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Varietal Assessment of Gladiolus (*Gladiolus* spp.) for Growth, Flowering Characteristics, Yield and Economics under Highland Agroclimatic Conditions of Wayanad, Kerala, India

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Authors' contributions

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

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ABSTRACT

Gladiolus (*Gladiolus grandiflora* L.) is a significant commercial flower that has been grown all over the world since the late 16th century. It is perfect for both garden displays and floral arrangements. It ranks first in the world for the trade of bulbous flowers and eighth for the production of cut flowers. This study was carried out to assess the high-yielding gladiolus variety in Wayanad conditions. To determine the growth and yield character of four commercial varieties of *Gladiolus* viz., Arka Amar, Arka Ayush, Arka Kesar, and Arka Tilak was planted in open fields under ecological conditions of Wayanad. These varieties were compared for their plant height, spike length, number of florets, floret diameter, and yield. As the result of the study, the data reveals that the maximum plant height was recorded in Arka Kesar (134 cm) followed by Arka Amar (126 cm). Spike length was recorded highest at (114.66 cm) in Arka Kesar followed by (112.33cm) in Arka Amar. Floret diameter was recorded highest in Arka Tilak (11.47 cm) and lowest was recorded in Arka Ayush (8.43 cm). The number of florets was observed maximum in Arka Kesar (20.10) followed by Arka Amar (18.30). The number of spikes/hectare was recorded maximum in Arka Kesar (2.40 lakhs) followed by Arka Amar (2.25 lakhs).

Keywords: Cultivars; growth and yield; variety; Gladiolus.

1. INTRODUCTION

Gladiolus (*Gladiolus grandiflora* L.) is an herbaceous plant popularly known as “Queen” of the bulbous flowers that belongs to the family Irridaceae, derived from the Latin word “Gladius” meaning ‘sword’ [1]. It is also named as “Sword Lily” or “Corn Flag”. Gladiolus ranks fourth in global trade, third in cut flower output in India, and sixth in loose flower production [2]. Gladiolus flower cultivation generates six times the profit as compared to rice production [3]. It is perfect for both garden displays and floral arrangements. Asexual propagation in Gladiolus is accomplished through the use of corms and cormlets [4]. There are spring and summer flowering types, with the summer type being more common and widely used to produce cut flowers [5]. It produces magnificent inflorescence with a variety of colors which makes it attractive for use as herbaceous border, beddings, rockeries, pots, and cut flowers [6]. It has high demand in both domestic and international markets due to the vibrant colors, and variable sizes of spikes, also used in bouquets, interior decorations and flower arrangements [7,8]. Given the current situation, enhancing both quantitative and qualitative aspects is imperative to leverage demand. When cultivating gladiolus, soil and climate play a major role. As there is no data on how well gladiolus genotypes perform in Wayanad, the study's findings can be applied to gladiolus enhancement by introducing new color, earliness, and quality spike criteria. Performance evaluation is vital to determine the right variety for a given area. The current experiment was conducted to examine flower variation and yield characteristics among the varieties for increasing Wayanad's flower production. Hence, the objective of the study was the assessment of *Gladiolus grandiflora L.* varieties in Wayanad district for high income from existing crops in homesteads.

2. MATERIALS AND METHODS

The experiment was conducted at Krishi Vigyan Kendra, Wayanad during 2019-2020 to evaluate the performance of four cultivars, *viz*., Arka Amar ($\mathbf{T_1}$), Arka Ayush ($\mathbf{T_2}$), Arka Kesar ($\mathbf{T_3}$) and Arka Tilak ($\mathbf{T_4}$). For the cultivation of different cultivars of gladiolus standard methodology, cultural operations, and plant protection measures were followed according to the standardized package of practices throughout the crop stand. The experiment was laid out in Randomized Block Design (RBD) with five replications.

