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Performance of Gladiolus Cultivars on Morphological Traits and Corm Production under the Agro-Climatic Conditions of Peshawar-Pakistan

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Declaration

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ABSTRACT

Gladiolus is an important commercial cut flower valued for its vibrant colors and spikes with extended vase life. However, the growth and corm production of different cultivars are highly affected by environmental factors. In areas like Peshawar-Pakistan, limited research exists to guide the selection of suitable gladiolus cultivars that can thrive under these conditions. Inadequate knowledge about the adaptability and performance of available cultivars often results in weak growth, late flowering, and low production of corms, making it a challenge for commercial production. In this regard, an experiment was designed on the Performance of gladiolus cultivars on morphological traits and corm production under the agro-climatic condition of Peshawar was conducted at Ornamental Nursery, Department of Horticulture, The University of Agriculture Peshawar. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. Three cultivars of Gladiolus viz., namely White Prosperity, Rose Supreme and Magma were used for their performance. Significant variation ($P \leq 0.05$) was recorded among cultivars regarding morphological traits and corm production. The cultivar White Prosperity took minimum days to emergence (8.33 days), having maximum plant height (102 cm) and produced maximum number of leaves plant^{-1} (8), number of florets spike^{-1} (13), number of cormels corm^{-1} (20) and daughter corm weight (17.6 g) compared to Rose Supreme and Magma. It is concluded that the cultivar White Prosperity is recommended for quality flower and corm production under the agro-climatic condition of Peshawar valley.

INTODUCTION

Floriculture is an important sector of horticulture, with Netherlands, contributing major share to the cut flowers trade in the world (Van Uffelen and De Groot, 2005; Van Hemert, 2005). Gladiolus (*Gladiolus grandiflora L.*) is one of the most commercially important cultivated flowering plant worldwide including Pakistan. The name gladiolus was derived from the Latin word "gladiolus" means sword and hence it is often called as "sword lily" owing to the shape of its leaves. Gladiolus genus has more than 150 species all over the world that is mainly native of west, south, and east areas of Africa, but about 12 species have originated from Mediterranean areas (Cohat, 1993). The gladiolus is cultivated on an area of 7,384.34 ha in the world with an international trade worth 3,100 million US $ (Liemt, 1999; Lepcha et al., 2007). In Pakistan, the gladiolus ranks second among the commercially grown flowering plants after rose (Riaz et al., 2007). It is reported that area under gladiolus cultivation in Pakistan has been increased from 392.54 ha in 2005 to about 809.37 ha in 2015 (Ramzan et al., 2010). Gladiolus is known as queen of the bulbous plants and is very popular as a cut flower, because of its spike, colors and color combinations, having an advantage in every floral arrangement (Bushman, 1990). Gladiolus plant is commercially used for cut flowers and occasionally used for landscape

purpose. Gladiolus produce very attractive flowers and there is great consumer demand for it (Jenkins, 1963; Jenkins *et al.* 1970). Gladiolus spikes takes 60 to 100 days after planting to be harvested depending upon the cultivars and time of year (Jenkins, 1963; Jenkins *et al*. 1970). The flowers are bisexual, actinomorphic, perianth petaloid, have 3 stamens and the ovary is completely inferior (Hutchinson, 1959).

Agro-ecological conditions such as: Light, temperature, rainfall, humidity and soil condition are important in flowering of this crop as well as water, salinity and nutrient management also affect the crop production (Ahmed *et al*., 2017; Datta *et al*., 2015). Fertilizer requirements for rapidly growing gladiolus vary with climatic conditions, irrigation method and soil type (Wilfret, 1980). The modern gladiolus cultivars offer a diversity of colours, shapes, and sizes available in few other flowering plants. Moreover, new cultivars also come from other countries and the performance of these cultivars depends upon climatic conditions of the region under which they are grown. Gladiolus cultivars show narrow adaptations and fluctuating performance in terms of various traits over varying environments. As a result, cultivars which perform well in one region may not perform same in other regions of varying climatic conditions (Islam *et al*. 2017)

Gladiolus can be grown successfully in diverse agro-climatic conditions of Pakistan specially in sub-tropical areas. The performance of gladiolus depends upon the cultivars and the climatic condition of that specific locality. Keeping in view the above facts an experiment was conducted with an objective to find out the best gladiolus cultivar (s) for commercial production in the agro-climatic condition of Peshawar valley.

