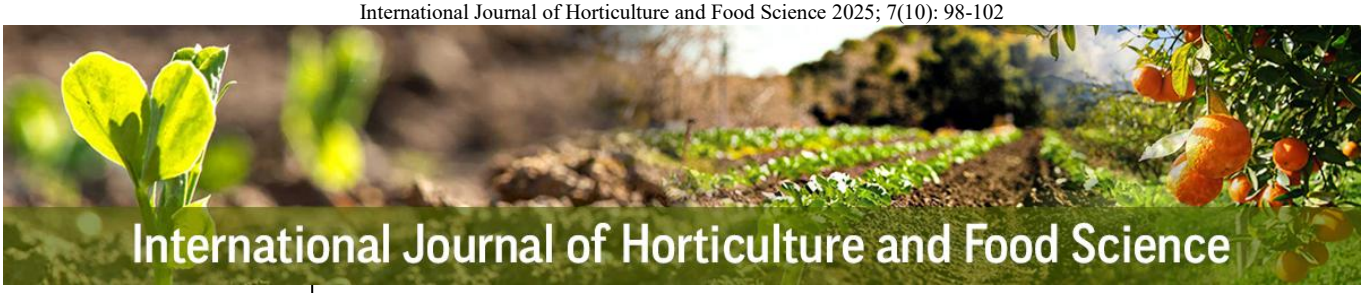


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# Effect of plant growth regulators and varieties on vegetative performance of gladiolus (*Gladiolus hybridus* Hort.) under semi-arid conditions of Rajasthan

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**Abstract**
A field experiment was conducted during the winter season of 2024-2025 at the Crop Research Farm, School of Agricultural Sciences, Jaipur National University, Jaipur (Rajasthan), to investigate the effect of plant growth regulators and varieties on vegetative performance. The study utilized a factorial randomized block design with three varieties (White Prosperity, Novlux and Oscar) and four levels of $GA_3$ (Control, 100 ppm, 200 ppm, 300 ppm), comprising 12 treatment combinations with three replications each. Results revealed significant variation among treatments for all measured parameters. Days to sprouting ranged from 10.46 to 12.93, with the minimum (10.46 days) recorded by the combined application of GA3 at 300ppm and variety Oscar. The highest plant height (87.20 cm), number of leaves per plant (9.66), leaf length (46.64cm), leaf width (2.73cm), and main stem diameter (1.72cm) were all achieved with the same combination. These findings indicate that the interaction of GA3 at 300ppm with the Oscar variety consistently enhanced early sprouting and superior vegetative growth compared to other combinations, making it a promising strategy for optimizing crop performance under similar agro-climatic conditions.

**Keywords:** Gladiolus, GA3, spikes, varieties, plant growth and rabi

## 1. Introduction
Gladiolus (*Gladiolus grandiflorus* L.), commonly known as "Glad," belongs to the family Iridaceae and subfamily Ixioideae. This ornamental corm-bearing plant traces its origin to South Africa. Owing to its sword-like foliage, it is popularly referred to as the **"**Sword Lily" or "Corn Lily." Gladiolus is cultivated worldwide for its elegant flower spikes adorned with vibrantly colored florets, earning it the title of the "Queen of tropical bulbous flowers" (Suresh Kumar *et al.*, 2022) [17].

In India, gladiolus has emerged as a significant cut flower crop**,** particularly in the domestic flower markets of Delhi, Kolkata, Bengaluru, Mumbai, and Hyderabad (Bhattacharjee, 2021) [4]. Nationwide, gladiolus occupies an area of 11,670 ha, producing approximately 0.50 lakh tonnes of loose flowers and 93 lakh cut spikes (Anon, 2024). Recently, gladiolus has also gained popularity in Telangana, especially in peri-urban areas, driven by its high demand for bouquets, vases, and decorative arrangements, along with relatively easy cultivation and attractive market returns. In Telangana, the total area under flower crops is 6,900 ha, yielding around 0.41 lakh tonnes of loose flowers and 35.11 lakh cut flowers (Anon, 2024). Gibberellic acid ($GA_3$) plays a crucial role in the regulation of growth and development in *Gladiolus*, significantly affecting its physiological and yield-related characteristics. Recent studies have revealed that foliar application of $GA_3$ markedly improves morpho-physiological traits such as plant height, spike length, and overall productivity in *Gladiolus* varieties. The hormone promotes cell division and elongation, resulting in enhanced spike quality, a greater number of florets, and earlier flowering. Application of $GA_3$ at suitable concentrations through foliar spraying has been found to increase vegetative vigor and flowering efficiency, thereby improving the ornamental appeal and commercial value of *Gladiolus* spikes (Gayatri *et al.*, 2025) [8].

