Indian J. Hort. 67(Special Issue), November 2010: 382-385

Efficacy of bio-and chemical fertilizerrs on certain floral qualities of gladiolus

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ABSTRACT

An experiment on two gladiolus varieties *viz*. Jester and Sylvia with chemical and bio-fertilizers was conducted in Division of Floriculture and Landscaping, IARI, Pusa, New Delhi. Variety Jester performed significantly better over Sylvia for early flowering (116.16 days) higher floret diameter (8.37 cm), florets/ spike (13.60), floret remaining open (5.86), days to last floret opening (128.05 days), enhanced vase life (8.34 days) and low disease incidence (9.07%) while variety Sylvia was found significantly better for more number of days to last floret opening (135.04 days). Application of full dose of NPK resulted into significant influence on delayed flowering floret diameter, florets remaining open, enhanced vase life and low disease incidence, While significant effect for days to last floret opening was recorded when there was no application of NPK. However, the effect of half dose of recommended NPK was found at par with that of full dose for days to flowering floret diameter and days to last floret opening. The combined inoculation of gladiolus corms with AZT+PSB was found best for days to flowering (114.59 days), first floret diameter (9.08 cm), florets remaining open (6.46) and days to last floret opening (128.90 days) among all the bio-fertilizer(s) treatments. Among interactive effects of varieties and chemical fertilizers, V_1C_2 was found best for low disease incidence (8.80%). Significant interactive effect between varieties and biofertilizers was recorded, as V_1T_2 showed low disease incidence (7.03%). Interactive effect of chemical and biofertilizers was also observed significant and C_2T_7 was found best for disease incidence (9.99%). However, interactive effect of varieties, chemical and biofertilizers was found significant for disease incidence (6.66%) under $V_1C_2T_7$.

Key words: Gladiolus, varieties, chemical fertilizer, biofertilizer, floral characters.

INTRODUCTION

Gladiolus is an important bulbous ornamental belonging to family Iridaceae. It is used as a cut flower and landscape plant in the gardens is liked because of its vivid colour, size and shape of spike. It is Heavy feeder of inorganic fertilizers owing to its shallow root system. The adverse effects of the indiscriminate use of chemical fertilizers on soil health and environment have received global attention. Moreover, the addition of inorganic fertilizers in higher doses constitutes one of the most expensive inputs that tend to make agriculture beyond the capacity of resource poor farmers. Such a situation necessitates the use of more ecofriendly biofertiizer like Azotobacter, Azospirillum, Vesicular-Arbiscular Mycorrhiza (VAM) and Phosphobacteria to supplement the nutrient demand and improve soil fertility. Biofertilizers are eco-friendly source of nutrients. They fix the atmospheric nitrogen as well as increase the solubility of fixed soil phosphate. They also improve plant growth by producing phytohormones. Although, biofertilizers are not a substitutes of chemical fertilizers, they may be useful in increasing the yield, when biofertilizers are combined with organic manure and inorganic fertilizers in balanced proportions. Cormels require more fertilizers than corms mainly due to their stored reserves. The numbers of spikes produced per corm depend upon the size of corm planted. Thus a larger corm which received good nutritient in the previous season may produce more than one spike per corm, Woltz (23).

MATERIALS AND METHODS

The present investigation was carried out in the Division of Floriculture and Landscaping, IARI, New Delhi. The soil of experimental plot was loamy and slightly alkaline in nature with pH 8.3, available nitrogen

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165 kg/ha, phosphorus 16 kg ha^{-1} and potassium 310 kg ha^{-1}. The experiment was laid out in a split plot design with three replications comprising 48 treatment combinations. The treatments consisted of two varieties Jester (V_1) and Sylvia (V_2), three NPK levels (NPK as control, C_0), half of the recommended NPK (C_1), full dose of NPK (C_2) and eight bio-fertilizer(s) treatments (uninoculated control, T_1), *Azospirillum* (AZP, T_2), *Azotobacter* (AZT, T_3), phosphobacteria (PSB, T_4) vesicular arbiscular myucorrhiza (VAM, T_5), AZP + PSB (T_6), AZT+PSB(T_7) and VAM+PSB (T_8). Observations on various flowering parameters and disease incidence were recorded on five randomly selected plants per replication of each treatment.

