The Pharma Innovation Journal 2022; 11(3): 85-90

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(3): 85-90

www.thepharmajournal.com
Received: 07-12-2021
Accepted: 13-01-2022

Rahul Tiwari
M.Sc. Department of Horticulture, Bundelkhand University, Jhansi, Uttar Pradesh, India

Harpal Singh
Assistant Professor, Department of Horticulture, Bundelkhand University, Jhansi, Uttar Pradesh, India

Satvaan Singh
Ph.D., Scholar, Department of Floriculture and Landscape Architecture, SVPUA&T-Meerut, Uttar Pradesh, India

Alok Pratap
MSc., Department of Horticulture, Floriculture and Landscape Architecture, SVPUA&T-Meerut, Uttar Pradesh, India

GK Ahirwar
Ph.D., Scholar, Department of Horticulture, SVPUA&T, Meerut, Uttar Pradesh, India

Corresponding Author:
Rahul Tiwari
M.Sc. Department of Horticulture, Bundelkhand University, Jhansi, Uttar Pradesh, India

Influence of plant growth regulators on gladiolus (*Gladiolus grandiflorus* L.) cv. Traderhorn under Bundelkhand region

Rahul Tiwari, Harpal Singh, Satvaan Singh, Alok Pratap and GK Ahirwar

Abstract
The present investigation entitled title "Influence of Plant growth regulators on Gladiolus (*Gladiolus grandiflorus* L.) cv. Traderhorn under Bundelkhand Region" was carried at the Experimental, Organic Research farm Kargunwa ji, Jhansi, Department of Horticultural Sciences, Institute of Agricultural Sciences, Bundelkhand University Jhansi (Uttar Pradesh) during *Rabi* season of 2020-2021.
The research material comprised of nine treatments along with three replications in Randomized Block Design with planting distance (30 x 30) cm. The data on 80% emergence of plant (7.687 days), stem girth/diamter of plant was maximum (2.18 cm), number of leaves per plant at harvest was maximum (11.3), maximum leaf area at harvest (2.107 cm^2), maximum leaf area index (2.107 cm^2). The data on 80% emergence of spike at harvest was maximum (82.36), maximum number of floret per spike at harvest (15.803). The data at harvest on length of rachis was found maximum (46.770 cm), at harvest equitorial diameter (3.490 cm), polar Length of individual corm per plant of gladiolus (6.237). The number of corm per plant of gladiolus (6.23), maximum corm yield ((19.710 t/ha), Yield of cormel (16.710 t/ha), All the parameters were significantly influenced by different doses with T_5 (BA) 100ppm + (GA_3) 100ppm) and T_8 (BA) 150ppm+ (GA_3) 150ppm in comparison to the control plot T_0. Thus it can be assumed that application of growth regulators such as Gibberellic acid (GA_3) and Benzyl adenine (BA) should not be overlooked in flower crops under Bundelkhand region. Further researches are required to determine other plant growth regulators which are inevitable in quality improvement of flowers.

Keywords: Benzyl adenine, gibberellic acid, growth, gladiolus, trader horn yield

Introduction
The botanical name of 'Gladiolus' known as *Gladiolus grandiflorus*. Gladiolus is one of the significant monocotyledonous blooming enduring bulbous plant has a place with family Iridaceae and broadly developed as a cut blossom on the planet and alluded to as the "Queen of Bulbous" blossoms. It has a chromosome number n=15 and greater part of South African species are diploid (2n=30). (*Gladiolus grandiflorus*), by and large called "Glad", an individual from family Iridaceae and sub-family Ixiodeae, started from South Africa, is a conspicuous bulbous cut blossom plant (Manning and Goldblatt, 2008) [11]. It is otherwise called the Sword Lily, because of its blade molded leaves, or Corm. Being a significant bulbous elaborate plant, it possesses an excellent situation among business bloom crops which has popularity in both homegrown and worldwide business sectors. It possesses eighth place on the planet's cut bloom exchange and has a worldwide history (Umrao *et al.*, 2007) [18].
The flower is popular because of alluring spikes, huge florets, stunning tones and long shelf life (Parmar *et al.* 1994) [16]. With the advancement being developed of gardening industry in India, the farmers are redirecting to high qualities botanical yields because of expansion in usage of blossoms in different get-togethers. The main botanical yields in India utilized as cut blossoms incorporate rose, tuberose, gladiolus, marigold and jasmine (Roychowdhury, 2010) [17]. Notwithstanding, nearby new flower market is overwhelmed with for the most part gladiolus. The gladiolus has the potential not exclusively to satisfy the neighborhood necessities yet additionally to procure unfamiliar trade as the crop is of brief length (110-120 days); wide varietal abundance, preferable monetary returns over customary yields and wide scope of accessible climatic circumstances in the nation have added to its development possibilities. The business cultivators are establishing gladiolus in various zones of the country to satisfy the neighborhood utilization interest; but the production and blossom quality are still

low to fulfill worldwide guidelines (Mukhopadhya, 1995) [15]. In this way, research is expected to build the yield and nature of the bloom to reinforce our neighborhood market and furthermore to satisfy the commodity guidelines. The major gladiolus producing nations are the United States (Florida and California), Holland, Italy, France, Poland, Bulgaria, Brazil, India, Australia and Israel.