MATERIALS AND METHODS

Experimental Site

The experiment on "Performance of gladiolus cultivars on morphological traits and corm production under the agro-climatic condition of Peshawar" was conducted at Ornamental Nursery, Department of Horticulture, The University of Agriculture Peshawar, during 2018. The experimental farm is located at 34.01° N latitude, 71.35° E longitude at an altitude of 350 m above sea level in Peshawar valley. Peshawar is located about 1600 km north of the Indian Ocean and has continental type of climate. The research farm is irrigated by Warsak canal from river Kabul. The maximum rain fall in Peshawar is around 78mm in March while the lowest is in June i.e. 7mm (Basit et al., 2022).

Experimental Description

The experiment was comprised in Randomized Complete Block Design (RCBD) with one factor i.e. Cultivars (White Prosperity, Rose Supreme and Magma) which were replicated three times. The whole experimental plot area was divided into 9 subplots of equal size and then thoroughly prepared before plantation of gladiolus corms. The corms of three varieties were cleaned by removing the dried scales or tunics present on them and then planted at a spacing of 30 x 30 cm. All agronomic practices (irrigation, weeding, hoeing) were performed uniformly throughout the experimental plots.

Data Collection

Days to emergence was computed from date of sowing to emergence of plant from the randomly selected plants from every treatment. Numbers of leaves plant^{-1} produced on randomly selected plants in each treatment per replication were counted and their average was computed. Numbers of florets in each spike were counted from randomly selected plants and their average were calculated. The plant height was measured with measuring tape from the bottom to the tip of the randomly selected plants in each treatment and their means were calculated. From each treatment ten (10) pods, the weight of each daughter corm was measured with the help of electronic balance and their average were computed. Total numbers of cormels corm^{-1} were counted in randomly selected plants of every treatment and their average were worked out.

Data Analysis

The results of experimental study were generated using Statistix software version (8.1) and were subjected to Analysis of Variance (ANOVA) for Randomized Complete Block Design and their means were computed by least significant difference (LSD) at 5% level of significance (Ali et al.,2024).

Results and Discussion

Morphological Attributes

Days to Plant Emergence, Number of Leaves Plant^{-1} and Plant Height

Significant differences ($P \leq 0.05$) were found for gladiolus cultivars for days to plant emergence, number of leaves plant^{-1} and plant height (Table-1). The mean data pertaining in Figure 1 revealed that minimum days to plant emergence (8.23), highest number of leaves (8.33) and taller plant (102cm) were attained by cultivar White prosperity. While maximum days to plant emergence (19.97), lowest number of leaves (6) and shorter plant (60.70cm) were observed in cultivar Magma.

Significant variations in days to corm sprouting might be attributed due to genotypic differences that may contributed to different hormones levels, especially of gibberellins and abscisic acid in the corms which is controlling the period of dormancy (Kumar et al., 2015 and Nair and Shiva, 2003) and it may also resulted due to the genetic makeup of the cultivars and food reserves in plants that is the major source of spike emergence,

