



# Effect of Pre and Postharvest Factors on Vase life of Gladiolus or Effect of Different Floral Preservatives on Vase Life of Gladiolus

Rasika Ashok Sarje <sup>a</sup>, Ashwini Kailas Abhangrao <sup>a\*</sup>,  
Sarath Jayakumar <sup>a</sup>, Ritika Gupta <sup>a</sup>, Smriti Pathania <sup>a</sup>  
and B. Vidya Sree <sup>a</sup>

<sup>a</sup> Department of Horticulture, School of Agriculture, Lovely Professional University,  
Phagwara-144411, India.

## Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

## Article Information

DOI: <https://doi.org/10.9734/ijpss/2024/v36i74733>

## Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/116582>

Review Article

Received: 27/03/2024

Accepted: 29/05/2024

Published: 07/06/2024

## ABSTRACT

Gladiolus is a popular ornamental and cut flower grown globally. However, the vase life of gladiolus flowers is relatively short due to physiological factors such as water stress, carbohydrate depletion, microbial activity, and ethylene exposure. This review discusses various preharvest and postharvest factors that influence the vase life of gladiolus flowers. Genetic factors, environmental conditions like temperature and humidity, and biotic stresses can impact vase life during the preharvest stage. Postharvest factors such as ethylene production, carbon dioxide levels, and

\*Corresponding author: E-mail: [ashwini.abhangrao@gmail.com](mailto:ashwini.abhangrao@gmail.com)

**Cite as:** Sarje, Rasika Ashok, Ashwini Kailas Abhangrao, Sarath Jayakumar, Ritika Gupta, Smriti Pathania, and B. Vidya Sree. 2024. "Effect of Pre and Postharvest Factors on Vase Life of Gladiolus or Effect of Different Floral Preservatives on Vase Life of Gladiolus". *International Journal of Plant & Soil Science* 36 (7):297-303. <https://doi.org/10.9734/ijpss/2024/v36i74733>.

pest/disease issues also play a crucial role. The use of chemical preservatives like sucrose, salicylic acid, and growth regulators like gibberellic acid have been found effective in extending the vase life and maintaining the quality of cut gladiolus flowers. Integrated management of these factors can help improve the postharvest longevity and marketability of gladiolus as a cut flower.

**Keywords:** *Gladiolus*; vase life; PGR; preservatives; flower quality; microbial growth; postharvest management.

## 1. INTRODUCTION

Gladiolus (*Gladiolus grandiflorus* L.) is one of the most important ornamental and bulbous flowering plants, it carries noble history with it. The name of Gladiolus derived from latin word "Gladius (Sword)", hence it known as Sword lily. It originates from South Africa and Asia belongs to monocot family Iridaceae [1]. Gladiolus also known as "Queen of bulbous plant" and is well known in every corner of the globe which ranks 8<sup>th</sup> position in cut flowers, 1<sup>st</sup> position in bulbous plants and has more than 150 species in the world [2]. The number of species found in the genus is 255 [3]. The main goal is to grow beautiful cut flowers that can be sold in local flower markets or used for decoration in gardens. However, it's worth mentioning that the dried bulbs of these flowers have medicinal benefits when ground into powder. Gladiolus is a perennial bulbous and half-hardy flowering plant containing attractive, elegant and delicate florets opening in sequence from bottom to top along with the spikes. They vary in their height from one to four feet; some are soft and light, others robust and strong adapted to any climate except the frigid condition [4]. Vase life of gladiolus flower is noticeably short due to blockage of the vascular system by air or bacterial growth, reducing water uptake and blocking xylem vessels called as Vascular occlusion. Short vase life of cut flower has been a major problem in floriculture industry as the longevity of vase life is a crucial factor in consumer preference [5].

Different studies and experiments have proved that vase life of gladiolus can be extended by adding or subjecting to different chemical solutions at various concentration such as; chlorine hydroxyquinoline, sulphates, salicylic acid, humic acid, silver nanoparticles, sugar solutions, diethyl sulphonate, and different plant growth regulators [2]. The American Conference of Governmental Industrial Hygienists has recommended exposure limit of soluble silver compounds by 0.01mg/m<sup>3</sup>. While ionic silver compound has a toxic effect on human as well as environment, organic acid and essential oil also

have a noticeable effect on the improvement of vase life of cut gladiolus flowers which might be due to their antibacterial properties that reduce bacterial proliferation in the stem vessels of cut flowers [6]. [5]. Therefore, this study aims to evaluate various vase solutions and their effectiveness in extension of vase life, quality of the produce and in turn about the cost of vase solutions.