*White Prosperity*, *Novalux*, and *Oscar* are prominent and well-recognized cultivars of *Gladiolus*, each distinguished by their unique floral traits and ornamental value in landscaping and floral design. *White Prosperity* is characterized by its tall and sturdy spikes bearing large, ruffled, pure white blossoms, which contribute to its popularity as an elegant cut flower and a preferred choice for garden borders due to its long-lasting and graceful blooms (Hassan *et al.*, 2024) [9]. *Novalux* is notable for its early flowering behavior, producing bright, attractive spikes earlier than many other cultivars. It also exhibits strong vegetative growth and high corm yield, making it a suitable variety for both ornamental cultivation and commercial propagation (Mageswari, 2017) [12]. *Oscar*, on the other hand, is admired for its striking velvety red flowers borne on tall, firm stems, creating a bold visual appeal in gardens and floral arrangements. Its large flower size and intense color not only enhance aesthetic appeal but also attract pollinators, increasing its desirability among growers and flower enthusiasts (Azimi *et al.*, 2020) [3]. Collectively, these varieties represent the impressive diversity, charm, and adaptability of the *Gladiolus* genus.

## 2. Materials and Methods

A field experiment was conducted during the winter season of 2024-25 at the Crop Cafeteria, School of Agricultural Sciences, Jaipur National University, Jaipur (Rajasthan). The corms of *Gladiolus* cultivars were obtained from SOAS, Jaipur National University. Healthy and uniform-sized corms (4-5 cm in diameter) were selected for planting. The experiment included 12 treatment combinations consisting of three *Gladiolus* cultivars (*White Prosperity*, *Novalux*, and *Oscar*) and four concentrations of $GA_3$ (Control, 100 ppm, 200 ppm, and 300 ppm). The study was arranged in a Factorial Randomized Block Design (FRBD) with three replications. Data were recorded on various growth parameters, including days to corm sprouting, plant height (measured in centimeters from the ground level to the spike tip), leaf length and width (cm), number of leaves per plant (counted after spike emergence), length of the fourth leaf (from base to tip), and stem diameter (measured using a digital vernier caliper).

## 3. Result and Discussion

### 3.1 Days to Corm sprouting

Result pertaining to the days to sprouting is presented in Fig. 1 shows the effect of growth regulators significantly decreased days to sprouting at harvest over control.

Days to sprouting varied from 10.46 to 12.93 among all the treatments. Minimum days to sprouting (11.48) was reported with variety Oscar and (10.46) $GA_3$ (300 ppm) recorded minimum days to sprouting. Combined the application of $GA_3$ (300 ppm) and variety Oscar recorded the minimum days to sprouting. However, there was no significant difference among treatments. Early number of days to sprouting might be due to free GA3, which breakdown the reserve food material by hydrolytic enzymes in presence of sufficient moisture, resulted in early sprouting of corms. Similar results were observed by Kumar and Singh (2005) [10] and Baskaran *et al.,* (2014) [2] in gladiolus

### 3.2 Plant height (cm)

Result pertaining to the plant height is presented in Fig. 2 shows the effect of growth regulators significantly increased plant height at harvest over control.

Plant height varied from 55.29 cm to 87.20 cm among all the treatments. Highest plant height (87.20 cm) was reported with application of $GA_3$ (300 ppm) and variety Oscar (75.39 cm) recorded highest plant height. Combined the application of $GA_3$ (300 ppm) and variety Oscar recorded the highest plant height which was significantly superior over other treatment. The increased height of the plant might be associated with the application of GA3 that plant an boost in the endogenous level of gibberellins in various stages of plant growth and development, which encourage vegetative growth by inducing active cell division and cell elongation in the apical meristem. Another possible justification for the considerable increase in plant height could be the effect of gibberellins on photosynthetic activity, which resulted in the plants efficiently utilizing photosynthetic products that enhance the plant growth and development. These results are also consistent with the findings of Sharma *et al*. (2006) [15], Kumar *et al*. (2008) [11] and Chopde *et al*. (2013) [5] in Gladiolus.