RESULTS AND DISCUSSION

It is evident from Table 1 and 2 that on an average variety Jester gave significantly higher flower diameter (8.67 cm) was obtained with full dose of NPK over control (7.46 cm) while half dose of NPK (8.40 cm) was at par. Combined inoculation of AZT+PSB resulted significantly higher diameter (9.08 cm) of first floret over uninoculated ones (7.33 cm). Bhalla *et al.* (1) and Issac *et al*. (6) recorded maximum floret size with common basal dose (CBD)+ 6% Manchurian tea + 6% Panchgavya in gladiolus and Gaur *et al.* (4) also observed maximum diameter of flowers with 75% NPK + 10 T vermicompost/ ha in gladiolus, while Pathak *et al.* (12) reported maximum floret diameter with VAM + vermicompost+ vermiwash treatment in gladiolus.. However, the effects AZP+PSB and VAM+PSB (8.83 cm and 8.67 cm, respectively) were at par with AZT+PSB under pooled data analysis. Jester showed significantly higher number of florets remaining open (6.13) under the application of full dose of NPK was found over the control (5.13). Significantly higher number of florets remaining open (6.46) was found under the combined inoculation with AZT+PSB over the uninoculated treatment (4.74). Jester took significantly lesser number of days (128.65) to last floret opening than variety Sylvia (135.04). The variety Jester took lesser days to flowering (116.16 days) than variety Sylvia. This might be attributed to their genotypic differences as Jester is short duration variety while Sylvia is late one. The gladiolus crop took minimum days to flowering when there is no NPK application than full or half dose of NPK application. The possible reason for this might be due to the fact that high dose of N& P encouraged vigorous vegetative growth with more photosynthetic area for greater production and mobilization of photosynthatase, which ultimately delayed the reproductive phase. Similar observations were also made by John *et al.* (7), Prabhu *et al.* (14) in cucumber, Dalve *et al*. (2) and Sobhana *et al*. (20) in tuberose.

Application of full dose of NPK significantly delayed the days to last floret opening (134.27 days) as compared to no NPK treatment (129.18 days). Combined application of AZT+PSB induced the earlier flowering (114.59 days), early opening of last floret (128.90 days) over the uninoculated ones (134.54 days).The results are in confirmation with the findings of Bhalla *et al.* (1). However, the effects of VAM+PSB (130.26 days), AZP+PSB (130.30 days), VAM (131.23 days), PSB (132.38 days) and AZT (132.17 days) were at par with AZT+PSB treatment. Variety Jester showed significantly higher vase life of spike (8.34 days) than Sylvia (7.96 days). Full dose of NPK recorded significantly higher vase life of spike (8.34 days) than Sylvia (7.96 days). Full dose of NPK recorded significantly higher vase life (8.85 days) over the control ones (7.36 days). The combined application of AZT+PSB resulted significantly higher vase life (8.98 days) over uninoculated treatment (7.01 days).

There was significantly lesser percentage of disease incidence (9.07%) in Jester than Sylvia (16.37%). Full dose of NPK resulted significantly lesser percentage of disease incidence (12.07%) over the control (13.38%). There was significantly less percentage of disease incidence (11.08%) with the combined inoculation of AZT+PSB over the uninoculated ones (13.88%). As far as interactive effect of varieties and chemical fertilizers on percentage of disease incidence was concerned, V_2C_0 showed maximum percentage of disease (17.19%) while minimum (8.74%) was recorded under V_1C_1. In case of interactive effect of varieties and biofertilizers, V_2T_1 resulted into maximum percentage of disease (17.39%) while minimum (7.03%) was obtained under V_1T_7. In case of interactive effect of chemical and biofertilizers, C_0T_1 gave maximum percentage of disease (14.43%) while minimum (9.90%) was recorded under C_2T_7. In case of interactive effects of varieties, chemical and biofertilizers on percentage disease incidence, the trend was erratic.

Full dose of NPK had significant influence on all the floral characters. However, plants supplied with half dose of NPK or no fertilizer application showed earliness in days to flowering and last floret opening, while full dose of NPK delayed it considerably. The earlier and frequent foliar application of urea resulted in significant increase in length of spike, Marital *et al*. (10).

Full dose of NPK showed significant influence on diameter of first floret number of florets remaining open, vase life of spike and disease incidence as against control. The possible reason could be due to presence

of calcium in CAN and sulphur in single superphosphate, which participated in higher protein synthesis and thus improved the vegetative growth, dry matter accumulation and partitioning towards the developing spikes. The differential response of these characters to NPK doses may also be ascribed to the differences in NPK uptake patterns by the plants at the spike emergence stage. Beneficial effects of NPK on floral characters have been reported by Pandey *et al*. (11) and Dalve *et al.* (3) in gladiolus.

