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Research Article

Response of Biofertilizers on Floral and Yield Attributing Parameters of Gladiolus (*Gladiolus grandiflorus* L.) var. Arka Amar under Hill Conditions of Uttarakhand

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ABSTRACT

The present investigation was carried out at Floriculture and Landscaping Block, College of Horticulture, VCSG, UUHF, Bharsar, Pauri Garhwal during March-September, 2016. The experiment consists of eight treatments viz. control, PSB (2 ml/l), Azotobacter (25 g/l), VAM (20 g/l), PSB (2 ml/l) + Azotobacter (25 g/l), PSB (2 ml/l) +VAM (20 g/l), Azotobacter (25 g/l) +VAM (20 g/l) and PSB (2 ml/l) + Azotobacter (25 g/l) +VAM (20 g/l). The treatments were replicated thrice in a Randomized Complete Block Design. The results revealed that the minimum days taken to first floret opening (111.76± 0.26), maximum diameter of 2nd floret (12.46 ±0.11cm), number of spikes per plant and plot (2.00 ± 0.11 and 32.00 ±2.13, respectively) and number of corms per plot (31.00 ±1.15) were recorded from the plants grown in plots applied with PSB (2 ml/l) + Azotobacter (25 g/l) +VAM (20 g/l). However, maximum corm weight (60.60 ± 1.11g), corm diameter (6.20 ± 0.10 cm), number of cormels per plant and plot (37.33 ± 1.20 and 600.76 ±1.94, respectively) were recorded in treatment combination Azotobacter (25 g/l) +VAM (20 g/l).

Key words: *Azotobacter, Corm yield, Floral attributes, Gladiolus, PSB and VAM.*

INTRODUCTION

Gladiolus (*Gladiolus grandiflorus* L.) is commonly known as Queen of bulbous flower crop and Sword Lily. It is a perennial plants belongs to the family Iridaceae with a basic chromosome number n =15. The flower ranks among top ten cut flowers in domestic as well as international market. Its tall majestic spike, brilliant colour florets with acropetal opening sequence and long lasting vase life make it popular among consumer. The crop is propagated through corms because of its easy of cultivation and doubling the farmers profit by selling the corms, cormels and flower spikes nowadays it gains the tremendous popularity among flower growers. The flowers are used for making bouquets, flower arrangements and vase decoration purpose.

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Beside cut flowers, in garden it is grown for making herbaceous borders, bedding plants and pots. The growth and development of plants depends on various factors among them nutrition plays a crucial role. Gladiolus is a highly nutrient responsive crop therefore for getting maximum return farmers are applying enormous amount of chemical fertilizers. By using excessive quantity chemical fertilizers one can get higher return but it also has adverse effect on soil as well as beneficial fauna.Long term fertilizer experiments have made clear the negative impacts of continuous use of chemicals on soil health[10]. Verma *et al.*[18] reported that indiscriminate and continuous use of chemical fertilizers has led to an imbalance of nutrients in soil which has adversely affected the soil health, affecting the yield and quality of the produce. The increasing cost of fertilizers prevents their use by poor farmer[2]. Therefore nowadays to restore the soil fertility attention is shifted towards the use of biofertilizers along with the chemical fertilizers. Biofertilizers are the products containing living cell of different types of microorganisms which have the ability to convert unavailable form of nutrients to available form through biological process. Muraleedharan *et al*.[16] observed that addition of biofertilizers in soil increase the availability of nutrients and improve the yield by 10 – 25% without adversely affecting the soil and environment. Use of biofertilizers and selection of the best microbial strains have vital role when integrating human society with vulnerable ecosystems[4]. Keeping this in view, the present investigation was undertaken to study the response of biofertilizers on floral and yield attributing parameters of gladiolus var. Arka Amar under hill conditions of Uttarakhand.

MATERIAL AND METHODS

The present investigation was conducted at Floriculture and Landscaping Block, College of Horticulture, VCSG, UUHF, Bhasar, Pauri Garhwal during March-September, 2016. The experiment consists of eight treatments viz. T_1: control, T_2:PSB (2 ml/l), T_3: *Azotobacter* (25 g/l), T_4:VAM (20 g/l), T_5:PSB (2 ml/l) + *Azotobacter* (25 g/l), T_6: PSB (2 ml/l) +VAM (20 g/l), T_7: *Azotobacter* (25 g/l) +VAM (20 g/l) and T_8: PSB (2 ml/l) + *Azotobacter* (25 g/l) +VAM (20 g/l). In all the treatments recommended dose of fertilizers was applied as a common basal dose. The treatments were replicated thrice in a Randomized Complete Block Design. The biofertilizers were applied to the corms by slurry dip method. The slurry was prepared by 200 g jaggary in one liter of water. Biofertilizers were added to the slurry. Then after corms were dipped in slurry about 30 minutes and dried under shade. Corms were planted in raised beds with 30 cm x 30 cm spacing with 16 plants in every bed. The final data of each characters recorded during the investigation were analyzed statistically using Analysis of Variance. The significance of various treatments was judged by following the methods of Gomez and Gomez[11].

