantly affected the number of florets but did not significantly affect flowering age and flower diameter. Atonik concentration has a significant effect on pedicels length but does not significantly affect plant height, number of leaves, flowering age, number of leaves, and flower diameter. The interaction between various corm diameters and Atonik concentrations had a significant effect on plant height but had no significant effect on the other observation components.

Table 1 and 2 shows the results of treatments to the vegetative variables of gladiolus.

| Corm diameter (d) | Atonik concentration (h) |
|------------------|--------------------------|
|                  | 2 mL L\(^{-1}\) (h\(_1\)) | 3 mL L\(^{-1}\) (h\(_2\)) | 4 mL L\(^{-1}\) (h\(_3\)) |
| 2 cm (d\(_1\))   | 8,039\(^a\)               | 6,879\(^b\)               | 6,381\(^b\)               |
|                  | (64,917)                  | (48,083)                  | (41,050)                  |
| 2.5 cm (d\(_2\)) | 8,337\(^a\)               | 9,154\(^a\)               | 8,228\(^a\)               |
|                  | (70,500)                  | (84,400)                  | (69,333)                  |

Numbers followed by different letters in the column were significantly different at the level of 95% (Tukey’s \(p \leq 0.05\))

Utilization of Atonik with a concentration of 3 mL L\(^{-1}\) water gave the best results on plant height. It indicates that the substance provided a physiological effect, which is plant height increase by stimulating growth. Atonic administration can increase the extension of plant stems resulting in plants vertical growth [8].

---

Table 1. Average of plant height (cm) of gladiolus with the treatment of corm diameter and Atonik application

---

---

---
Table 2. Average of number of leaves of gladiolus with the treatment of corm diameter and Atonik application

| Corm diameter (d) | Atonik concentration (h) | Average  |
|------------------|--------------------------|----------|
|                  | 2 mL L⁻¹ (h₁)            | 3 mL L⁻¹ (h₂) | 4 mL L⁻¹ (h₃) |
| 2 cm (d₁)        | 21,17                    | 16,67     | 17,17     | 18,33ᵇ     |
| 2.5 cm (d₂)      | 25,00                    | 21,33     | 22,50     | 22,94ᵃ     |

Numbers followed by different letters in the column were significantly different at the level of 95% (Tukey’s p≤=0.05)

Number and size of leaves are influenced by genotype and environment, namely the capacity to respond to better environmental conditions such as the availability of water and nutrition. The use of Atonik can provide rapid growth in leaf formation, root elongation, and other vegetative increase [9].

Proper plant growth provides sufficient carbohydrates. It affects cell division and cell differentiation, which speeds up the vegetative phase [10]. Salisbury [11] emphasized that the increase in the width of the Angiosperms’ leaf is caused by meristems which produce several new cells that potentially remain active for a considerable time even after the leaves become mature.

Based on variables observation, plant height responded to corm diameter and interaction between corm diameter and Atonik concentration, but not for the atomic concentration alone. It indicated the improvement of plant growth is possible through the regulation of the growing environment and the provision of nutrients. Also, plants have the internal ability to regulate growth and development through growth regulators. Possibly, not all natural plant hormones are available sufficiently; at this point, additional growth regulator is necessary for plants, to improve the work of these hormones [12]. Figure 1 and 2 showed the variables which are not significantly affected by both treatments nor their interaction.

![Figure 1. Age of 50% flowering (days) of gladiolus with the treatment of corm diameter and Atonik application](image)

Corm diameter treatments showed an influence on flowering age, the number of florets per stalk, and the diameter of flowers. The 2.5 cm corm diameter gave better results compared to the 2 cm corm. Sutater [4] stated that the food reserves contained in corn affect the growth of gladiolus plants. The content of food reserves in the eardrop is larger so that it is more available for the growing process.
More parameters of production which were affected by the size of corm are presented in table 3 and 4.

**Table 3.** The average number of florets of the gladiolus at the end of the observation

| Corm diameter (d) | Atonik concentration (h) | Average |
|-------------------|---------------------------|---------|
|                   | 2 mL L⁻¹ (h₁) | 3 mL L⁻¹ (h₂) | 4 mL L⁻¹ (h₃) |         |
| 2 cm (d₁)         | 6,14          | 5,43        | 5,44           | 5,67ᵇ   |
| 2,5 cm (d₂)       | 6,26          | 6,32        | 6,13           | 6,24ᵃ   |

Numbers followed by different letters in the column were significantly different at the level of 95% (Tukey’s p≤=0.05)

Variance showed that corm diameter had a significant effect, while Atonik concentrations had not, nor the interaction.