### 3.3 Number of leaves per plant

Result pertaining to the number of leaves per plant is presented in Fig. 3 shows the effect of growth regulators significantly increased number of leaves per plant at harvest over control.

Number of leaves per plant varied from 7.13 to 9.66 among all the treatments. Highest number of leaves per plant (9.66) was reported with application of $GA_3$ (300 ppm) and variety Oscar (8.84) recorded highest number of leaves per plant. Combined the application of $GA_3$ (300 ppm) and variety Oscar recorded the highest number of leaves per plant which was significantly superior over other treatment. The increase in the number of leaves with $GA_3$ application might be attributed to its stimulatory effect on *Gladiolus* corms, promoting enhanced cell division at the shoot apex and cell elongation. This growth-promoting action of gibberellic acid leads to greater vegetative development and leaf production. Similar findings were reported by Ravidas *et al.* (1992) [13], Umarao *et al.* (2007), Ramachandrudu and Thangam (2007) [14], and Sudhakar *et al.* (2012) [16] in *Gladiolus*, confirming the positive influence of $GA_3$ on vegetative growth parameters.

### 3.4 Leaf length (cm)

Result pertaining to the leaf length is presented in Fig. 4 shows the effect of growth regulators significantly increased leaf length at harvest over control.

Leaf length varied from 38.44 cm to 46.64 cm among all the treatments. Highest leaf length (46.64 cm) was reported with application of $GA_3$ (300 ppm) and variety Oscar (43.54 cm) recorded highest leaf length. Combined the application of $GA_3$ (300 ppm) and variety Oscar recorded the highest leaf length which was significantly superior over other treatment. However, their interaction between treatments was non-significant. The increase in the leaf leangth and leaf width with $GA_3$ application might be attributed to its stimulatory effect on *Gladiolus* corms, promoting enhanced cell division at the shoot apex and cell elongation. This growth-promoting action of gibberellic acid leads to greater vegetative development and leaf production. Similar findings were reported by Ravidas *et al.* (1992) [13], Umarao *et al.* (2007), Ramachandrudu and Thangam (2007) [14], and

Sudhakar *et al.* (2012) [16] in *Gladiolus*, confirming the positive influence of $GA_3$ on vegetative growth parameters.

### 3.5 Leaf width (cm)

Result pertaining to the leaf width is presented in Fig. 5 shows the effect of growth regulators significantly increased leaf width at harvest over control.

Leaf width varied from 1.78 cm to 2.73 cm among all the treatments. Highest leaf width (2.73 cm) was reported with application of $GA_3$ (300 ppm) and variety Oscar (2.44 cm) recorded highest leaf width. Combined the application of $GA_3$ (300 ppm) and variety Oscar recorded the highest leaf width which was significantly superior over other treatment.

### 3.6 Main stem diameter (cm)

Result pertaining to the mainstem diameter is presented in Fig. 6 shows the effect of growth regulators significantly increased mainstem diameter at harvest over control.

Mainstem diameter varied from 0.77 cm to 1.72 cm among all the treatments. Highest mainstem diameter (1.72 cm) was reported with application of $GA_3$ (300 ppm) and variety Oscar (1.43 cm) recorded highest mainstem diameter. Combined the application of $GA_3$ (300 ppm) and variety Oscar recorded the highest mainstem diameter which was significantly superior over other treatment. The significant increase in stem girth observed in $GA_3$-treated plants could be attributed to enhanced photosynthetic activity and greater synthesis of growth-promoting enzymes, which facilitate the production of nucleic acids and promote vigorous cellular growth. The stimulatory effect of $GA_3$ likely improved assimilate translocation and cell expansion, contributing to thicker stems. These results are in close agreement with the findings of Devadanam *et al.* (2007) [7] in tuberose and Chopde *et al.* (2011) [5] in *Gladiolus*, who also reported similar enhancement in stem development due to $GA_3$ application.