Plant growth regulators have been found to impact the development and blooming of gladiolus. GA_3 has numerous regulatory impacts on plant advancement. It animates synthesis of hydrolytic catalysts (enzymes) for processing of endosperms saves. GA_3 is the dynamic substance separated from organism '*Gibberella fujikuroi'* the centralization of GA_3. Gibberellins have likewise been found in delaying the dormancy. Gibberellins invigorate development, and postponement senesce GA_3 animate both cell division as well as cell enlargement. It can move openly along the stem in either acropetal or basipetal direction inferred that gibberellins increase weight of cut blossoms; Weiss, (2000) [20] reported that gibberellic acid promotes proteins in anthocyanin pathway, for example, chalkon synthetase, chalkon isomerase, dihydroflavinol reductase.

The announced advantages of PGRs on gladiolus incorporates breaking dormnacy, early sproutness, increase spike length, further developed florets shape, shading and better vase life. PGRs is delivered in anthers, which are in formative stage and afterward it is moved into corolla where it improves physiological and natural cycles like petal development and color creation (Manning and Goldblatt 2008) [14].

The manufactured cytokinin like benzyl adenine play a significant capacity like cell division, countering of apical predominance, advancement of chloroplast improvement and furthermore helps in defer the senescence. The joined utilization of BA and GA_3 benefits concerning the bulbous flowering crops in the production of good quality blossoms and bulbs. Benzyl Adenine was appropriate for breaking dormancy of gladiolus corm and cormels Mukhopadhyay (1985) [15]. At the same time, stimulation of cormels by GA_3 treatment has been accounted for by Arora *et al.,* (1992) [1].

Material and Methods

The present investigation was conducted out at Experimental, Organic Research farm Kargunwa Ji, Jhansi, Department of Horticultural Sciences, Institute of Agricultural Sciences, Bundelkhand University Jhansi (Uttar Pradesh) during *Rabi* season of 2020-2021in Randomized block design. Gladiolus variety 'Traderhorn' with 9 treatments T_0: Control, T_1: Benzyl adenine (BA) 100ppm, T_2: Benzyl adenine (BA) 150ppm,T_3:Gibberellic acid (GA_3)100ppm, T_4:Gibberellic acid (GA_3) 150ppm, T_5:(BA) 100ppm+(GA_3)100ppm, T_6:(BA) 100ppm+(GA_3) 150ppm, T_7:(BA)150ppm+(GA_3) 100ppm, T_8: (BA)150ppm+ (GA_3) 150ppm. The Net plot size: 1.8 x1.8 = 3.24 m^2, and the total Experimental area: 10.8x19.6 m^2=211.68 m^2. Generally corms are classified based on their diameter. The size of the corm has a definite bearing on the length of the spike (floral stem). A medium sized corm with high crown is better than a flat large corm. Generally for flowering, corms of diameter 2.5 cm and above are used for planting, while the smaller ones are used for corm multiplication. So good quality, adequately sized corms, free from pathogens should be selected for planting. Manurial dosage of 10 MT of FYM was applied at the time of preparation of field. After (90-120 days) to produce spikes, during harvesting, atleast 4-5 basal leaves was retained on the plants to ensure proper development of corms and cormels. The process of harvesting depends upon maturity. The spike and corm yield in gladiolus vary depending on the cultivar, corm size, planting density and management practices. All the cultural operation was carried out *viz.*, manual pruning of the weeds, irrigation, pest control were carried out as when required was done at 45 days of planting of the corms. Observation on various vegetative characters *viz.*, Plant height (cm Days required for 80% emergence of plant, Stem girth (cm), Number of leaves /plants, leaf area cm^2 at harvest, Leaf area index (LAI) and the flowering characters *viz.*, Days to 80% spike, Number of floret per spike, Flower stalk length, Length of rachis, Duration of flowering days. The corms yield characters *viz.*, Equitorial diameter individual corm, Polar Length of individual corm, Number of corm / plant, Number of cormel / plant, Corm Yield t/ha, Cormel Yield t/ha. The data were statistically analyzed by the method suggested by Panse and Sukhatme (1978) [2].