## 2. VASE LIFE OF GLADIOLUS

Vase life of a flower is influenced by respiration, carbohydrates, deterioration, disease and pests and water absorption. Ethylene synthesis plays a crucial role in vase life. Various factors including water stress, carbohydrate depletion, microbial activity and ethylene exposure can impact floral senescence. To prolong the vase life of cut flowers by mitigating the above effects, preservative solutions are employed post-harvest. These solutions enhance assimilate distribution, regulate water uptake, shield floral stems from microbial damage and minimize the influence of ethylene, thereby delaying the onset of floral senescence [7]. Carbohydrates and soluble sugars help to maintain quality of petals for longer time. Flowers are treated with sufficient amounts of sugars like sucrose and an appropriate preservative like silver thiosulfate can greatly enhance the longevity of cut flowers. As discussed earlier, not only sucrose but along with sucrose there are other agents also that are effective in extending the vase life of cut flowers.

Gladiolus (*Gladiolus grandiflorus* L.) is Grown for its inflorescences, a commercially significant decorative plant. For growers and sellers, improving its quality and vase life is essential. Gladiolus' diverse vase lives among species and cultivars are crucial for flower quality, consumer pleasure, and commercial viability. They hold the greatest economic significance in the floriculture business. The publication is useful to the scientific community because it addresses vase solutions and pre- and post-harvest factors that influence the vase life of gladiolus.

### 3. PRE AND POSTHARVEST AFFECTING FACTORS

#### A. Preharvest affecting factors

**i. Constitution of Inherent characters:** The genetic composition of the cultivars as well as differences in cell wall thickening, peroxidase and lignification levels, ethylene forming enzyme (EFE) and aminocyclopropane carboxylic acid (ACC) production have all been linked to these variations [8]. Khanal [8] assessed six gladiolus cultivars in Hissar, India and discovered variance in the responses of the varieties for various attributes. Miniature had the shortest vase life among the tested cultivars while Pusa Suhagain had the longest. Similarly, five gladiolus cultivars i.e. Agnerekha, American Beauty, Friendship, Mansoer red and true Yellow were assessed in a course of two seasons in Kerala, India by Khanal [6] mentioned that Agnerekha and Mansoer were the best for a longer vase life, while American Beauty and Friendship were found to be superior for cut flower yield. Variations in stem lignification, flower diameter, fresh weight, water uptake, and other factors are caused by genetic diversity and ultimately result in differences in the vase life of various flowers or different types of the same flowers. Even genetic variations exist amongst many cultivars of the same crop, as following different varieties with different days of vase life, IIHR-G-12 (14.20), Urmil (8.97), American Beauty (9.67), Moon Magic (5.39) (Verma and Singh, 2021). Differences in the genetic structure of flower species and varieties result in significant differences in their post-harvest lifespan [9]. An experiment was conducted on the different varieties of gladiolus, it showed the best performance for maximum number of corms per plot was "Legend" (37.67) and "Trader Horn" was maximum number of corms per plant (70.83). The maximum vase life was observed in "Darshan" (17.56 days) and maximum number of florets remaining open at a time in vase was observed in "Hunting Song" (6.78 florets) [10].

#### ii. Environmental Factors:

**a. Temperature:** By an increase in respiration rate, high temperatures can reduce floral quality and carbohydrate supplies. According to some observations, the longevity of cut flowers was reduced by temperatures as low as 12°–15°C or as high as 27°C during the three weeks before to harvest. The knowledge of temperature impacts on vase life is complicated by the potential interplay of temperature with other factors. The

reduced amount of carbohydrates in petals as a result of the cold temperature and weak light will cause the vase life to be shortened. Sugar level has been found to be closely associated with the postharvest life of cut flowers because temperature and light intensity directly affect the photosynthate level in flower tissues [8].