Twenty five healthy and uniform size corms each of different varieties were selected for planting. The corms were treated with carbendazim (0.2%) before planting in the field. Ridges were prepared and corms were planted at the spacing of 30 X 20 cm. The recommended dose of fertilizer consists of 40g N, 20g P_2O_5 and 20g K_2O per m^2 was applied in the form of urea, single super phosphate and muriate of potash respectively. The P and K dose was applied in the beds one week before planting as per the treatment combination. Nitrogen was applied in two equal split doses. The first half dose was applied at 3-leaf stage and second half dose was applied at 6-leaf stage. All the other recommended cultural

operations viz., irrigation, weeding were given in time.

Observations were recorded in five randomly selected plants and the mean value of these selected plants in each treatment was taken to represent a particular character. Data was recorded on different plant parameters viz., plant height (cm), spike length (cm), number of florets per spike, floret diameter (cm), spike yield and generated data was subjected to statistical analysis.

2.1 Plant Height (cm)

The height of the plant was recorded from the ground level to the growing tip of the plant and was expressed in centimeters (cm)

2.2 Spike Length (cm)

The length of the spike from the point of its emergence to the top of the spike at the spike harvesting stage was recorded and expressed in centimeters (cm).

2.3 Number of Floret/Spike

The total florets born on each spike were counted at the spike harvesting stage and expressed in nos.

2.4 Floret Diameter (cm)

The floret diameter from the first to fourth floret was measured and the average floret diameter was worked out and expressed in centimeters (cm).

2.5 Spike Yield

The total number of spikes per ha was estimated from the experimental plot and was expressed in lakh/ha.

2.6 Benefit-cost Ratio

The benefit-cost ratio was calculated as follows,

$$\text{Benefit-cost ratio} = \frac{\text{Net Profit (Rs/ha.)}}{\text{Cost of cultivation (Rs/ha.)}}$$

3. RESULTS AND DISCUSSION

Results obtained from the observations of parameters belonging to four different Gladiolus types are thus explained.

3.1 Plant Height

The data pertaining to plant height of gladiolus have been presented in Table 1. It is clear from the results that data had a favorable effect on plant height and was significant to each other. Among the four varieties the height of the plant, was recorded maximum in Arka Kesar (134cm) followed by Arka Amar (126 cm). The height difference of plants may be due to their genetic characteristics. Similar findings are also reported in Dahlia [9]. Other possible reasons could be the competitiveness for light, space, moisture, nutrition, and ventilation [10] and also due to the soil and climatic conditions prevailing in the area [11].

3.2 Spike Length

The data presented in Table 1 envisaged that the maximum spike length (114.66 cm) and were observed in variety Arka Kesar and the minimum was recorded in Arka Tilak (77.33cm) respectively and were on par. The variation in spike length may be due to the corm vigor attributed to the genetic potential of the varieties [12,13,14]. The cultivars having corms with more stored food material produces longer spikes with maximum rachis length. Our reports were in conformity with the findings of Geeta et al. [15], Rao and Sushma [16] in gladiolus.

Table 1. Evaluation of gladiolus varieties for flowering and yield characters

Treatment	Plant height (cm)	Spike length (cm)	Number of Floret/spike	Floret diameter (cm)	Spike Yield/ha	B: C Ratio
T_1	126.00	112.33	18.30	10.67	2.25	3.00
T_2	111.51	109.11	16.23	8.43	1.91	2.60
T_3	134.00	114.66	20.10	10.32	2.40	3.21
T_4	117.00	77.33	14.30	11.47	2.10	2.80
Mean	**122.12**	**103.35**	**17.08**	**10.00**	**2.18**	
SEd	**4.76**	**3.475**	**1.157**	**0.916**	**0.105**	
CD (0.05)	**10.486**	**7.654**	**10.659**	**12.67**	**6.826**	