Result and Discussion

Plant height (cm)

Data condensed in the Table-1 and Fig-1 clearly indicated that plant growth regulator gave significant effect on plant height. The data on height parameter at harvest was maximum with T_5 (BA) 100ppm+ (GA_3) 100ppm) and T_8 (BA) 150ppm+ (GA_3)150ppm treatment was (79.90 and 76.51) cm. These findings are similar to the findings of Baskaran and Misra *et al.*(2007) [2] in gladiolus

Days required for 80% emergence of plant.

Data pertaining to days required for 80% emergence of plant has been presented in Table-1 and graphically illustrated in Fig-1. The data on days required for 80% emergence at harvest was maximum with T_5 (BA) 100ppm+ (GA_3) 100ppm) and T_8 (BA) 150ppm+ (GA_3) 150ppm treatment was (7.687 and 6.800) days. These findings are similar to the findings of Bhattacharyya *et al.*(1984) [2] in gladiolus.

Stem girth (cm)

Data pertaining to stem girth/diamter of plant has been presented in Table-1 and graphically illustrated in Fig-1. The data on stem girth/diamter at harvest was maximum with T_5 (BA) 100ppm+ (GA_3) 100ppm) and T_8 (BA) 150ppm+ (GA_3) 150ppm treatment was (2.18 and 2.20) cm. These findings are similar to the findings Baskaran and Misra *et al.* (2007) [2] in gladiolus and Chopde *et al.*(2015) [4] in gladiolus.

Number of leaves per plant

Data pertaining to number of leaves per plant has been presented in Table-1 and graphically illustrated in Fig-1. The data on number of leaves per plant at harvest was maximum with T_5 (BA) 100ppm+ (GA_3) 100ppm) and T_8 (BA) 150ppm+ (GA_3) 150ppm treatment was (11.3 and 10.9). These findings are similar to the findings of Choudhury *et al.*(2015) [5] in tuberose.

Leaf area (cm^2): The data embodied in Table-1 and graphically depicted in Fig-1. The data on leaf area at harvest was maximum with T_5 (BA) 100ppm+ (GA_3) 100ppm) and T_8 (BA) 150ppm+(GA_3) 150ppm treatment was (724.670 and 688.663) cm^2. These findings are similar to the findings of Choudhury *et al.*(2015) [5] in tuberose.

Leaf area index (cm^2)
The data assembled in Table-1 and graphically depicted in Fig-1 indicated that the growth regulator application under the present study gave significant effect on leaf area index (cm^2) at harvest was maximum with T_5 (BA) 100ppm+ (GA_3) 100ppm) and T_8 (BA) 150ppm+ (GA_3) 150ppm treatment was (2.107 and 1.933) cm. These findings are similar to the findings of Choudhury *et al.* (2015) [5] in tuberose.

Flower parameters at harvest
Days required for 80% emergence of spike
The data presented in Table-2 and graphically displayed in Fig- 2 clearly showed that all the treatments in the study gave significant effect on days required for 80% emergence of spike at harvest was maximum with T_5 (BA) 100ppm+ (GA_3) 100ppm) and T_8 (BA) 150ppm+ (GA_3) 150ppm treatment was (82.36 and 87.34) days. These findings are similar to the findings of Choudhury *et al.*(2015) [5] in tuberose.

Number of floret per spike
The data presented in Table-2 and graphically displayed in Fig- 2 clearly showed that all the treatments in the study gave significant effect on number of floret per spike at harvest was maximum with T_5 (BA) 100ppm+ (GA_3) 100ppm) and T_8 (BA) 150ppm+ (GA_3) 150ppm treatment was (15.803 and 14.520). These findings are similar to the findings of Choudhury *et al.*(2015) [5] in tuberose.

Flower stalk length (cm)
It is evident from the data presented in Table-2 and Fig-2 that the different plant growth regulators application significantly affected the flower stalk length per plant of gladiolus. At harvest flower stalk length was maximum with T_5 (BA) 100ppm + (GA_3) 100ppm) and T_8 (BA) 150ppm+ (GA_3) 150ppm treatment was (79.94 and 75.79) cm. These findings are similar to the findings of Biswas *et al.* (1982) [3] in tuberose and Kumar *et al.* (2020) [9] in gladiolus.

Length of rachis (cm)
It is evident from the data presented in Table-2 and Fig-2 that the different plant growth regulators application significantly affected the length of rachis per plant of gladiolus. At harvest flower stalk length was maximum with T_5 (BA) 100ppm + (GA_3) 100ppm) and T_8 (BA) 150ppm+ (GA_3) 150ppm treatment was (46.770 and 43.613) cm. These findings are similar to the findings of Kumar *et al.*(2020) [9] in gladiolus.