**b. Relative Humidity:** High relative humidity (RH) levels (over 80% to 90%) shorten the postharvest life of cut flowers because they negatively impact the amount of calcium content [11]. High relative humidity of 90–95% is advised and is crucial for long-term storage because calcium level in the tissue is thought to affect the formation and function of the cell wall and membrane [12]. RH of 80% or above is generally utilised in practice for short term storage (1-2 days) because it is safe enough to delay withering due to moisture loss. Verma and Singh [13] mentioned Humidity useful in preventing water loss from the plant's surface and preserving the temperature of the plant. While high humidity promotes photosynthesis, it can also lead to fungus-related illnesses. Reduced humidity can lead to greater water loss, senescence, thin leaves, browning of the leaf margins and chilling injury. Water stress can therefore clearly shorten a flower's vase life [14] and flowers produced at varying humidity levels will exhibit variations in their vase life [13].

#### B. Postharvest affecting factors

**i. Ethylene:** Senescence is the time when flower petals produce ethylene. The two primary enzymes in charge of producing ethylene are ACC oxidase and ACC synthase [13]. Certain essential growth stages, such as the wilt of flowers and the abscission of leaves, together with other external conditions like mechanical injury and environmental stress, drive the production of ethylene [15]. Carbon makes up the majority of plant dry matter (45%). Through their stomata, plants absorb it from the surrounding air and fix it through the process of photosynthesis [13].

**ii. Carbon dioxide:** When cultivated at low and high CO<sub>2</sub> levels during the vegetative phase respectively, plants grown at elevated CO<sub>2</sub> during the generative growth phase produces 10-15 % more plants with multiple spikes and a better floral stem quality. The quantity of spikes was not significantly affected by elevated CO<sub>2</sub> throughout the vegetative growth phase, but the pattern suggests that spike quality was on the rise [16].

**iii. Pest and diseases:** Fusarium wilt, Yellow or corm rot, Storage rots, Dry or neck rot, Botrytis blight and flower rot, virus disease are some of the common diseases of gladiolus which can be directly or indirectly in low or high percentage affected the vase life of gladiolus. This can be managed by following various management practices.

### 3.1 Importance of Sucrose

Adding sugars in a vase solution has been found to be beneficial for prolonging the freshness and lifespan of cut flowers, it associated with the improvement water balance, improvement of color in case of carnation and rose, it helps to stimulate flower opening [17]. Sucrose, administered via pulse therapy, suppressed the genes involved in ethylene biosynthesis, leading to a decrease in ethylene production. However, in contrast to the control group, sucrose treatment notably increased xylem blockage on the cut stem surfaces while decreasing antioxidant activity, relative fresh weight and the expression of the cysteine proteinase inhibitor gene (DcCPI) [18]. Sugar plays a crucial role in extending the life span of flowers, particularly when they are cut, as they no longer receive essential nutrients and hormones from the parent plant [19].

### 3.2 Effect of Sucrose

Han 1992, conducted research on effect of sucrose solution has showed that the presence of sucrose in the vase solution improves the quality of cut spikes by prolonging their display life and enhancing the length of inflorescence with visible color. When a consistent supply of sucrose is provided in the vase solution, it leads to the complete opening of flower heads, achieving a 100% opening rate, 200ppm of citric acid with 4% of sucrose is good to extend the vase life of gladiolus [20]. Sucrose 4% combine with  $\text{CoSO}_4$ @100 ppm proved long duration of vase life with 12.3days and maximum blooming period of 22.3days [21]. In case of *Vriesea incurvata* Gaudich, (Bromeliaceae), the application of sucrose for 8 hours has been shown to enhance the preservation of color, brightness, and turgidity in floral scapes. It aids in maintaining water balance, reducing the loss of fresh weight, and extending the vase life of flowers by up to 24 days [7]. Sucrose preserved a noticeably better water balance in spikes when combined with cobalt chloride and silver nitrate, which extended the vase life. Cobalt chloride is very effective at preventing vascular blockages

that result from bacteria blocking vascular tissues. It has also been shown that treating iris spikes with  $\text{CoCl}_2$  greatly extends their vase life [21].

### 3.3 Importance of Chemicals

Chemical treatments considerably enlarged the spikes, floret diameter and increased holding solution consumption and solution absorption to its maximum compared to the control [22]. The calcium effectiveness in enzymes activation, enhances antioxidant activities and delays senescence in gladiolus and also helps to increase diameter of xylem with good water flow, it can delays senescence [23]. Salicylic acid (SA) considered as the messenger of molecules it involves in disease in plants which response to pathogenic attack, it plays key role to tackle the environmental stress and plant growth development [24].