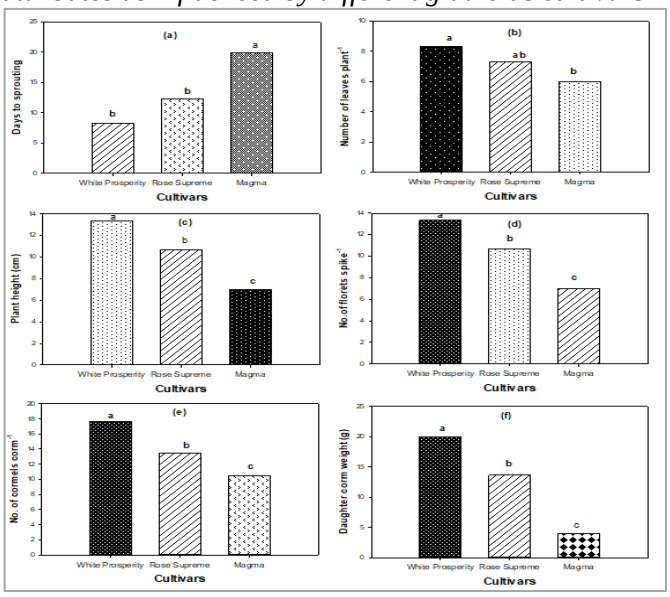
growth of plants (Punam et al., 2009 and Sindhu et al., 2014).The variation in days to emergence of corm amongst various cultivars might be attributed due to environmental conditions prevailed during sprouting period of corms that could have contributed to different genotype-environment interaction (Al-Humaid, 2004).

Maximum number of leaves in white prosperity might be attributed due to the favorable agro environmental conditions and their better interaction with the present environment which made them capable of producing leaves in higher quantity. Therefore the mutual coordination of nutrients absorption and photo assimilates in the presence of optimum temperature and relative humidity during the vegetative growth resulted in more leaves appearing in some cultivars. These results are in accordance with the observation of Wilson (1972), who reported that the production of more leaves may be attributed to the influence of environmental factors which accelerate photosynthesis processes and enable the plant to form a large number of leaves. Similar result were also reported by Hossain *et al*, (2011) and Moshtaq *et al* (2018) who reported that maximum (9) numbers of leaves was recorded in cv. Porter dale while least was found in cv. Nova (5), during lies studies on various gladiolus cultivars.

The differences in the heights of the plants might be due to the genotype as well as some environmental factors, which may have accelerated or retarded the activity of natural plant hormones in the stem. These findings are in agreement with those of Khan *et al.* (2001), who observed that the growth parameters of these cultivars to particular environmental conditions. Various cultivars showed different responses to prevailing soil and environment condition (Safiullah and Ahmed 2001).

Figure 1

Morphological, flowering and corm production related attributes as influenced by different gladiolus cultivars



Flowering Characteristics

Number of Florets Spike^{-1}

The statistical analysis of the data revealed that various gladiolus cultivars showed significant differences in number of florets spike^{-1} (Table 1). Data regarding number of florets spike^{-1} showed that highest number of florets spike^{-1} (13.3) were attained by cultivar White prosperity which was closely followed by cv. Rose supreme that produced number of florets spike^{-1} (10.67). Whereas lowest number (7.00) of florets spike^{-1} were recorded in cultivar Magma (Figure 1). Number of florets is one of the most important characters. The number of florets differs as different cultivar to cultivars might be attributed to hereditary traits of the cultivars of the gladiolus, which is governed by genetic makeup of the plants (Swaroop *et al*. 2018). Similar results on number of florets per spike have been reported by Ram *et al*. (2005) and Rani *et al*. (2007). Number of days taken to first blooming and number of florets per plant were differed significantly for different cultivars, might be due to the difference in genetic prospective and efficient utilization of natural resources and inputs (Shaukat et al., 2013).

Table 1

Mean Square value of morphological, flowering and corm production related attributes of gladiolus as influenced by different cultivars

		Mean Square (MS)					
Source	**DF**	**DTSP**	**NOLPP**	**PH**	**NOFPS**	**CPC**	**DCW**
Replications	2	0.282	0.78	42.88	2.33	3.11	0.91
Cultivars	2	104.31*	4.11*	1460.6*	30.3*	195*	38.9*
Error	4	5.579	0.44	3.49	0.67	2.11	0.58
Total	8						

DTSP: Days to sprouting percentage; NOLPP: Number of leaves plant-1; PH: Plant height; NOFPS: Number of florets plant-1; CPC: Cormels corm-1 and DCW: Daughter corms weight

Corms and Cormels Attributes

The number of cormels corm^{-1} and daughter corm weight varied significantly with gladiolus cultivars (Table 1). Cultivars white prosperity exhibited the maximum number of cormels corm^{-1} (20) and daughter corm weight (17.66g) of gladiolus which was closely followed by cultivar Rose supreme which produced (13.66) cormels corm^{-1} and had daughter corm weight (13.5g).While minimum number of cormels corm^{-1} (4) and daughter corm weight (10.5g) were observed in cultivar Magma (Figure 1) .