Duration of flowering days
Data pertaining to duration of flowering days has been presented in Table-2 and graphically illustrated in Fig-2. At harvest duration of flowering days was maximum with T_5 (BA) 100ppm + (GA_3) 100ppm) and T_8 (BA) 150ppm+ (GA_3) 150ppm treatment was (23.103 and 15.787) days
These findings are similar to the findings of Kumar *et al.* (2020) [10] in gladiolus.

Corm parameters at harvest
Equitorial diameter individual corm
It is evident from the data presented in Table-3 and Fig-3. that the different plant growth regulators supply significantly affected the equitorial diameter individual corm per plant of gladiolus. At harvest equitorial diameter was maximum with T_5 (BA) 100ppm + (GA_3) 100ppm) and T_8 (BA) 150ppm+ (GA_3) 150ppm treatment was (3.490 and 3.490) cm. These findings are similar to the findings of Kumar *et al.* (2020) [10] in gladiolus and Choudhury *et al.*(2015) [5] in tuberose.

Polar Length of individual corm
It is evident from the data presented in Table-3 and Fig-3. that the different plant growth regulators supply significantly affected the polar Length of individual corm per plant of gladiolus. At harvest polar length of individual corm was maximum with T_5 (BA) 100ppm + (GA_3) 100ppm) and T_8 (BA) 150ppm+ (GA_3) 150ppm treatment was (6.237 and 5.973) cm. These findings are similar to the findings of Kumar *et al.*(2021) [9] in gladiolus and Choudhury *et al.*(2015) [5] in tuberose and Parmar *et al.*(1989) [16] in tuberose and Umrao *et al.*(2007) [19] in tuberose

Number of corms / plant
It is evident from the data presented in Table-3 and Fig-3. that the different plant growth regulators significantly affected the number of corm per plant of gladiolus. At harvest number of corm per plant was maximum with T_5 (BA) 100ppm + (GA_3) 100ppm) and T_8 (BA) 150ppm+ (GA_3) 150ppm treatment was (6.040 and 5.930). These findings are similar to the findings of Misra *et al.* (1998) [12] in Gladiolus and Miller *et al.*(1982) [13] in Primula.

Number of cormel / plant
Data condensed in the Table-3 and Fig-3. clearly indicated that plant growth regulator gave significant effect on number of cormel per plant. At harvest flower stalk length was maximum with T_5 (BA) 100ppm + (GA_3) 100ppm) and T_8 (BA) 150ppm+ (GA_3) 150ppm treatment was (32.577 and 30.053). These findings are similar to the findings of Biswas *et al.* (1982) [3] in tuberose and Chopde *et al.* (2015) [4] in gladiolus.

Table 1: Effect of foliar application of growth regulators on growth parameters of Gladiolus (*Gladiolus grandiflorus* L.) cv. Traderhorn

		Growth parameters at harvest					
S.no	**Treatment**	**Plant height (cm)**	**Days required for 80% emergence of plant**	**Stem girth (cm)**	**Number of leaves/plants**	**leaf area cm^2 at harvest**	**Leaf area index (LAI)**
T_0	Control 0ppm	55.960	12.467	1.353	5.800	211.193	0.793
T_1	Benzyl adenine (BA) 100ppm	58.887	10.690	1.427	6.990	253.697	0.993
T_2	Benzyl adenine (BA) 150ppm	62.637	10.467	1.633	7.683	271.430	1.087
T_3	Gibberellic acid (GA_3) 100ppm	68.823	10.607	1.667	8.460	269.173	1.123
T_4	Gibberellic acid (GA_3) 150ppm	70.597	11.053	1.693	8.053	222.873	1.577
T_5	(BA)100ppm+ (GA_3) 100ppm	79.907	7.687	2.187	11.367	724.670	2.107
T_6	(BA)100ppm+ (GA_3) 150ppm	69.733	9.750	1.740	7.987	334.227	1.590
T_7	(BA)150ppm+ (GA_3) 100ppm	71.083	9.407	1.757	8.887	356.290	1.660
T_8	(BA)150ppm+ (GA_3) 150ppm	76.510	6.800	2.200	10.990	688.663	1.933
	SE(m)	0.110	0.004	0.021	0.005	1.377	0.006
	C.D.	0.332	0.012	0.063	0.015	4.163	0.018

Table 2: Effect of foliar application of growth regulators on flowering parameters of Gladiolus (*Gladiolus grandiflorus* L.) cv. Traderhorn

