Indian Journal of Agricultural Sciences **93** (11): 1266–1269, November 2023/Short Communication
https://doi.org/10.56093/ijas.v93i11.141492

Effect of gamma irradiation on growth and corm yield of gladiolus (*Gladiolus grandiflorus*) varieties

RISHIKA CHOUDHARY[1]*, ANUJ KUMAR[1], JYOTI KANWAR[1], B K KACHOULI[1] and BALI RAM YADAV[1]

KNK College of Horticulture, Mandsaur, Madhya Pradesh 458 001, India

Received: 26 August 2023; Accepted: 22 September 2023

Keywords: Corm yield, Gamma irradiation, Gladiolus varieties

The interaction between humans and flowers has unique features. India's flower scene has changed significantly, with a substantial portion of agricultural output dedicated to floriculture. This significantly contributes to India's GDP. Gladiolus (*Gladiolus grandiflorus* Andrews), a notable member of the Iridaceae plant family, is nicknamed the Queen of Bulb Flowers. It's immensely popular as an ornamental plant in India and globally, thanks to its captivating flowers. With rising demand, there's a push to improve Gladiolus genetics. Successful cultivation relies on wisely choosing suitable varieties. Incorporating new genetic material requires evaluation to match specific regions. Mutations are a potent method for creating new Gladiolus types. Techniques involving chemicals and radiation have produced innovative varieties. Despite research, only a few types have emerged through radiation-induced mutations. Considering this, a year-long study evaluated Gladiolus growth and corm-related traits.

An empirical study was carried out during November 2022 to April 2023 at the K.N.K. College of Horticulture, Mandsaur (23.45° to 24.13° North and 74.44° to 75.18° East with elevation of 435.02 m above the mean sea level). This region falls under Agro climatic zone number 11 of the state. Soil in the field experimentation had a texture of clay loam (47.0% sand, 24.0 silt and 29.0% clay. The soil of experimental trail was low in available nitrogen (154 kg/ha), medium in phosphorus (18.5 kg/ha) and (293 kg/ha). Reaction of soil is slightly alkaline (*p*H 7.24). The experiment was carried out in Factorial Randomized Block Design with three replications. In this experiment 4 varieties [Arka Aayush (V_1); Arka Pratham (V_2); Arka Kesar (V_3); Arka Tilak (V_4)] were taken to expose the 5 doses of gamma radiation [0.0 kr (G_1); 1.25 kr (G_2); 2.25 kr (G_3); 3.25 kr (G_4); 4.25 kr (G_5)]. Different gamma doses were administered to corms of each variety. Gladiolus corms left untreated served as the control. Treated and untreated corms of each variety were planted in the beds for comparison.

Growth parameters: The results of our study revealed significant variation among the four gladiolus varieties concerning all the growth parameters assessed (Table 1). Notably, Arka Kesar stood out by displaying the highest values for plant height, length of longest leaf, and the width of longest leaf at both the 30 and 60 days after planting (DAP), surpassing the other varieties (Arka Aayush, Arka Pratham and Arka Tilak). These variations in plant height among the varieties could potentially be attributed to a combination of factors, including substantial genetic diversity within the gladiolus species and the influence of environmental conditions on their growth. Similarly, the discrepancies in the length of the longest leaf may result from both phenotypic differences and underlying genetic variances, which could interact with environmental factors. Our findings are consistent with previous research by Chourasia *et al.* (2015), Kaur and Bajpay (2019), Safeena and Thangam (2019), Chandramouli (2020), and Shyla and Kumar (2021) in the field of gladiolus cultivation, providing further support for the validity of our results. Arka Tilak variety displayed the highest number of leaves per plant at both 30 and 60 days after planting (DAP) (Table 1). This variation in leaf count might be attributed to the accumulation of distinct nutritional reserves in the mother corms of specific gladiolus varieties. This observation aligns with the findings of Pandey *et al.* (2012) and Chourasia *et al*. (2015) in the context of gladiolus cultivation, further underscoring the importance of genetic factors and environmental influences in shaping these growth characteristics. The differences in leaf count among the varieties may be linked to their unique genetic compositions, as well as the specific environmental conditions in which they were cultivated. Importantly, our results are in line with similar studies conducted by Mahawer *et al*. (2013), Naresh *et al*. (2015), Mushtaq *et al*. (2018), Safeena and Thangam (2019) and Sathyanarayana *et al.*