### 3.4 Effect of Chemicals

Gladiolus spikes were treated with vase holding solution of calcium of 0, 100, 200, 300 and 400 mM and the results found that 200mM calcium delayed flower opening and fading, superior in quality retaining [23]. Calcium sulphate also increases the vase life of flower spike. According to the Marandi [5], Salicylic acid (Acidifying agent) also known as SA, is a basic compound found in plants that helps regulate various aspects of their growth and development. It plays a role in processes like the opening and closing of tiny pores called stomata, the sprouting of seeds, the absorption of essential minerals, the determination of plant gender and the activation of defense mechanisms against diseases, The findings of this study indicate that among all the treatments, Acidifying agent salicylic acid (SA) had the most positive impact on the fresh weight percentage, solution uptake in terms of volume ( $\text{cm}^3$ ) and overall vase life of the cut flowers. Some studies have found that the application of salicylic acid can extend the vase life of flowers by reducing their respiration rate and inhibiting ethylene production.

Additionally, research has demonstrated that salicylic acid enhances the ability of flowers to withstand water deficit stress, resulting in improved vase life for cut rose flowers [25]. The use of sucrose in conjunction with antimicrobial agents (Germicide i.e. HQS and  $\text{AgNO}_3$ ) and an ethylene inhibitor ( $\text{AgNO}_3$ ) enhanced the carbohydrate content in flowers, improved water uptake, delayed senescence, preserved flower

turgidity, decreased bacterial growth, and minimized xylem blockage. These combined effects resulted in superior flower quality and prolonged longevity [1 and 26].

### 3.5 Effect of Growth Regulators on Physiological Parameters

Sable et al. [27] studied the effect of foliar application of Plant growth regulators gladiolus cv. H.B.Pitt, corms treated with Bavistin 0.1% and plants sprayed with GA<sub>3</sub>, NAA, CCC in different range it founds GA<sub>3</sub> at 200ppm was effective for elongation of cell and internodal length, height of plant and maximum no of leaves, increase the no. of florets and its weight, overall it enhance the growth and quality of flower. Padmalatha et al. [28] was conducted a study on two cultivars, Darshan and Dhiraj it founds the influence of foliar application of Boron (10 ppm) along with GA<sub>3</sub> (150ppm) significant effect in increasing no. of corms and cormels at the stage of 3<sup>rd</sup> and 6<sup>th</sup> leaf stage, increase weight and size of corms, it can be suggest for multiplication of high-quality planting material and extending vase life of gladiolus. The use of Gibberellic acid on gladiolus corms has proven to be a successful method for overcoming dormancy and enhancing various aspects of plant development. This treatment has been found to have a positive impact on vegetative growth, improve the quality of flowers, and contribute to the enlargement of both corms and cormels in gladiolus plants [29-38].

### 4. CONCLUSION

Gladiolus is one of the most demanding cut flowers throughout the world, however flowers are perishable and day by day gladiolus industry is growing, due to this more research into new technologies is highly necessary to address the severe decline in vase life of gladiolus flowers. It has been shown that the aforementioned strategies can prolong the flower's post-harvest life.

### COMPETING INTERESTS

Authors have declared that no competing interests exist.