S.no	Treatment	Flower parameters at harvest				
		Days to 80% spike	Number of floret per spike	Flower stalk length	Length of rachis	Duration of flowering days
T_0	Control 0ppm	105.450	10.650	54.490	32.683	10.527
T_1	Benzyl adenine (BA) 100ppm	95.523	12.337	57.597	25.103	13.453
T_2	Benzyl adenine (BA) 150ppm	94.500	12.923	61.747	36.983	14.213
T_3	Gibberellic acid (GA_3) 100ppm	93.377	12.697	64.980	39.320	14.630
T_4	Gibberellic acid (GA_3) 150ppm	96.367	12.937	69.863	39.317	13.663
T_5	(BA)100ppm+ (GA_3) 100ppm	82.360	15.803	79.947	46.770	23.103
T_6	(BA)100ppm+ (GA_3) 150ppm	99.340	12.923	72.543	40.393	14.997
T_7	(BA)150ppm+ (GA_3) 100ppm	92.433	12.967	73.683	41.977	15.347
T_8	(BA)150ppm+ (GA_3) 150ppm	87.347	14.520	75.797	43.613	15.787
	SE(m)	0.047	0.180	0.061	3.595	0.104
	C.D.	0.141	0.543	0.185	10.870	0.315

Table 3: Effect of foliar application of growth regulators on yield of corms in Gladiolus (*Gladiolus grandiflorus* L.) cv. Traderhorn

S.no	Treatment	Corm parameters at harvest					
		Equatorial diameter individual corm	Polar Length of individual corm	Number of corm/plant	Number of cormel/plant	Corm Yield t/ha	Cormel Yield t/ha
T_0	Control 0ppm	1.773	3.577	2.567	17.210	10.530	8.903
T_1	Benzyl adenine (BA)100ppm	2.423	4.023	3.070	18.003	10.950	10.587
T_2	Benzyl adenine (BA) 150ppm	2.683	4.737	3.350	20.903	11.040	10.983
T_3	Gibberellic acid (GA_3) 100ppm	2.677	4.937	3.650	25.973	12.380	10.833
T_4	Gibberellic acid (GA_3) 150ppm	2.397	4.830	4.283	24.600	12.930	10.973
T_5	(BA)100ppm+ (GA_3) 100ppm	3.490	6.237	6.040	32.577	19.710	16.710
T_6	(BA)100ppm+ (GA_3) 150ppm	2.540	4.553	4.933	25.973	15.450	11.607
T_7	(BA)150ppm+ (GA_3) 100ppm	2.973	5.273	5.733	26.707	16.560	11.983
T_8	(BA)150ppm+ (GA_3) 150ppm	3.273	5.973	5.930	30.053	16.940	14.070
	SE(m)	0.140	0.005	0.039	0.157	0.002	0.009
	C.D.	0.423	0.015	0.117	0.476	0.007	0.028