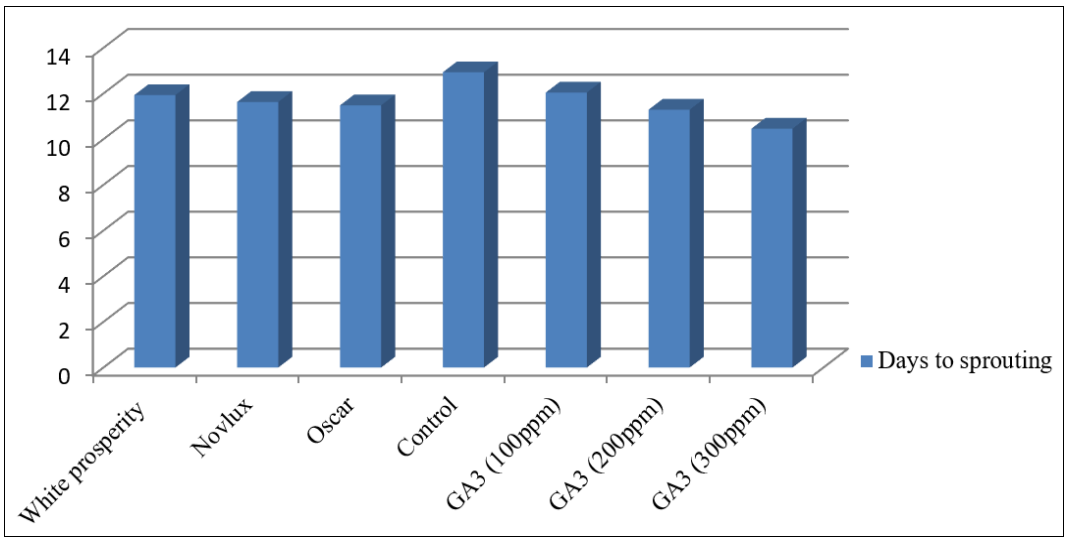


**Fig 1:** Effect of plant growth regulators and varieties on days to sprouting of gladiolus.

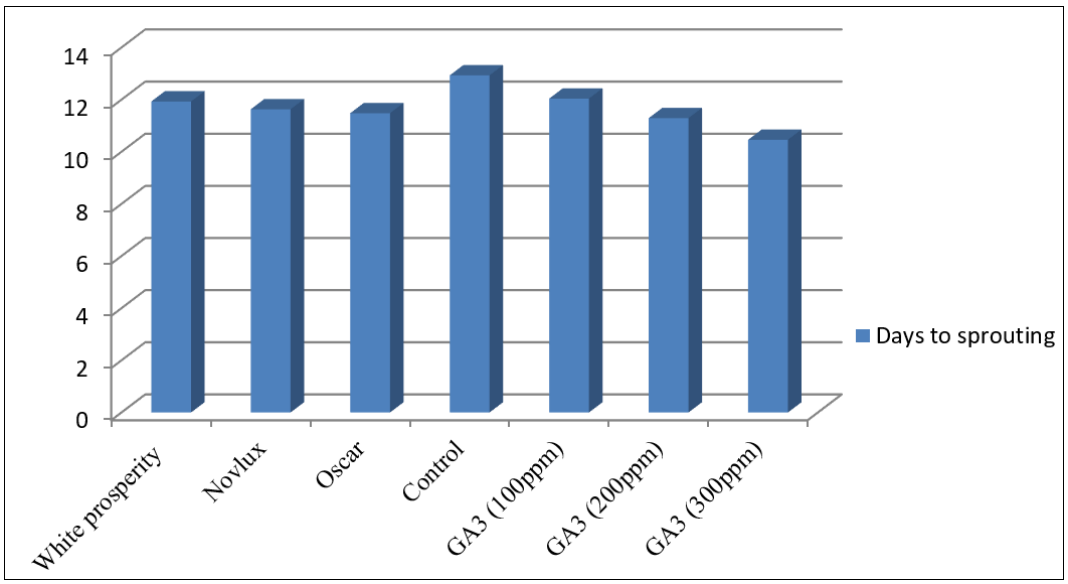


**Fig 2:** Effect of plant growth regulators and varieties on plant height (cm) of gladiolus

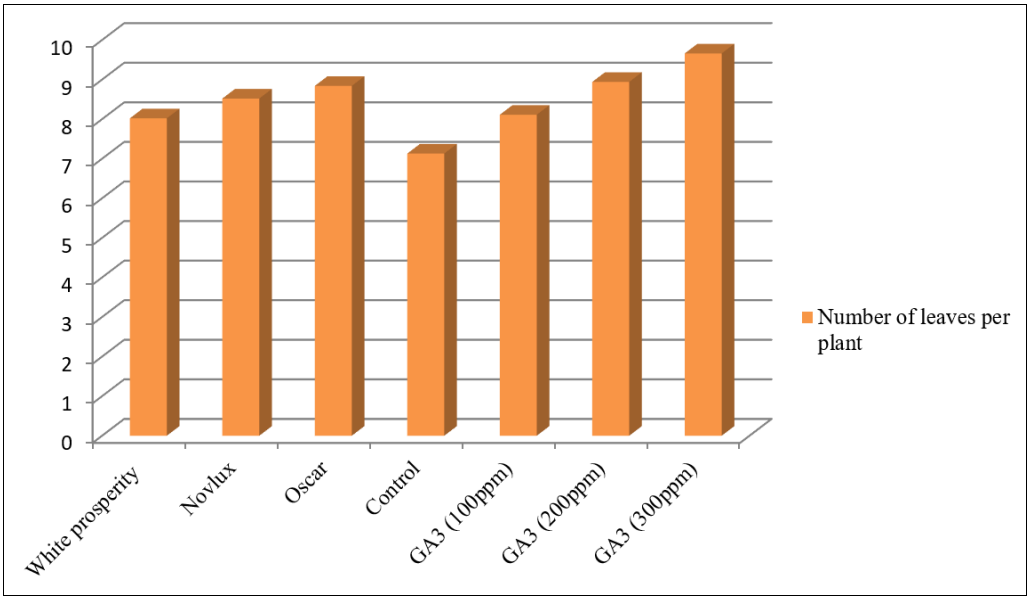


**Fig 3:** Effect of plant growth regulators and varieties on number of leaves per plant of gladiolus.

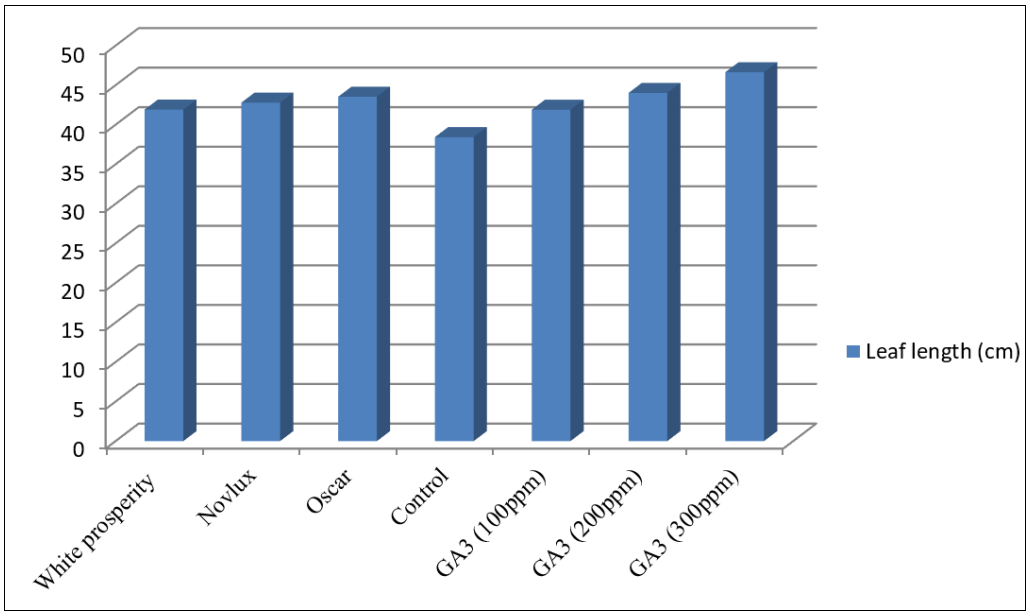