[1]KNK College of Horticulture (Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior), Mandsaur, Madhya Pradesh. *Corresponding author email: rishikatetarwal@gmail.com

Table 1 Effect of gamma irradiation on growth parameters at different growth stages in gladiolus varieties

Treatment	Plant height (cm)		Number of leaves per hill		Length of longest leaf (cm)		Width of longest leaf (cm)	
	30 DAP	60 DAP	30 DAP	60 DAP	30 DAP	60 DAP	30 DAP	60 DAP
Varieties								
V_1	32.31	49.57	12.80	16.45	19.60	28.10	1.96	3.00
V_2	31.04	47.64	8.92	10.08	18.48	27.22	2.28	3.12
V_3	35.52	53.99	10.12	13.37	23.50	32.53	2.46	3.36
V_4	33.51	51.85	14.27	18.25	22.08	31.41	2.31	3.20
SEm±	0.51	1.08	0.30	0.45	0.55	0.56	0.06	0.07
CD (P=0.05)	1.47	3.08	0.85	1.28	1.57	1.61	0.16	0.19
Gamma irradiation doses								
G_1	33.07	49.01	10.65	13.04	21.08	30.15	2.28	3.32
G_2	34.09	52.88	12.31	16.14	21.59	30.60	2.37	3.28
G_3	33.77	51.06	11.99	15.03	21.46	30.33	2.34	3.23
G_4	32.88	50.86	11.50	14.61	20.75	29.59	2.22	3.11
G_5	31.68	50.01	11.20	13.88	19.71	28.40	2.06	2.92
SEm±	0.57	1.20	0.33	0.50	0.61	0.63	0.06	0.08
CD (P=0.05)	1.65	NS	0.95	1.43	NS	NS	0.18	0.22

Refer to the methodology for treatment details. DAP, Days after planting.

(2022), further substantiating the robustness and consistency of these findings in the field of gladiolus research.

The results of our study reveal distinct patterns in response to the different gamma dose treatments (Table 1). Notably, we observed significantly increased values in plant height, width of longest leaf at 30 days after planting (DAP), and leaf count at 30 and 60 DAP following exposure to G_2 (1.25 kr) gamma radiation. These outcomes clearly outperformed those obtained with other administered gamma doses, including G_1 (0.0 kr), G_3 (2.25 kr), G_4 (3.25 kr), and G_5 (4.25 kr). The reduction in plant height observed at higher gamma radiation doses may be attributed to several factors, including a decrease in the number of vertical cell layers and disruptions in auxin levels or auxin inactivation. These findings are consistent with the research conducted by Sathyanarayana *et al.* (2022), Lamichhane *et al*. (2022) and Devi *et al.* (2023), in the context of gladiolus cultivation, providing further support for the validity of our results. Conversely, we found that the maximal width of longest leaf at 60 DAP was recorded under the control condition (0.0 kr), displaying similar performance to 1.25 kr, 2.25 kr, and 3.25 kr, while significantly surpassing the response observed with 4.25 kr. This substantial reduction in leaf width may be attributed to impaired plant growth resulting from physiological, morphological, and cytological perturbations induced by ionizing radiations. Similar results have been reported by Dogra and Dhatt (2017) and Tiwari *et al.* (2018) in related studies. However, the response of plant height at 60 days after planting (DAP), as well as the length of the longest leaf at both 30 and 60 DAP, exhibited non-significant alterations in reaction to the various gamma doses applied. These findings suggest that certain growth parameters may be more sensitive to gamma radiation exposure than others, highlighting the complexity of the plant's response to varying levels of ionizing radiation.