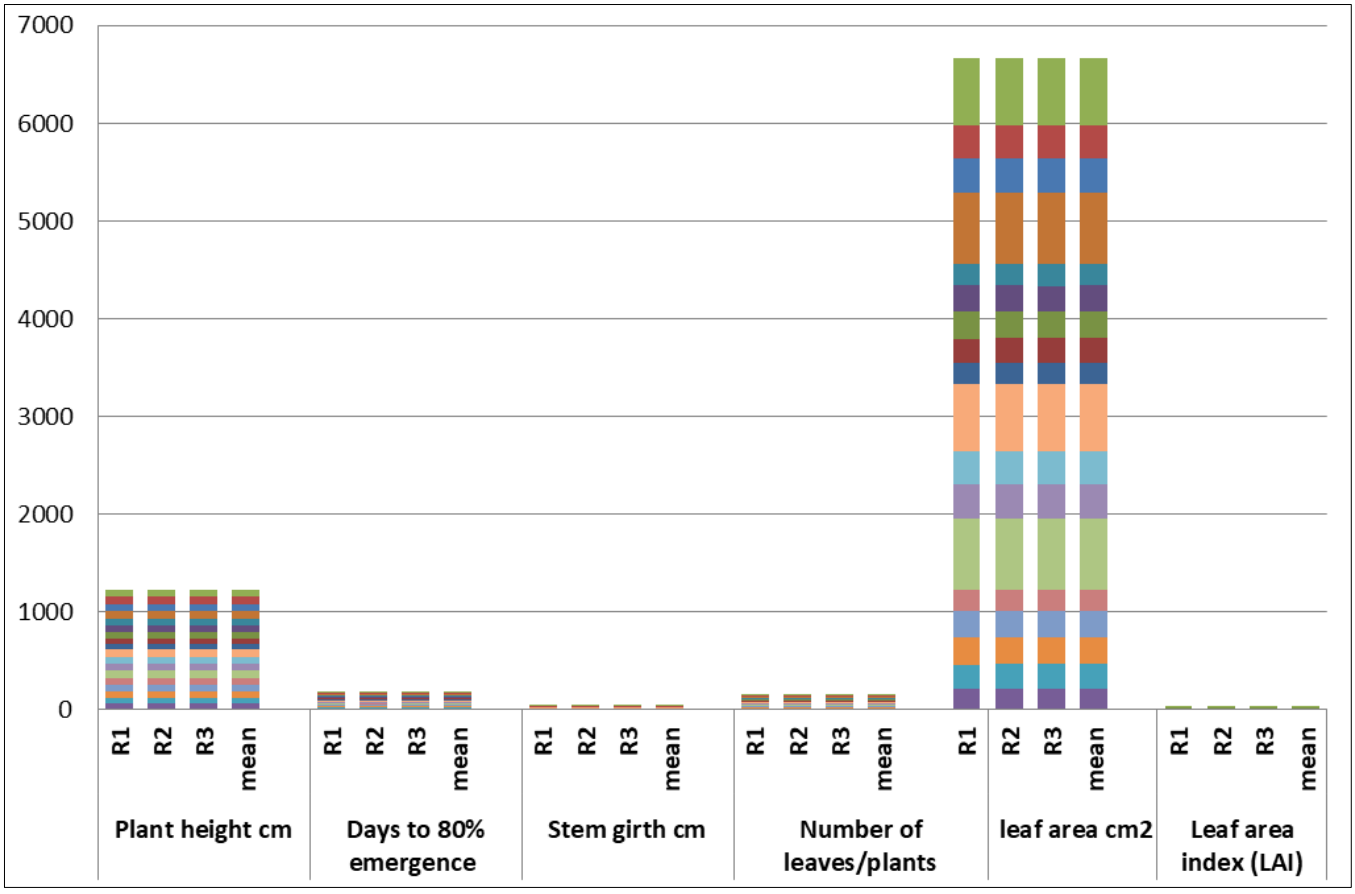

Fig 1: Effect of foliar application of growth regulators on growth parameters of Gladiolus (*Gladiolus grandiflorus* L.) cv. Traderhorn