**Fig 4:** Effect of plant growth regulators and varieties on leaf length (cm) of gladiolus.

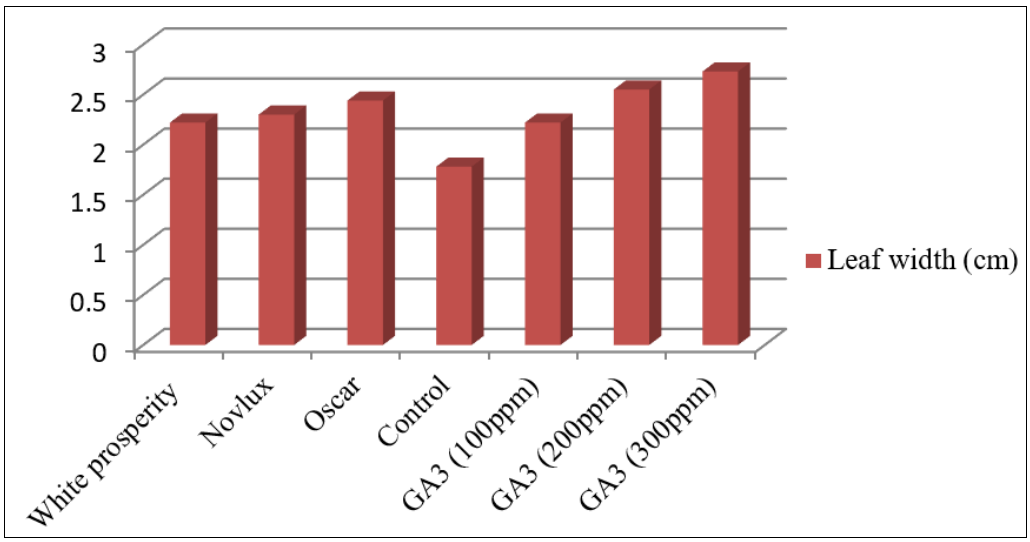


**Fig 5:** Effect of plant growth regulators and varieties on leaf width (cm) of gladiolus.

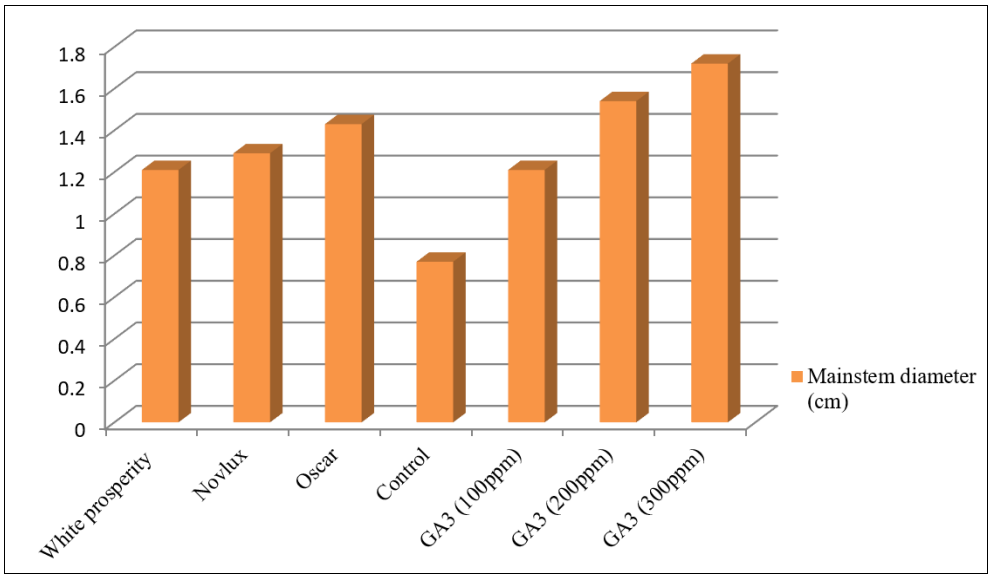


**Fig 6:** Effect of plant growth regulators and varieties on main stem diameter (cm) of gladiolus.

## 4. Conclusion

It is concluded that application of GA3, especially at 300 ppm rate, significantly enhanced the vegetative parameters of gladiolus under semi-arid conditions of Rajasthan. Among all treatments, the combination of GA3 (300 ppm) with the variety Oscar consistently resulted in the best performance across most traits including earliest sprouting, highest plant height, maximum leaf length, leaf width and main stem diameter.

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