Cormels development and formation is based on vegetative growth and when the vegetative growth is good enough, with proper plant height, number of leaves and leaf area the plant produced sufficient photosynthesis (Misra, 1994). In gladiolus the

production of corm and cormels^{-1} ability determines its rate of multiplication. More number of cormels corm^{-1} productions may be attributed to genetic makeup of a cultivar. Jhon *et a*l.(1996). Rani *et al*.(2007), Ranpise *et al*.(2010), and Hossain *et al*.(2011) also reported the same result on variation in number of cormels corm^{-1}.The variation in production of cormels per plant might be due to the soil and climatic and genetic composition (Swain et al., 2008).Similarly Safiullah and Ahmed (2001) reported that the variation in number of leaves could be due to genotype as well as some environmental factors.

Corms are the storage organ which store food for the plants. The production of more weight of daughter corm may be due to good vegetative growth of plants in initial stages, which supplies higher amounts of photosynthesis for storage in corms. It may be due to heredity characters (Saini *et al*., 1991). Das(1998), Dimri(2002) ,Rajvi and Yadav (2005) and Rahul *et al*.(2011) also reported similar variation in weight of corms. Larger and heavier corms are one of the important criteria for selecting of quality corms obtains quality spikes. Variation in traits of corms and cormels may be primarily due to genetic constitution of the cultivars which may get further modified owing to the prevailing environmental conditions. Wide variation for yield was observed by Kumar (2009) and Shaukat et al (2013).Variation in corm weight under various cultivars is due to available food material for the development of corms, genetic makeup of the cultivar which may get further development of corm in the particular environmental conditions. Similar result reported by Sharma et al. (2018) and Pragya et al. (2010).

CONCLUSION

On the basis of the above results, it was concluded that Cultivars White Prosperity were found superior compared to other cultivars in term of morphological and corm production related attributes of gladiolus in agro climactic conditions of Peshawar valley and hence recommended for general cultivation for cut flower production.

REFERENCES

Ahmed, M. J., Akbar, Z., Kosar, N., & Khan, Z. A. (2002). Introduction and evaluation of exotic gladiolus (Gladiolus grandifilorus) cultivars. *Asian Journal of Plant Sciences*, *1*(5), 560-562. https://doi.org/10.3923/ajps.2002.560.562

Ahmed, M. J., & ., S. G. (2002). Evaluation of exotic cultivars of dahlia (Dahlia coccinea) under Rawalakot conditions. *Asian Journal of Plant Sciences*, *1*(5), 565-566. https://doi.org/10.3923/ajps.2002.565.566

Ahmed, N., Mahmud, N., Zaman, M., Ferdous, Z., & Halder, S. (2017). Effect of different salinity level on tomato (Lycopersicon esculentum) production under climate change condition in Bangladesh. *Annual Research & Review in Biology*, *13*(3), 1-9. https://doi.org/10.9734/arrb/2017/33613

Al-Humaid, A. I. (2004). Adaptation of some Gladiolus cultivars to Al-Qassim environmental conditions. https://www.cabidigitallibrary.org/doi/full/10.5555/20053057390

Ali, H., Ahmad, M., Jabin, S., Muqarrab, R. Z., Ahmad, I., Khan, M. A., Khan, M., Khalil, I., Basit, A., Kamal, M., & Ahmad, M. (2024). Influence of willow bark extracts and application times on the production of Roselle. *Plant Protection*, *8*(4), 671-677. https://doi.org/10.33804/pp.008.04.5422

Ali, Z., Shabbir, M., Qadeer, A., Ahmad, H., Qasim, M., & Aziz, O. (2016). Performance evaluation of gladiolus varieties under diverse climatic conditions. *Plant Gene and Trait*. https://doi.org/10.5376/pgt.2016.07.0004