RESULT AND DISCUSSION

The perusal of data presented in Table 1 indicates that minimum number of days taken to first floret opening (111.76 ± 0.26 days) was recorded in treatment T_8 (PSB @ 2 ml/l + *Azotobacter* @ 25 g/l + VAM @ 20 g/l). Whereas, maximum number of days taken to first floret opening (121.33± 0.33) was recorded in control i.e. T_1. All the treatments significantly improved the number of days taken to first floret opening as compared to control T_1 except T_3. Davel and Patel,[8] stated that *Azotobacter* and PSB helps in increasing the availability of N and P required for flower development as *Azotobacter* fixes nitrogen and PSB makes the insoluble phosphorus available by secreting certain organic acids, mainly oxalic acid. VAM has an ability to explore more soil volume on account of the microscopic hyphae produced by the fungi thereby making the nutrients available for diffusion of phosphate ions and increasing the surface area for absorption of nutrients such as N , K, Mn and Zn. Earliness in first floret opening in T_8 treatment might be due to easy uptake of nutrients by the use of biofertilizers inoculated corms and simultaneous transport

of growth promoting substances to the auxiliary buds resulting in breakage of apical dominance. A similar trend was also observed by Kumar *et al*.[14] and Singh *et al*.[17] in gladiolus.

Similarly, maximum diameter of 2nd floret (12.46 ± 0.11 cm) was recorded in T_8 and found statistically at par with T_5 (12.38 ± 0.09cm). Minimum floret diameter was recorded in treatment T_1 (8.71 ± 0.11cm). The increment in floret diameter might be due to the availability of nutrition and elevated levels of macronutrients which have positive effect on floral characteristics. The findings are in line with those reported by Kulkde *et al*.[13] in tuberose and Ahmed *et al*.[3] and Kumari *et al*.[15] in gladiolus. Data presented in Table 1 also showed that maximum number of spikes per plant and per plot (2.00 ± 0.11and 32.00 ± 2.13, respectively) from the plants grown in plot applied with T_8 followed by T_4 (1.60 ± 0.11 and 25.60 ± 4.26, respectively). Whereas, minimum number of spikes per plant and per plot (1.13 ± 0.06 and 18.13±1.06, respectively) were recorded in control. It might be due to the influence of combination of biofertilizers and RDF which increased the availability of nitrogen and phosphorus as well as micronutrient like Zn. Zn is precursor of auxin, which improves the vegetative growth, dry matter accumulation and their partitioning towards the development of spikes in gladiolus. Gupta[12] reported that Phosphate Solubilizing Bacteria (PSB) species like *Pseudomonas striata* and *Bacillus polymyxa* are beneficial in increasing the phosphorus availability in soil and thereby increases the yield. The results were in accordance with the reports of Chauhan and Kumar[7] in marigold, Adhikari *et al.*[1] and Kumari *et al*.[15] in gladiolus.

On perusal of Table2 showed that all applied treatments showed significant influence on number of corms per plot. Among the different treatments applied, maximum (31.00 ± 1.15) number of corms per plot was found in T_8 (PSB @ 2 ml/l + *Azotobacter* @ 25 g/l + VAM @ 20 g/l), which was found statistically at par with T_6 (29.00 ± 0.57). Number of corms per plot was found minimum (20.66 ± 0.08) in control (T_1). The better nitrogen fixation by *Azotobacter*, absorption of phosphorus by VAM and greater solubilization of insoluble phosphates by PSB and growth promoting substances, control of pathogens and proliferation of beneficial organisms in rhizosphere layed a significant role[5] in increasing number of corms in T_8 treatment. The present findings are in confirmation with Dubey and Misra[9] and Kumar *et al*.[14] in gladiolus.