### REFERENCES

1. Prabesh Koirala, Rajiv Raman Neupane, Bishal Dura, Puspa Raj Poudel, Rukmagat

2. Pathak. Study on the Effect of Different Chemicals and Essential Oils on the Vase Life Of Gladiolus (Var American Beauty) Cut Flower. Syrian Journal of Agricultural Research – SJAR. 2023;10(1):453-465
3. Pratikshya lamichhanea, Pranisha Bhattaraia, Swastika Subedia, Januka Dahala, Janak Adhikarib. Effects Of Different Treatments On Vase Life Of Gladiolus Cut Spikes: A Review. Tropical Agroecosystems (TAEC). 2022;ISSN: 2735-0274.
4. Syed Atif Shaukat, Syed Zulfiqar Ali Shah, Syed Kashif Shaukat, Syed Waasif Shoukat. Performance Of Gladiolus (Gladiolus grandiflora L.) Cultivars Under The Climatic Conditions Of Bagh Azad Jammu And Kashmir Pakistan. Journal of Central European Agriculture. 2013;14(2): 636-645. DOI:10.5513/JCEA01/14.2.1244.
5. Childs JL. The Gladiolus its history, species and cultivation. New York: Mayflower press; 1873. Available:https://play.google.com/books/reader?id=kGJEAAAAYAAJ&hl=en&pg=GB.S.PP5
6. Rasul Jalili Marandi, Abbas Hassani, Ali Abdollahi, Soyli Hanafi. Improvement of the vase life of cut gladiolus flowers by essential oils, salicylic acid and silver thiosulfate. Journal of Medicinal Plants Research. 2011;5(20):5039-5043.
7. Jowkar MM, Kafi M, Khalighi A, Hasanzadeh N. Reconsideration in using citric acid as vase solution preservative for cut rose flowers. Current Research Journal of Biological Sciences. 2012;4(4):427-436.
8. Edwin Pulido, Raquel Rejane-Negrelle, Francine Lorena Cuquel. Sucrose, salicylic acid and citric acid solutions to extent vase life of Vriesea incurvata Gaudich. (Bromeliaceae) floral scapes. Acta Agronómica. 2021;70(1):27- 34.
9. Asmita khal. A term Paper on: Post Harvest Handling And Factors Affecting Post Harvest Life of Gladiolus Flower; 2014. Available:https://studylib.net/doc/10135916/.
10. Gupta J, Dubey RK. Factors affecting post-harvest life of flower crops. International Journal of Current Microbiology and Applied Sciences. 2018;7(1):548-557.
11. Singh N, Pal AK, Roy RK, Tewari SK, Tamta S, Rana TS. Characterization of gladiolus germplasm using morphological,

- physiological, and molecular markers. *Biochemical genetics*. 2018;56:128-148.
11. Mortensen L, Fjeld T. Effects of air humidity, lighting period and lamp type on growth and vase life of roses. *Scientia Horticulturae*.1998;73:229-23.
  12. Hardenburg RE, Waltada AE, Wang CY. The commercial storage of fruits, vegetables, and florists and nursery stocks. *USDA Agr. Handb.* 1986; 66(REV):75-92.
  13. Jyoti Verma, Parminder Singh. Post-harvest Handling and Senescence in Flower Crops: An Overview. *Agricultural Reviews*. 2021;42(2):145-155 .
  14. Bhattacharjee S.K. Postharvest biology and technology of cut flowers: A review. *Advances in Horticulture and Forestry*. S.P. Singh (Ed.) Scientific Publishers, Jodhpur. 1999;7:117-148.
  15. Sanjamveer S Vehniwal, Lord Abbey. Cut flower vase life – influential factors, metabolism and organic formulation. *Horticulture International Journal*. 2019;3(6).
  16. Kromwijk JAM, Meinen E, Dueck TA. The effect of elevated CO<sub>2</sub> on the vegetative and generative growth, and on stomata, *International Symposium on Orchids and Ornamental Plants – Royal Flora; 2014, Chiang Mai, Thailand, 2012-01-09/2012-01-13.*  
Available:<https://doi.org/10.17660/ActaHortic.2014.1025.23>.
  17. Kazuo Ichimura. Improvement of Postharvest Life in Several Cut Flowers by the Addition of Sucrose. *JARQ*. 1998;32:275-280.
  18. Da Y. Park, Aung H. Naing, Trinh N, Jeung-Sul Han, In-Kyu Kang, Chang K. Kim. Synergistic Effect of Nano-Silver with Sucrose on Extending Vase Life of the Carnation cv. Edun. *Front. Plant Sci. Sec. Plant Breeding*. 2017;8.
  19. Ajish Muraleedharan and Joshi JL. Studies On Prolonging The Vase Life Of Rose Flowers With Citric Acid And Sucrose Solution. *JETIR*. 2017;4(4).
  20. Koirala P, Neupane RR, Dura B, Poudel PR, Pathak R. Study on the effect of different chemicals and essential oils on the vase life of gladiolus (Var American Beauty) cut flower.
  21. Ranvir Singh and Shashikala Beura. Postharvest Life of Gladiolus as influenced by Floral preservatives. *Journal of Ornamental Horticulture. New series*. 2002;5(1):76-79.
  22. Singh PV, Sharma M. The Postharvest Life of Pulsed Gladiolus Spikes: the Effect of Preservative Solutions. *Proc. XXVI IHC – Elegant Science in Floriculture Eds. Th. Blom and R. Criley Acta Hort*. 2003;624.
  23. Masood Ahmad And Abdur Rab. Calcium Effects On Post-Harvest Attributes And Vase Life Of Gladiolus Using Different Methods Of Application. *Pak. J. Bot*. 2020;52(1):167-179.
  24. Gholam Abbas Mohammadi, Ali Salehi Sardoei, Mojghan Shahdadneghad. Improvement of the vase life of cut gladiolus flowers by salicylic acid and Putrescine. *International journal of Advanced Biological and Biomedical Research*. 2014;2(2):417-426.
  25. Mona Mehdikhah, Rasoul Onsinejad, Mohammad Nabi Ilkaee and Behzad Kaviani. Effect of Salicylic Acid, Citric Acid and Ascorbic Acid on Post- harvest Quality and Vase Life of Gerbera (*Gerbera jamesonii*) Cut Flowers,. *Journal of Ornamental Plants*. 2016;3:181-191.
  26. Mishra P, Khanal A. Vaselife analysis of gladiolus using different vase solutions. *Journal of Bioscience and Agriculture Research*. 2019;21(01):1749-1754
  27. Sable PR. Effect of organic and inorganic fertilizers on yield and vase life of gladiolus cv. HB Pitt; 2018.
  28. Padmalatha T, Satyanarayana Reddy G, Chandrasekhar R. Effect of plant growth regulators on corm production and vase life in gladiolus. *J. Hortl. Sci*. 2015;10(2):220-225.
  29. Priyanka, Holkar S, Chandrashekar SY, Hemanth Kumar P. *et al.*, Effect of Gibberellic acid on Growth, Flowering, Flower Quality and Corm Yield of Gladiolus – A Review, *Trends in Biosciences*. Print:ISSN 0974-8431, 2018;11(24):3211-3216.
  30. Banti Kumar, Sunil Malik, Mukesh Kumar, M.K. Singh, and Vlpin Kumar. Postharvest quality and vase life of tuberose (*Polianthes tuberosa* Linn.) as affected by vase chemicals. *Journal of Ornamental Horticulture*. 2017;10(4):274-275.
  31. Alaei M, Babalar R, Naderi M, Kafi. Effect of pre- and postharvest salicylic acid treatment on physio-chemical attributes in relation to vase-life of rose cut flowers.