Corm parameters: Among the cultivars examined in our study, Arka Tilak exhibited the highest values for both the number of corms (11.54) and the number of cormels (2.92), surpassing the other varieties. Specifically, Arka Ayush had 11.22 corms and 2.73 cormels, Arka Pratham had 10.63 corms and 2.26 cormels, and Arka Kesar had 10.50 corms and 2.34 cormels (Fig 1). The variation in the number of corms per hill is closely related to vegetative growth and the number of shoots per hill, which contributes to the overall corm and cormel production. These findings align with the research conducted by Kaur and Bajpay (2019), reinforcing the importance of these growth parameters in determining corm and cormel yields. The noticeable differences in the number of corms per hill may be attributed to the distinct genetic characteristics inherent to each cultivar and the prevailing environmental conditions under which they were grown. These results are consistent with similar observations reported by Kumawat *et al*. (2018), highlighting the role of genetic diversity and environmental factors in influencing corm production. Likewise, the variability in cormel weight per plant, as previously documented by Chourasia *et al*. (2015), Swaroop *et al.* (2018), Sharma *et al*. (2023) and Devi *et al.* (2023) can be attributed to the inherent genetic traits of the cultivars and the specific ecological conditions. These factors collectively contribute to the overall cormel weight and, subsequently, the productivity of gladiolus plants.

The most significant increases in both corm and cormel count per plant were observed when the plants were exposed to G_2 (1.25 kr) gamma radiation, surpassing the effects of