Ankit Chourasia, A. C., Viradia, R. R., Ansar, H., & Madle, S. N. (2015). Evaluation of different gladiolus cultivars for growth, flowering, spike yield and corm yield under Saurashtra region of Gujarat. https://www.cabidigitallibrary.org/doi/full/10.5555/20153218808

Basit, A., Amin, N. U., Shah, S. T., & Ahmad, I. (2021). Greenbelt conservation as a component of ecosystem, ecological benefits and management services: Evidence from Peshawar city, Pakistan. *Environment, Development and Sustainability*, *24*(9), 11424-11448. https://doi.org/10.1007/s10668-021-01890-3

Buschman, J. C. M. (1984). *Gladiolus as cutflower in subtropical and tropical regions*. International Flowerbulb Centre.

Coetzee, J. (2002). Benefit sharing from flowering bulb - Is it still possible? *Acta Horticulturae*, (570), 21-27. https://doi.org/10.17660/actahortic.2002.570.1

Cohat, J. (1993). Gladiolus. The physiology of flower bulbs. Amsterdam, 297- 320.

Das, T.K. 1998. Corm and cormel production in gladiolus as affected by spike removal and K application. Indian J. Hort., 55(4): 327-331.

Datta, A., Shrestha, S., Ferdous, Z., & Win, C. C. (2014). Strategies for enhancing phosphorus

efficiency in crop production systems. *Nutrient Use Efficiency: from Basics to Advances*, 59-71. https://doi.org/10.1007/978-81-322-2169-2_5

Datta, A., Ullah, H., & Ferdous, Z. (2017). Water management in rice. *Rice Production Worldwide*, 255-277. https://doi.org/10.1007/978-3-319-47516-5_11

Dimri, D. C. (2002). Performance of some promising gladioli cultivars under low hills of Uttaranchal. *Progressive Horticulture*, *34*(2), 265-267. https://www.cabidigitallibrary.org/doi/full/10.5555/20033159624

Goldblatt, P., & Manning, J. (1998). *Gladiolus in southern Africa* (pp. 320-pp).

Hartmann, H. T., & Kester, D. E. (1975). *Plant propagation: principles and practices* (pp. 662-pp).

Hossain, M., Talukder, K., Asaduzzaman, M., Mahmud, F., Amin, N., & Sayed, M. (2013). Study on morphological characteristics of different genotypes of gladiolus flower. *Journal of Science Foundation*, *9*(1-2), 1-8. https://doi.org/10.3329/jsf.v9i1-2.14642

Hutchinson, J. (1959). *Families of flowering plants*. Macmillan & Co. Ltd. St. Martins St., London. Pp-792

Islam, M., Anwar, M., Alam, A., Khatun, U., & Ara, K. (2017). Performance of different gladiolus varieties under the climatic condition of Tista meander floodplain in Bangladesh. *Progressive Agriculture*, *28*(3), 198-203. https://doi.org/10.3329/pa.v28i3.34655

Jenkins, J. J. (1970). Commercial gladiolus production in North Carolina. N. C. Agric. Ext. Circ. 44: 1-34.

Jhon, A. Q., Bichoo, G. A., & Siddique, M. A. A. (1996). Performance of gladiolus cultivars in Kashmir. *Flora and Fauna (Jhansi)*, *2*(1), 75-77. https://www.cabidigitallibrary.org/doi/full/10.5555/19970302557

Kem, J. C., Yadav, S. K., & Satya Kumar, S. K. (2003). Performance of gladiolus cultivars under valley conditions of Uttaranchal. *Progressive Hort*, *35*(1), 108-110. https://www.cabidigitallibrary.org/doi/full/10.5555/20043121059

Kumar, R., & Yadav, D. S. (2005). Evaluation of gladiolus cultivars under sub-tropical hills of Meghalaya. *Journal of ornamental Horticulture*, *8*(2), 86-90.

Larson, R. A. (Ed.). (2012). *Introduction to floriculture*. Elsevier.