Longer vase life of whole spike resulted from full dose of NPK, the obvious reasons being that the spikes produced were longer with more number of florets. Calcium, phosphorus and potassium generally act as protective elements in reducing the rate of plant senescence, Sharma *et al*. (19). The improvement in several post harvest characters of gladiolus spike due to higher NPK through CAN, SSP and MOP can be attributed to the CA^{++} calmodulin binding in the cells, which regulated the different activities in plant metabolism. Phosphorus participating in the skeleton of plasma membrane, nucleic acid and co-enzymes, regulates metabolic activity of cut spikes by lowering the respiration activity and degree of dehydration, thereby increasing post-harvest characters, Lodhi *et al*. (9). Phosphorus application produces less succulence and softer flowers thus more deposition of carbohydrate in the cells, which also helped in increasing vase life as reported by Hatibarua and Misra (5) in gladiolus. Potassium is known to increase the resistance of plants to the stress of moisture, heat and diseases caused by pathogenic fungi, nematodes and other microorganisms and to provide mechanical strength to tissues. Beneficial effects of higher dose of NPK on post-harvest characters have been reported by Kathiresan and Venkatesha (8) and Rajiv and Misra (17) in gladiolus. Applications of various biofertilizers singly and in different combinations with each other have significant effect on all the floral characters. Among various biofertilizes and their combinations, AZT+PSB was found the best; followed by AZP+PSB and VAM+PSB.

Significant improvements in floral qualities were recorded with the inoculation of corm with AZT+PSB, followed by AZP+PSB and VAM+PSB. It might be due to increased availability of nitrogen and better mobilization, solubilization of phosphate and better uptake of N and P as well as micronutrients like Zn, which is precursor of auxin, which improved the vegetative growth, dry matter accumulation and their partitioning towards the developing spikes. Beneficial effects of biofertilizers on floral characters have been reported by Kathiresan and Venkatesha (8) with AZP+VAM+NPK in gladiolus. Significant increase in first floret diameter was recorded by Preethi *et al*. (15) with AZP+VAM+NPK in marigold.

Significant improvement in earliness in flowering, number of florets remaining open at a time and days for last floret opening was obtained with dual inoculation of corm with AZT+PSB. There is lack of supporting evidence to conform these findings.

Significant reduction was recorded in percentage disease incidence with AZT+PSB, followed by AZP+PSB and VAM+PSB. Tilak and Annapurna (21) reported that application of Azospirillum in onion significantly reduced the plant mortality from transplanting shock due to faster and higher rate of absorption of water and minerals viz., P, K, Mg and Zn due to the bacterium in rhizosphere. They also reported that Azospirillum might also give protection of seedlings against pathogens through the production of siderophores. Several mechanisms for disease suppression by biofertilizers have been proposed including production of antifungal metabolites, siderophores, nutrient competition and niche exclusion (Saxena et al., 18). Thus they might indirectly promote growth by suppressing the diseases causing fungal pathogens. It is well known that root pattern and nature of crop have direct bearing on utlization and uptake of nutrient by crop. Verma and Shinde (22) reported better root development due to Azotobacter inoculation in crop plants. Higher foliage growth with sufficient N, P, K favours higher photosynthetic rate thereby translocating the assimilates faster to root zones which exudes chelating acid. Such organic chelating agents could exchange with surface bound nutrients and bring it to labile pool for easy uptake of plants. This in addition may stimulate higher number of fibrous root formation and a better crop stand against biotic and abiotic stresses and increased dry matter contents of plants.

Significantly increased vase life of whole spike resulted from all the biofertilizers except with Azospirillum applied singly. However, AZT+PSB was found best followed by AZP+PSB and VAM+PSB. Longer vase life might be attributed to the better overall food and nutrient status of spike under these treatments. There is no literature available especially in case of gladiolus to conform these findings. However, some work has been done with regard to improved vase life and storability in some other crops. Similar findings were recorded by Prabhat Kumar (13) in China aster with VAM+PSB treatment.

ACKNOWLEDGEMENTS

The authors are grateful to Dr. K.S. Jahuari, Principal Scientists, Division of Microbiology, IARI, Pusa New Delhi for his help rendered.