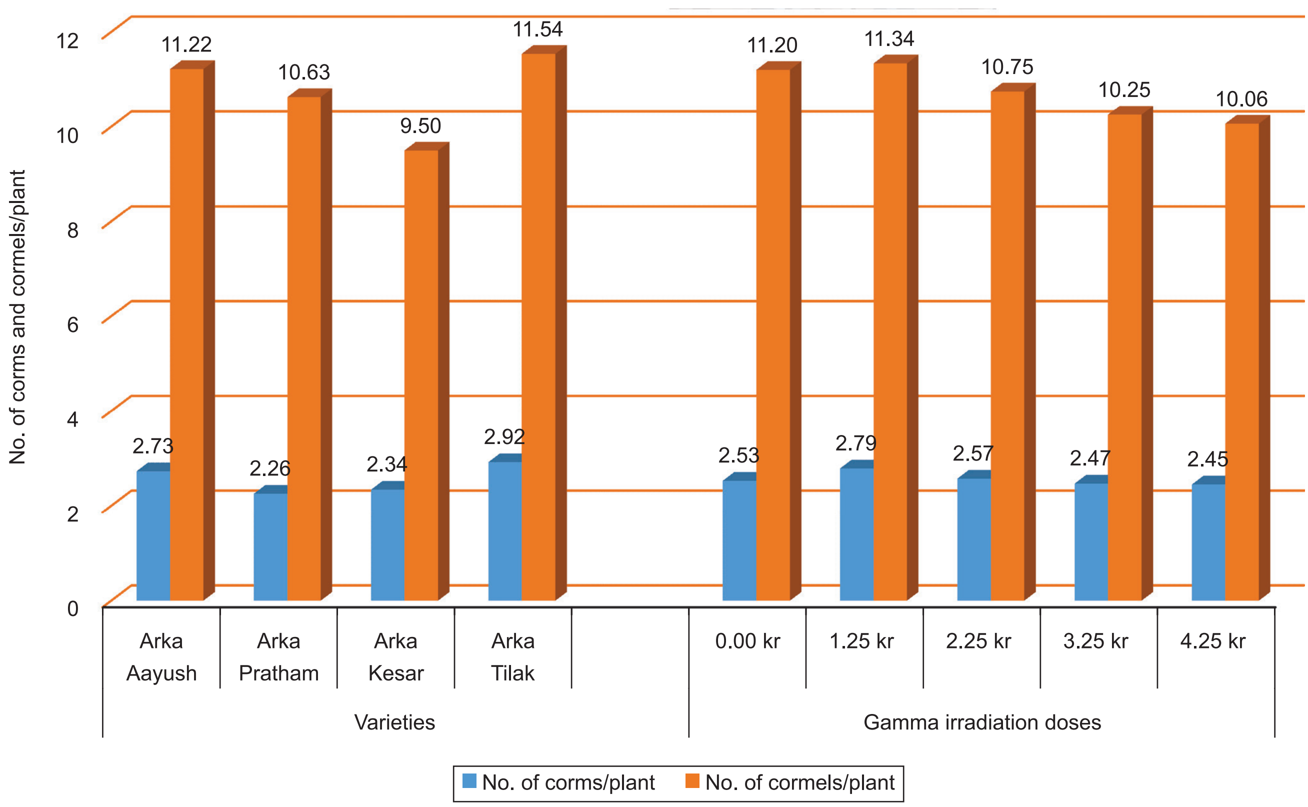

Fig 1 Effect of gamma irradiation on number of corms and cormels per plant in gladiolus varieties

other administered gamma doses (Fig 1). This observation aligns with the consensus among several researchers that lower levels of gamma irradiation tend to have favourable effects on various plant attributes, as supported by experimental evidence. In contrast, higher doses of gamma radiation often lead to adverse or unfavourable outcomes. It is worth noting that different cultivars may exhibit varying responses to distinct doses of gamma radiation, resulting in both inhibitory and stimulatory effects. This variability can be attributed to the inherently random and non-directional nature of mutational processes that occur in the natural environment, making it difficult to predict their specific impact on plant traits. This phenomenon has been observed in other studies as well. For instance, Jun *et al.* (2007) reported a reduction in corm count in saffron plants subjected to higher doses of gamma radiation, a finding that is consistent with the findings of Sisodia and Singh (2014). A prevalent consensus in the scientific community highlights that elevated doses of gamma rays may impede effective photosynthetic transfer to the corms, which, in turn, could contribute to a decrease in vegetative growth. This decrease in vegetative growth is a potential cause for the observed decline in corm number and weight, as indicated by studies such as those conducted by Kumari and Kumar (2015), Chandramouli (2020), Shyla and Kumar (2021) in the context of gladiolus cultivation.

SUMMARY

The data analysis has revealed distinct performance trends among different aspects of gladiolus cultivation. Specifically, Arka Kesar, a gladiolus variety, demonstrated superior growth characteristics, excelling in terms of plant height, the length and width of the longest leaf at both 30 and 60 days after planting (DAP). On the other hand, Arka Tilak outperformed in the number of corms and cormels per plant. Furthermore, the application of gamma irradiation at a level of 1.25 kr was found to be advantageous for several growth parameters. It positively influenced plant height, the number of leaves per hill, the length and width of the longest leaf at both 30 and 60 DAP, as well as the number of corms and cormels per plant. In conclusion, the study suggests that the Arka Kesar variety, when subjected to 1.25 kr gamma irradiation, displayed significant superiority across multiple growth parameters in gladiolus cultivation in the Malwa region of Madhya Pradesh, India. However, for corm yield specifically, Arka Tilak irradiated with 1.25 kr demonstrated better performance. These findings provide valuable insights for optimizing gladiolus cultivation practices in the region.

REFERENCES

Chandramouli R. 2020. 'Performance of gladiolus (*Gladiolus grandiflorus* L.) cultivars under Malwa plateau of Madhya Pradesh'. MSc Thesis, K.N.K. College of Horticulture, Mandsaur, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh.

Chourasia A, Viradia R R, Ansar H and Madle S N. 2015. Evaluation of different gladiolus cultivars for growth, flowering, spike yield and corm yield under Saurashtra region of Gujarat. *Bioscan* **10**(1): 131–34.