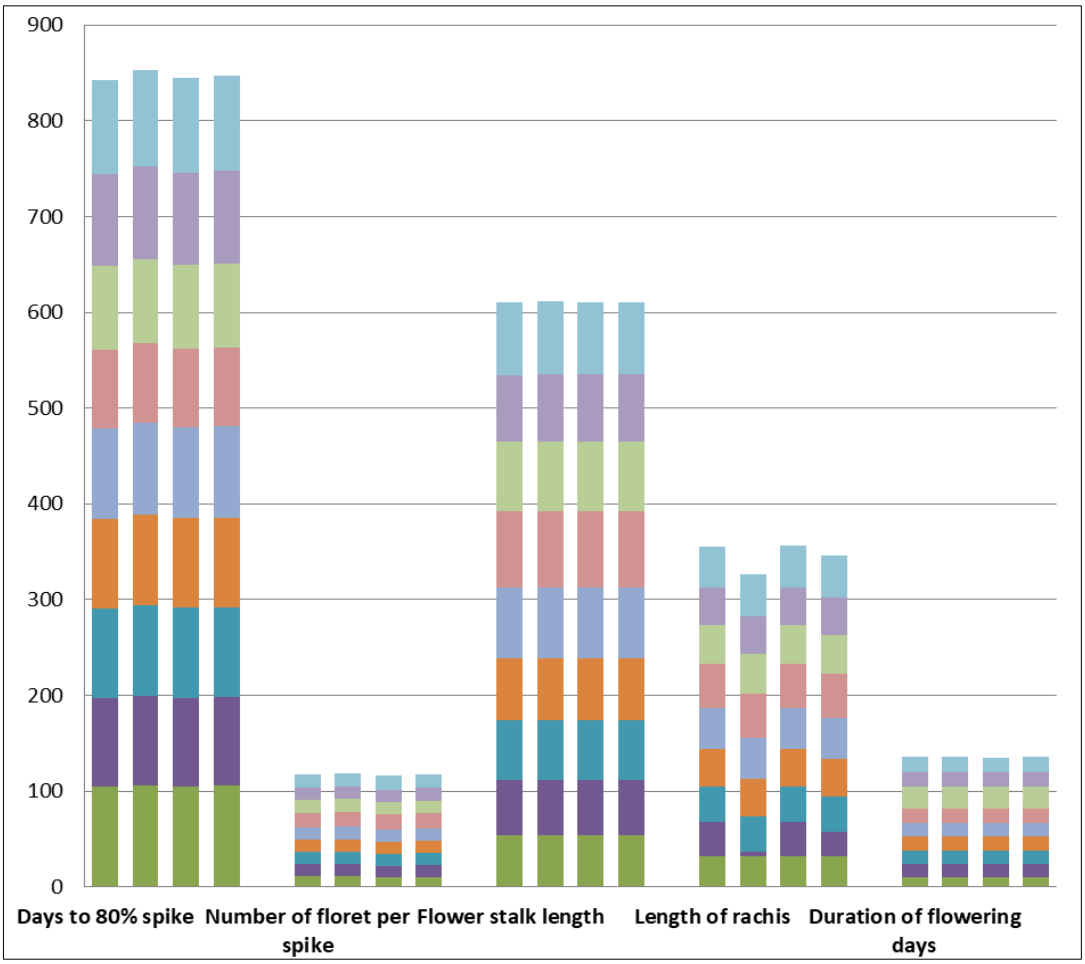

Fig 2: Effect of foliar application of growth regulators on flowering parameters of Gladiolus (*Gladiolus grandiflorus* L.) cv. Traderhorn

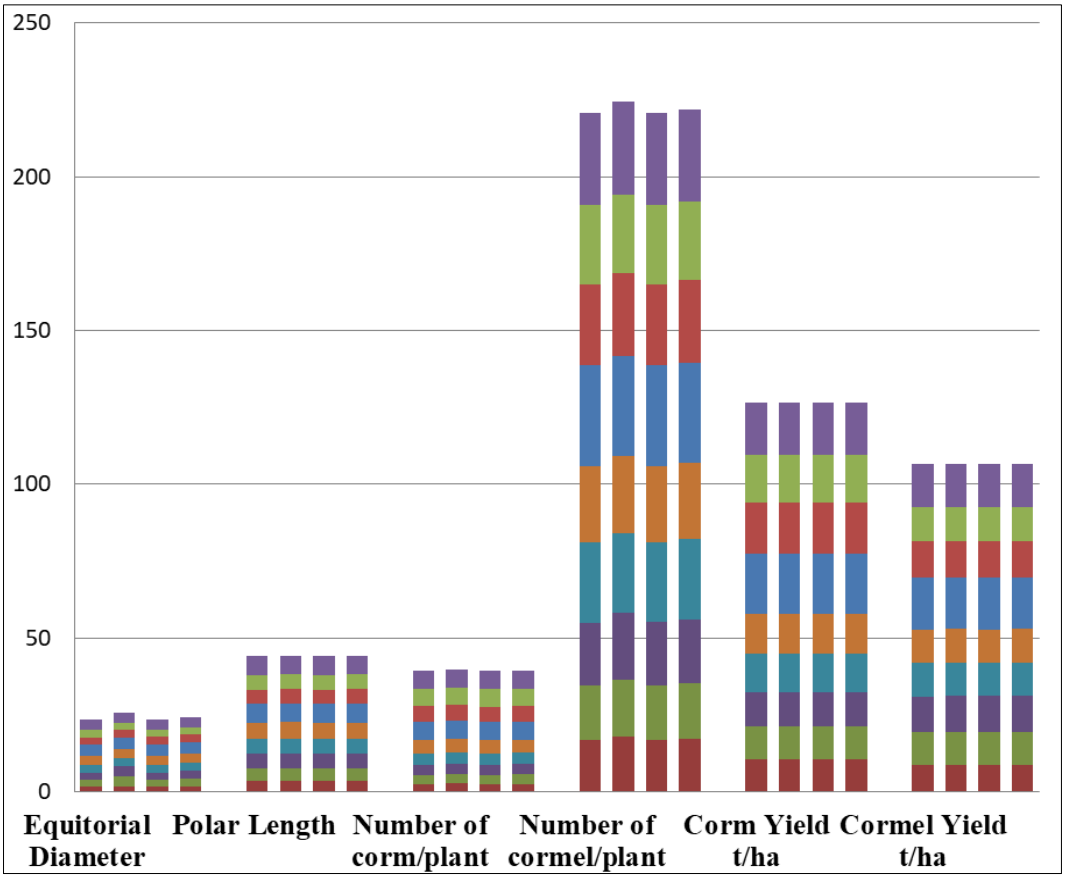

Fig 3: Effect of foliar application of growth regulators on flowering parameters of Gladiolus (*Gladiolus grandiflorus* L.) cv. Traderhorn

Corm Yield (t/ha)

Data condensed in the Table-3 and Fig-3. Clearly indicated that plant growth regulator gave significant effect at harvest corm yield (t/ha) was maximum with T_5 (BA) 100ppm + (GA_3) 100ppm) and T_8 (BA) 150ppm+ (GA_3) 150ppm treatment was (19.710 and 16.940) t/ha. These findings are similar to the findings of Biswas *et al.* (1982) [3] in tuberose and Chopde *et al.* (2015) [4] in gladiolus.