- Postharvest Biology and Technology. 2011;61 (2011):91–94.
32. Utsav Bhandari, Yekraj Budha. A brief report on post-harvest handling of cut, loose and pot flowers; 2022. Available:<https://www.researchgate.net/publication/358890233>.
33. Salman Mushtaq, Ishfaq Ahmad Hafiz, Muhammad Shahid Iqbal, Syed Zia ul Hasan, Muhammad Arif, Sami Ullah, Misbah Rasheed<sup>4</sup> and Rizwan Rafique. Studies On The Performance Of Some Exotic Gladiolus Cultivars Under Rain-Fed Conditions. International Journal of Modern Agriculture. 2013;2(3), Copyright © Zohdi Publisher ISSN: 2305-7246.
34. Mehraj H, Mahasen M, Taufique T, Shiam IH, Jamal Uddin AFM. Vase Life Analysis of Yellow Gladiolus Using Different Vase Solutions. J. Expt. Biosci. 2013;4(2):23-26, ISSN 2223-9626.
35. Seid Hussen and Hassen Yassin. Review on the impact of different vase solutions on the postharvest life of rose flower. International Journal of Agricultural Research and Review. 2013;1(2):013-017.
36. Susan S. Han. Role of Sucrose in Bud Development and Vase Life of Cut *Liatris spicata* (L.) Willd. Hortscience. 1992;27(11):1198-1200.
37. Kumar P, Verma LS, Sharma G, Manisha Netam and Hemant Kumar. Study The Effect Of Plant Growth Regulators On Vase-Life Of Gladiolus: A review. Journal of Pharmacognosy and Phytochemistry. 2020;9(6):564-570, E- ISSN: 2278-4136 ISSN: 2349-8234.
38. Available:<https://dfr.icar.gov.in/ForFarmers/InsectPests>

© Copyright (2024): Author(s). The licensee is the journal publisher. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

*Peer-review history:*

The peer review history for this paper can be accessed here:  
<https://www.sdiarticle5.com/review-history/116582>