Among the treatments, T_7 (*Azotobacter* @ 25g/l + VAM @ 20g/l) was found to be significantly superior in recording highest corm weight (60.60 ± 1.11 g) followed by T_8 and T_4 (57.50 ± 0.62 g and 55.33 ± 0.33 g, respectively). Corm weight was found lowest in T_1 (45.00 ± 0.93 g). Similarly, maximum corm diameter (6.20 ± 0.10 cm) was obtained from the treatment T_7 and found statistically at par with T_8 (6.15 ± 0.69 cm) and T_4 (5.86 ± 0.40 cm).Whereas, lesser corm diameter of (5.23 ± 0.02 cm) was recorded in control (T_1), which was at par with T_2 and T_3 (5.36 ± 0.06 and 5.54 ± 0.05 cm respectively). The highest number (37.33 ± 1.20) of cormels per plant was produced by T_7 (*Azotobacter* @ 25g/l + VAM @ 20g/l) and which was found statistically at par with T_8 andT_6 (36.33 ± 0.88 and 35.33 ± 2.60, respectively). Whereas minimum number of cormels per plant (26.33 ± 0.33) were recorded in control (T_1). The highest number of cormels per plot (600.76 ± 1.94) was produced by T_7 followed by T_8 (585.42 ±2.24). Whereas, minimum (425.09 ± 2.22) was observed in control (T_1). The increase in corm weight, corm diameter and number of cormels per pant and per plot may be attributed to cell enlargement caused by *Azotobacter* and VAM and it was also possibly due to increased production of carbohydrate which was transferred to corm for storage. The present findings are in close agreement with the findings of Ahmed *et al*.[3] in gladiolus and Kumari *et al*.[15] in gladiolus.

Table 1: Effect of biofertilizers on floral attributes of gladiolus var. Arka Amar

Treatments	**Number of days taken to first floret open (days) ± S.E(m)**	**Diameter of floret (cm) ± S.E(m)**	**Number of spikes per plant ± S.E(m)**	**Number of spikes per plot ± S.E(m)**
T_1	121.33 ±0.33	8.71 ± 0.11	1.13 ± 0.06	18.13± 1.06
T_2	118.50 ±0.28	11.63 ±0.08	1.20 ± 0.11	19.20± 1.84
T_3	120.66 ±0.33	9.33 ± 0.06	1.46 ±0.26	23.46 ± 4.20
T_4	116.66±0.33	9.73± 0.17	1.60 ± 0.11	25.60 ±4.26
T_5	116.00± 0.57	12.38 ± 0.09	1.53±0.06	24.53 ±1.84
T_6	114.16± 0.23	11.43± 0.27	1.26 ± 0.06	20.26 ±1.06
T_7	117.06 ± 0.44	10.14±0.05	1.33 ± 0.13	21.33 ±1.06
T_8	111.76± 0.26	12.46±0.11	2.00± 0.11	32.00 ±2.13
S.E (d)	0.50	0.20	0.18	2.90
C.D $_{(0.05)}$	1.10	0.43	0.39	6.28

Table 2: Effect of biofertilizers on corm yield of gladiolus var. Arka Amar

Treatments	**Number of corms per plot ± S.E (m)**	**Weight of corms (g) ± S.E (m)**	**Diameter of corms (cm) ± S.E (m)**	**Number of cormels per plant ± S.E(m)**	**Number of cormels per plot ± S.E (m)**
T_1	20.66 ± 0.08	45.00 ±0.93	5.23 ±0.02	26.33 ±0.33	425.09 ±2.22
T_2	24.33 ± 1.20	50.38 ± 0.18	5.36 ± 0.06	29.00 ± 1.52	468.00 ± 2.30
T_3	25.00 ±0.56	51.70 ± 0.47	5.54 ± 0.05	30.00± 0.57	484.66 ± 2.60
T_4	23.00 ±0.57	55.33 ± 0.33	5.86 ± 0.04	31.00 ±0.57	495.33± 2.33
T_5	28.00 ± 1.15	52.10 ±0.34	5.65 ± 0.18	33.00 ± 1.15	532.66 ±2.40
T_6	29.00 ± 0.57	54.70± 0.70	5.78± 0.32	35.33 ±2.60	568.42 ±1.67
T_7	27.66 ± 0.88	60.60 ± 1.11	6.20 ± 0.10	37.33 ± 1.20	600.76 ± 1.94
T_8	31.00± 1.15	57.50 ±0.62	6.15 ±0.07	36.33 ±0.88	585.42 ±2.24
S.E (d)	1.28	0.98	0.16	1.76	2.01
C.D $_{(0.05)}$	2.78	2.13	0.36	3.82	4.36

CONCLUSION

From the above investigation, it can be concluded that application of biofertilizers along with recommended doses of fertilizers showed significant improvement in floral and yield attributing parameters of gladiolus var. Arka Amar. Among all the treatments applied PSB @ 2ml/l + *Azotobacter* @ 25 g/l + VAM @20 g/l was found best with respect to improving floral parameters and number of corms per plot. Whereas, corm weight, corm diameter, number of cormels per plant and per plot was found maximum under PSB (2 ml/l) + *Azotobacter* (25 g/l) +VAM (20 g/l) followed by PSB @ 2ml/l + *Azotobacter* @ 25 g/l + VAM @ 20 g/l.