Cormel Yield (t/ha)

It is evident from the data presented in Table-3 and Fig-3. At harvest Yield of cormel was maximum with T_5 (BA) 100ppm + (GA_3) 100ppm) and T_8 (BA) 150ppm+ (GA_3) 150ppmtreatment was (16.710 and 14.070) t/ha. These findings are similar to the findings of Kumar *et al.*(2021) [9] in gladiolus and Choudhury *et al.*(2015) [5] in tuberose.

References

1. Arora JS, Singh NS, Grewal K, Singh A. Effect of GA_3 on cormel growth in gladiolus. Indian J Plant Physiol. 1992;35:202-206.
2. Baskaran V, Misra RK. Effect of plant growth regulators on growth and flowering of gladiolus. Indian J Hort. 2007;64:479-482.
3. Biswas J, Bose TK, Matti. Effect of growth substances on growth and flowering of tuberose (*Polianthes tuberose* Lin.). South Indian Hort. 1982;31:129-132.
4. Chopde N, Nehare N, Maske SR, Lokhande S, Bhute PN. Effect of foliar application of zinc and iron on growth, yield and quality of gladiolus. Plant Archives. 2015;15(1):417-419.
5. Choudhury ML. Effect of growth regulants on growth and flowering of tuberose (*Polianthes tuberosa* L.). Annals of Agricultural Science. 1987;32:1451-57.
6. Gowda JVN. Effect of ethrel and benzyladenine on breaking dormancy in gladiolus cormels, In J Prakash and K.R. Bhandar, eds., Floriculture Technology, Trades and Trends. Oxford and IBH Publishing Co. Pvt. Ltd. Calcutta. Groot. 1984, pp. 203- 204.
7. Karssen CM. The role of Gibberllins in germination. Planta. 1987;171:525.
8. Khan FU, Tewari GN. Effect of growth regulators on growth and flowering of dahlia (*Dahlia variabilis* L.). Indian J Hort. 2003;60:192-194.
9. Kumar P, Verma LS, Sharma G, Netam M, Kumar H. Study the effect of plant growth regulators on vase-life of gladiolus. Res. J Phar. Phyto. 2021;10(1):849-853.
10. Kumar A, Singh AK. Effect of Plant Growth Regulators and Micronutrients on Vegetative and Flowering Characters of Gladiolus (*Gladiolus grandiflorus* L.) cv. Novalux. Int. J Curr. Microbiol. App. Sci. 2020;9(11):1136-1143.
11. Manning J, Goldblatt P. The Iris family: Natural history & classification. Portland, Oregon, Timber Press.2008; 8,138- 142.
12. Misra RL, Singh B. Gladiolus. In T.K. Bose and L.P. Yadav. Eds., Commercial Flowers. Naya Prokash. 1998; 266-353.Calcutta, India.
13. Miller EA, Holcomb EJ. Effect of GA3 on Germination of Primula vulgaris Huds. and *Primula* x *polyantha*. Hort. Science. 1982;17:814-815.
14. Manning J, Goldblatt P. The Iris family: Natural history & classification. Portland, Oregon. Timber Press. 2008;8:138-142.
15. Mukhopadhyay A. Gladiolus. Publication and Information Division. Indian Council of Agric. Res. Krishi Anusandhan Bhavan, New Delhi, 1985.
16. Parmar PB, Chundawat BS, Gautam SK. Effect of pre-planting chemical treatments of bulbs and timing of planting on growth and flowering of tuberose cv. double. Indian J Hort. 1989;51:201-206.
17. Panse VG, Sukhatme PV. Statistical methods for agricultural workers. ICAR Publication, New Delhi. 1978, 359.
18. Roychowdhury N. Effect of plant spacing and growth regulators on growth and flower yield of gladiolus grown under polythene tunnels. Acta Horticulture. 1989;246:259-263.
19. Umrao V, Singh RP, Singh AR. Effect of gibberellic acid and growing media on vegetative and floral attributes of gladiolus. Indian J Hort. 2007;64:73-76.
20. Weiss D. Regulation of flower pigmentation and growth: multiple signaling pathways control anthocyanin synthesis in expanding petals. Physiologia Plantarum. 2000;110(2):152-7.