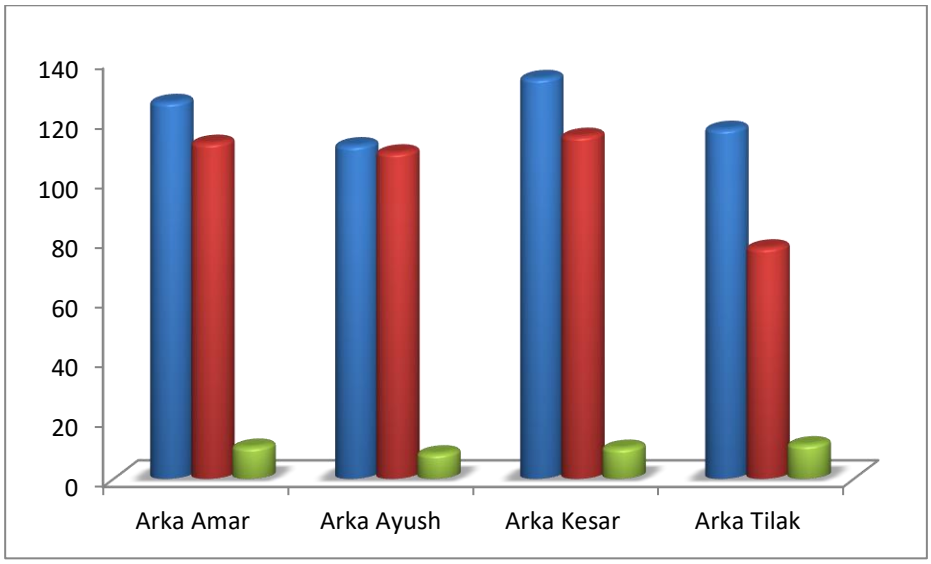

Fig. 1a. Plant height (cm), spike length (cm), floret diameter (cm)

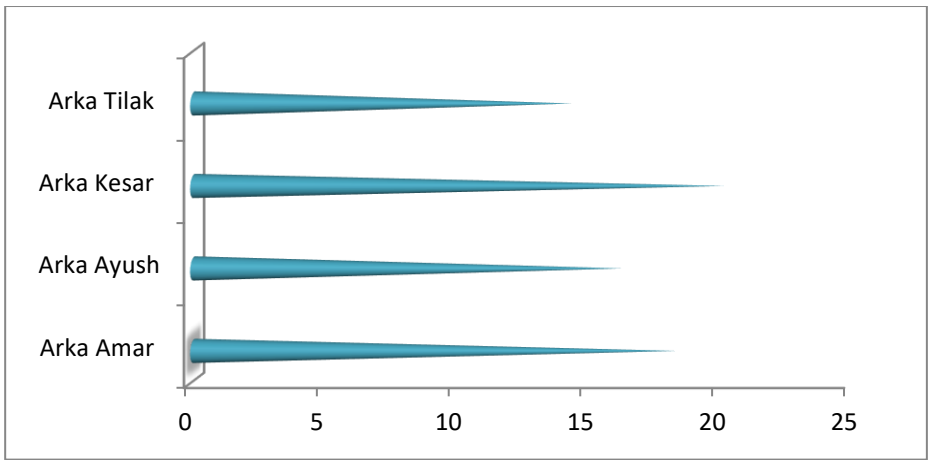

Fig. 1b. Number of florets/spike (No.s)