REFERENCES

1. Adhikari, Y. S., Bohra, M., Punetha, P., Upadhyay, S. and Nautiyal, B. P., Studies on Effect of integrated nutrient management on vegetative growth, floral attributes, corm yield and economics of gladiolus cv. Arka Amar in Bharsar, Uttarakhand. *International Journal of Pure and Applied Bioscience* **6(4):** 643-650 (2018).
2. Adhikary, S. P. and Gantayet, P. K., Studies on the influence of organic fertilizers on the growth and some biochemical parameters of chilli (*Capsicum annum* L.). *The Bioscan* **7(2):** 255- 258 (2012).
3. Ahmed, A., Tahir, M., Rashid, H., Basha, A., Raz, S., Najam-ud-Din and Ahmad, A., Investigation of biofertilizers influence on vegetative growth, flower quality, bulb yield and nutrient uptake in gladiolus (*Gladiolus grandiflorus* L.). *International*

Journal of Plant, Animal and Environmental Science **4(1):** 94-99 (2014).

4. Arab, A., Zamani, R. G., Sayyari, M. H. and Asili, J., Effects of chemical and biological fertilizers on morpho-physiological traits of pot marigold (*Calendula officinalis* L.). *European Journal of Medicinal Plants* **8(1):** 60-68 (2015).
5. Barea, J. M. and Brown, M. E., Effects on plant growth produced by *Azotobactor paspali* related to synthesis of plant growth regulating substance. *Journal of Applied Bacteriology* **37:** 583-586 (1974).
6. Chaudhary, S. V. S., Influence of various biofertilizers on growth, flowering and bulb production in tuberose (*Polianthes tuberosa* L.) cv. Double. *Annals of Horticulture* **2(1):** 92-94 (2007).
7. Chauhan, A. and Kumar, V., Effect of graded levels of nitrogen and VAM on growth and flowering in calendula (*Calendula officinalis* L.). *Journal of Ornamental Horticulture* **10**(**1**)**:** 61-63 (2007).
8. Davel, A. and Patel, H. H., Impact of different carbon and nitrogen source on phosphate solubilization by *Pseudomonas fluorescence*. *Indian Journal of Microbiology* **43:** 33-36 (2003).
9. Dubey, R. K. and Misra. R. L., Study of chemical and biofertilizers on gladiolus. *Progressive Horticulture* **3**7(**2**)**:** 62-65 (2005).
10. Ganiger, V., Mathad, M., Madalageri, J. C., Babalad, M. B., Hebsur, H. B., Nirmala, H. B. and Yenagi, B., Effect of organics on the physico-chemical properties of soil after bell pepper cropping under open field condition. *Karnataka Journal of Agricultural Science* **25(4):** 479-484 (2012).
11. Gomez, L. A. and Gomez, A. A., Statistical Procedure for Agricultural Research, *John Wiley and Sons* 680 (1984).
12. Gupta, S. C., Effect of combined inoculation on odulation, nutrient uptake and yield of chickpea in vertisol. *Journal of the Indian Society of Soil Science* **54(5):** 251-254 (2006)
13. Kulkde, S., Pillewan, S., Meshram, N., Khobragade, H. and Khobragade, Y. R., Effect organic manure and biofertilizer on growth and yield of tuberose (*Polianthes tuberosa* L.) cv. Single. *Journal of Soils and Crops* **16:** 414-416 (2006).
14. Kumar, J., Kumar, V. and Pal, K., Effect of organic manures, inorganic fertilizers and VAM on growth and flowering of gladiolus (*Gladiolus floribundas* L.) cv. White Prosperity. *Journal of Ornamental Horticulture* **14**(**1&2**)**:** 95-99 (2011).
15. Kumari, A., Chowdary, M. and Baloda, S., Biofertilizers and their application in flower crops: A review. *Annals of Agricultural Bioresearch* **18(2):** 195-205 (2013).
16. Muraleedharan, H., Seshadri, S. and Perumal, K., A Booklet on Biofertilizer. *JR Designing Chennai* **1:** 4-7 (2010).
17. Singh, R., Kumar, K., Raj, S. and Kumar, S., Effect of integrated nutrient management on growth and flowering in gladiolus (*Gladiolus grandiflorus* L.) cv. White Prosperity. *Annals of Horticulture* **6(2):** 242-251(2013).
18. Verma, S. K., Angadi, S. G., Patil, V. S., Mokashi, A. N., Mathad, J. C. and Mummigatti, U. V., Growth, yield and quality of chrysanthemum (*Chrysanthemum morifolium* Ramat.) cv. Raja as influenced by integrated nutrient management. *Karnataka Journal of Agricultural Sciences* **24(5):** 681-683 (2011).