Lewis, G. J., Obermeyer, A. A., & Barnard, T. T. (1972). Gladiolus: a revision of the South African species. *Journal South African Botany Suppl.*, *10*. https://cir.nii.ac.jp/crid/1130000797833463424

Misra, R. L. (1994). *Effect of leaf and spike clippings on corm and cormel yield of gladiolus. in: Prakash J, Bhandary kR ed. floriculture-technology, trades and trends*. India, Oxford & IBH Publishing Company. Pp. 55–58.

Mushtaq, S., Hafiz, I., Arif, M., & 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. https://doi.org/10.9734/ajaar/2018/39494

Negi, S. S., Sharma, T. V. R. S., Raghava, S. P. S., & Srinivasan, V. R. (1982). Variability studies in gladiolus. *Indian Journal of Horticulture*, *39*(3and4), 269-272. https://www.indianjournals.com/ijor.aspx?target=ijor:ijh&volume=39&issue=3and4&article=025

Rahul Kumar, R. K., Sanjay Kumar, S. K., & Yadav, Y. C. (2011). Variability studies for yield and yield attributing traits in Gladiolus. *Progressive Agriculture*, *11*(2), 356-360. https://www.cabidigitallibrary.org/doi/full/10.5555/20113407391

Ram, R. B., Tomar, K. S., & Datta, S. K. (2005). Performance of certain gladiolus varieties under sodic conditions. *Journal of Ornamental Horticulture*, *8*(1), 77-78. https://www.indianjournals.com/ijor.aspx?target=ijor:joh&volume=8&issue=1&article=020

Ranpise, S. A., Nijasure, S. N., & Gondhali, B. V. (2010). Effect of preservatives on vase life of gladiolus cv. American beauty. *Journal of Maharashtra Agricultural Universities*, *35*(3), 446-448. https://www.cabidigitallibrary.org/doi/full/10.5555/20113088406

Rao, T. M., & Janakiram, T. (2006). Pperformance of exotic Orchidiolas and IIHR gladiolus cultivars. *Journal of Ornamental Horticulture*, *9*(1), 61-62. https://www.indianjournals.com/ijor.aspx?target=ijor:joh&volume=9&issue=1&article=016

Rupa Rani, R. R., Prasad, K. K., & Rakesh Ranjan, R. R. (2007). Study on varietal performance in gladiolus. *Orissa Journal of Horticulture*, *35*(2), 35-38. https://www.cabidigitallibrary.org/doi/full/10.5555/20113014232

Safiullah, S., & Ahmed, M. J. (2001). Evaluation of exotic cultivars of gladiolus (Gladiolus grandiflorus) under Rawalakot conditions. *Sarhad J. Agric*, *7*(2), 171-174.

https://www.cabidigitallibrary.org/doi/full/10.5555/20013159963

Saini, R. S., Gupta, A. K., & Yamdagni, R. (1991). Performance of different cultivars of (Gladiolus floribundus L.) under Hisar conditions. *South Indian Horticulture*, *39*(2), 99-101. https://www.cabidigitallibrary.org/doi/full/10.5555/19940302619

Stuart, N. W., & McClellan, W. D. (1951). Effect of nutrient supply and fertilizer practices on Gladiolus growth in the greenhouse and field. *Gladiolus Magazine*, *15*(2).

Swaroop, K., Singh, K. P., Bhatia, R., Panwar, S., Kumar, A., & Mishra, R. L. (2022). Evaluation and performance of gladiolus hybrids for commercial traits. *Journal of Ornamental Horticulture*, *25*(1and2), 79-83. https://doi.org/10.5958/2249-880x.2022.00012.3

Wilfret, G. J. (1980). Introduction to floriculture (Larson, RA ed.).

Zeeshan Ali, Z. A., Abdul Qadeer, A. Q., Ahmad, H. M., Omar Aziz, O. A., Muhammad Qasam, M. Q., & Qurban Ali, Q. A. (2015). Assessment of effect of different herbicides on morphological traits of Gladiolus grandiflorus. https://www.cabidigitallibrary.org/doi/full/10.5555/20153366930