Devi N S, Jamja T, Tabing R and Tagi N. 2023. Influence of gamma radiation on growth, flowers and morphological changes in gladiolus. *Environment Conservation Journal* 2278-5124 (online) 1-10. http://www.environcj.in

Dogra N and Dhatt K K. 2017. Effect of gamma irradiation on growth and corm production of *Gladiolus hyberidus* L. *International Journal of Agriculture Sciences* **9**(53): 4905–08.

Jun Z, Xiaobin C and Fang C. 2007. The effects of 60Co γ-irradiation on development of *Crocus sativus* L. *Acta Horticulturae* **739**: 307–11.

Kaur H and Bajpay A. 2019. Performance of various Gladiolus cultivars under Punjab conditions. *Journal of Pharmacognosy and Phytochemistry* **8**(4): 875–78.

Kumari K and Kumar S. 2015. Effect of gamma irradiation on vegetative and propagule characters in gladiolus and induction of homeotic mutants. *International Journal of Agriculture, Environment and Biotechnology* **8**(2): 413–22.

Kumawat P, Sisodia A and Singh A K. 2018. Evaluation of gladiolus cultivars for plant growth and corm production. *Journal of Pharmacognosy and Phytochemistry* **7**(3): 3083–85.

Lamichhane P, Bhattarai P, Subedi S, Dahal J and Adhikari J. 2022. Effect of different treatments on vase life of gladiolus cut spikes: A review. *Tropical Agroecosystems* **3**(1): 12–15.

Mahawer T C, Mahawer L N and Bairwa H L. 2013. Performance of gladiolus cultivars under sub-humid southern plains of Rajasthan. *Journal of Horticultural Sciences* **8**(2): 204–09.

Mushtaq S, Hafiz I A, Arif M and Anwar A. 2018. Performance evaluation of elite gladiolus cultivars under agro climatic conditions of Rawalpindi. *Asian Journal of Advances in Agricultural Research* **5**(3): 1–6.

Naresh S, Rao A V D D, Bhaskar V V, Krishna K U and Rao M P. 2015. Evaluation of gladiolus (*Gladiolus hybrida* L.) hybrids under coastal Andhra Pradesh conditions. *Plant Archives* **15**(1): 451–54.

Pandey R K, Bhat D J, Sheetal D, Arvinder S, Nomita L and Shivani J. 2012. Evaluation of gladiolus cultivars under subtropical conditions of Jammu. *International Journal of Agricultural Sciences* **8**(2): 518–22.

Safeena S A and Thangam M. 2019. Field performance of gladiolus cultivars for growth, yield and quality cut flower production under humid agro climatic conditions of goa. *International Journal of Agriculture Sciences* **11**(3): 7797–7800.

Sathyanarayana E, Singh J and Das B K. 2022. Identification and evaluation of gamma ray induced mutants in gladiolus (*Gladiolus grandifloras* L.). *International Journal of Environment and Climate Change* **12**(8): 43–56.

Sharma P, Sharma G and Abrol, G. 2023. Evaluation of Gladiolus cultivars for growth, flowering and corm multiplication under Jhansi conditions of Bundelkhand Region. *International Journal of Bio-resource and Stress Management* **14** (1): 39–44.

Shyla M R and Kumar R. 2021. Evaluation in different gladiolus (*Gladiolus Grandifloras* L.) varieties for spike and corm yield enhancement in coastal Tamil Nadu. *Plant Archives* **21**: 527–31.

Sisodia A and Singh A K. 2014. Influence gamma irradiation on morphological changes, post-harvest life and mutagenesis in gladiolus. *International Journal of Agriculture, Environment and Biotechnology* **7**(3): 535–45.

Swaroop K, Singh K P, Kumar P and Sindhu S S. 2018. Improvement and performance of Gladiolus hybrids for flower traits/novel colour and higher corm multiplication. *International Journal of Agriculture and Innovation Research* **6**(4): 4–7.

Tiwari A, Singh A K and Pal S. 2018. Effect of gamma irradiation on growth and floral characters of gladiolus varieties. *International Journal of Chemical Studies* **6**(6): 1277–82.