**Table 4.** The average pedicels length of the gladiolus at the end of the observation

| Corm diameter (d) | Atonik concentration (h) | Average |
|-------------------|---------------------------|---------|
|                   | 2 mL L⁻¹ (h₁) | 3 mL L⁻¹ (h₂) | 4 mL L⁻¹ (h₃) |         |
| 2 cm (d₁)         | 22,66         | 18,92       | 18,92          | 20,16ᵇ  |
| 2,5 cm (d₂)       | 24,75         | 21,75       | 22,76          | 23,09ᵃ  |
| Rata-rata         | 23,71ᵃ        | 20,33ᵇ      | 20,84ᵇ         |         |

Variance showed that for pedicels length, corm diameter had a very significant effect, while the Atonik concentration had a significant effect. The interaction of both had no significant effect.

These results were in line with Soertini’s [13] where larger corm diameter would produce good quality flowers and faster plant growth. In conditions where sunlight is sufficient, a larger size of corm will perform better because it gets more energy.

Andalasari [3] added that the greater the size of the corm, the faster the emergence of flower buds and the more and longer the flower and pedicels. Also, the large size of the corm affects the number of emerging flowers and increase the diameter of the flower bud.
Immersing in Atonik solution is also very helpful in the flowering phase as it stimulates growth, which is expected to produce higher production and yield quality. Kusumo [14] stated that in certain growth phases plants will flower, if not, there are inhibiting factors, applying growth regulator has been widely practiced to directly encourage flowering.

4. Conclusion
- Interaction between 2.5 cm corm diameter and the Atonik concentration of 3 mL L\(^{-1}\) gave the best influence on the average plant height.
- The 2.5 cm diameter corm provided best results on plant height (84.4 cm), number of leaves (32.67 strands), flowering age (82.0 days), number of florets (6.2 per stalk) and pedicels length (23.1 cm) while the 2 cm diameter corm gave the best results on the average flower diameter (5.67 cm).
- Atonik concentration of 2 mL L\(^{-1}\) gave the best results on the average length of the pedicels (23.71 cm), and at the concentration of 3 mL L\(^{-1}\) the best results were on plant height (84,400 cm), flowering age (82.0 cm), and the number of floret (6.2), while the concentration of 4 mL L\(^{-1}\) had the best result on the average flower diameter (5.67 cm).

References
[1] Listiana N, Nawawi N and Wardiyati T 2010 Pengaruh komposisi media tanam dan pupuk SP-36 terhadap pertumbuhan tanaman gladiol (Gladiolus hybridus. L) Buana Sains 10 147–52
[2] Sari S W, Lestari S and Respatijarti R 2013 Keragaman Genetik Dan Heritabilitas Enam Genotip Gladiol (Gladiolus Hybridus L.) J. Produksi Tanam. 1
[3] Andalasari T D 2017 Usaha Perbanyakan Subang Gladiol (Gladiolus hibridus L) dengan Menggunakan Benziladenin (BA) J. Penelit. Pertan. Terap. 11
[4] Sutater T 1993 Pengaruh Pembelahan Subang dan Pemupukan K terhadap Pertumbuhan dan Produksi Gladiol Varietas Salem Bul. Penel. Hort 107–13
[5] Sahroni M S 2016 Pengaruh pemberian ZPT dan komposisi pupuk tunggal (Urea, TSP, KCl) pada pertumbuhan dan produksi tanamangladriol (Gladiolus hybridus L.)
[6] Wudianto R 1988 Membuat Setek, Cangkok dan Okulasi, penebar Swadaya
[7] Sunarlim N, Zam S I and Purwanto J 2012 Pelukaan Benih dan Perendaman dengan Atonik pada perkecambahan Benih dan pertumbuhan Tanaman semangka non Biji (Citrullus vulgaris Schard L.) J. Agroteknologi 2 21–4
[8] Sun I K 2013 Pengaruh konsentrasi atonik dan dosis pupuk NPK terhadap pertumbuhan bibit salak gula pasir (Salacca zalacca cv. Gulapasir)
[9] Gardner F P, Pearce R B and Mitchell R L 1991 Physiology of Crop Plants (Terjemahan Susilo, H dan Subiyanto)
[10] Jana S and Shekhawat G S 2011 Plant growth regulators, adenine sulfate and carbohydrates regulate organogenesis and in vitro flowering of Anethum graveolens Acta Physiol. Plant. 33 305–11
[11] Salisbury F B and Ross C W 1995 Fisiologi tumbuhan III vol 173
[12] Heddy S 1986 Hormon tumbuhan (Rajawali, Jakarta)
[13] Soertini S 1975 Kultur jaringan tangkai dan kuncup bunga gladiol Bul. Penelit. Hortik. 1 41–8
[14] Kusumo S 1984 Zat pengatur tumbuh tanaman