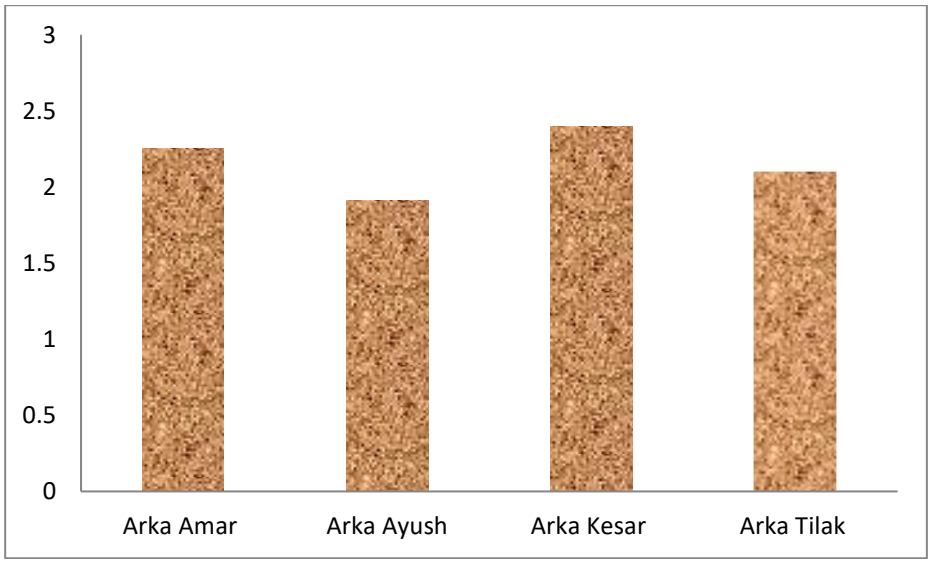

Fig. 1c. Yield (no. of spikes in lakhs/hectare)

3.3 Number of Florets

Maximum number of florets per plant (20.10) was observed in variety Arka Kesar and the minimum was recorded in Arka Tilak (14.30) respectively. Results reveal that the data was significant to each other (Table 1). Producing spikes with more florets happens because of less competitiveness among plants to obtain water, minerals, nutrition, and light [5]. The difference in number of florets per spike might be due to variation in genetic makeup of different cultivars and efficient utilization of resources besides the size of planting material [17]. Similar results were reported by Ainarkar et al. [3] in gladiolus.

3.4 Floret Diameter

Floret diameter was recorded highest in Arka Tilak (11.47 cm) and lowest was recorded in Arka Ayush (8.43 cm). Results reveal that diameter of florets among the four varieties showed real significance. Variation in floret size among the varieties also might be due to their difference in genetic constitution. This is in line with the findings of Pandey et al. [18], and Singh et al. [14].

3.5 Spike Yield

With respect to the number of spike yields/hectare, the maximum yield was recorded in the variety Arka Kesar (3.21 lakhs/ha) followed by Arka Amar (3.00 lakhs/ha). The increased yield might be due to its capacity to produce a maximum number of spikes/plant mainly attributed to the variation in the sprouting percentage of corms and sprouts per plant which are the genetically controlled characteristics [13,19]. Similar findings were also reported in tuberose [20].

The studies revealed that the gladiolus varieties Arka Amar and Arka Kesar were also superior with respect to vegetative and reproductive character and these varieties can be recommended for commercial cultivation in Wayanad district.

The growth, flowering behavior, and yield in plants are influenced by genetic diversity and the climatic conditions of a specific location. When different cultivars are grown under identical conditions, the genetic factors become the primary drivers of phenotypic differences. These variations can be attributed to the inherent growth characteristics of each genotype. Similar variability has been observed in gladiolus genotypes, where the genetic makeup plays a significant role in the expression of various traits. Some cultivars display unique or exotic characteristics, highlighting the genetic foundation behind the expression of desirable traits [21]. Sharma and Gupta [22] noted that larger mother corms, which store more food reserves, contribute to improved plant growth. This positive effect is likely linked to corm production, which is influenced by the size of the corms.

4. CONCLUSION

In the present investigation, it is observed that the maximum plant height, spike length, number of florets per plant, and spike yield were found to be in Arka Kesar. The maximum floret diameter however was found to be in Arka Tilak. On the basis of above findings, these varieties can be recommended for cut flower purpose to the farmers in this region. The results reported from the present investigation are suggestive and can be further applied for appropriate recommendations.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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