REFERENCES

1. Bhalla, R., Kanwar, P., Dhiman, S.R. and Jain, R. 2006. Effect of biostimulants on the growth and flowering of gladiolus cv. Red Beauty. National Symposium on Ornamental Bulbous Crops. 5-6 Dec. 2006. SVBPUA&T, Meerut.pp. 57.
2. Dalve, P.D., Mane, S.V. and Nimbalkar, R.R., 2009. Effect of biofertilizers on growth, flowering and yield of gladiolus. *Asian J Hort*. **4**: 227-29
3. Dalve, P.D., Manisha Deshmukh, Dange, N.-R. and Kawarkhe, V.J., 2009. Effect of biofertilizers with reduced doses of nitrogen on growth and flowering of gladiolus. *International J. Agri. Sci*. **5**: 258-60
4. Gaur, A., Misra, R.L., Kumar, P.N. and Sarkar, J. 2006. Studies on integrated nutrient management in gladiolus. National Symposium on Ornamental Bulbous Crops. 5-6 Dec. 2006. SVBPUA&T, Meerut. pp.107.
5. Hatibarua, P and R.L. Misra, 1999. Effects of nitrogen sources on vegetative and floral character of gladiolus cv. Dhanvantari *J. Orn. Hort*. **2**: 111-14.
6. Issac, S, Paramesh, R. and Jayanthy, R., 2008. Influence of bio-inoculants of dormancy and growth of gladiolus (*Gladiolus grandiflorus* L. cv. Black Jack) seed corms. *J Plant Sci. Res.* **24**: 203-05.
7. John, A.Q., Paul, T.M. and Siddique, M.A.1997. Nutritional studies in gladiolus: Growth and floral characters. *Adv. Pl. Sci.* **10**: 45-49.
8. Kathiresan, C. and J. Venkatesh, 2002. Effect of biofertilizer with levels of N and P on gladiolus. In: Floriculture Research Trend in India. ISOH, New Delhi pp.118-21.
9. Lodhi, A.K.S., G.N. Tiwari, and R.K. Pathak, 1991. Effect of nitrogen and phosphorus application on vase life of cut flowers of chrysanthemum (*Chrysanthemum morifolium* Ram (*Dendranthema marifolium*). *Hort. J*. **4**: 49-51.
10. Marital Jamwal, Parmar, A.M., Singh, D.B., Mishra, R.L. and Satpal Baloda, 2007. Effect of foliar application of urea on vegetative and floral growth of gladiolus. *Haryana J Hort. Sci*. **36**: 282-84.
11. Pandey, R.K., Puneet Rathore, M.K.Singh and R.Rathore. 2000. Effect of different levels of nitrogen and phosphorus on gladiolus under Agra condition. *J. Orn. Hort*. **3**: 60-61.
12. Pathak, G., Kumar, P. and Singh G. 2006b. Effect of pre-harvest treatment on shelf life of gladiolus cv. White Prosperity. *National Symposium on Ornamental Bulbous Crops.* 5-6 Dec. 2006. SVBPUA&T, Meerut.pp. 155-56.
13. Prabhat Kumar, 2003. Response of biofertilizer and GA_3 on growth and yield of China aster (*Callistephus chinensis* (L.) Nees). Ph.D. Thesis submitted in Division of Floriculture and Landscaping, Indian Agricultural Research Institute, New Delhi.
14. Prabhu, M., Natarajan, S., Srinivasan, K. and Pugalendhi, L., 2006. Intergrated nutrient management in cucumber. *Indian J. Agric. Res*. **40**: 123-26.
15. Preethi, T.L., C.M. Pappiah, and S. Anbu. 1999. Studies on the effect of Azospirillum, nitrogen and ascorbic acid on growth and flowering of Edward rose (*Rose bourboniana*). *South Indian Hort.* **47**: 106-07.
16. Rajadurai, K.R. and A. Beaulah, 2000.The effect of inorganic fertilizers Azospirillum +VAM on yield characters of African marigold (*Tagetes erecta). J. Ecotoxicol Envl. Monotoring,* **10**: 102-5.
17. Rajiv, K. and Misra, R.L., 2009. Flowering of gladiolus cv. Jester Gold as affected by different doses of nitrogen, phosphorus and potassium. *Environ. Ecology*. **27**: 607-10.
18. Saxena, A.K., K.K. Pal and K.V.B.R. Tilak, 2000. Bacterial biocontrol agents and their role in plant disease management. In: Biocontrol potential and its Exploitation in Sustainable Agriculture (eds. R.K. Upadhyay, K.G. Mukherjee and B.P. Chandola), pp 25-37. Khiveer Acad. Phenn. Pub, New York.
19. Sharma, R.M., Yamdagni, R., Gaur, H. and Shukla, R.K. 1996. Role of calcium in horticulture - a review. *Haryana J. Hort. Sci.* **25**: 205-12.
20. Sobhana, A., Bhaskar, J. and Rajeevan, P.K.2006. Studies on effect of NPK on growth and flowering of tuberose (*Polianthes tuberosa* L.) National Symposium on Ornamental Bulbous Crops. 5-6 Dec. 2006. SVBPUA&T, Meerut. pp. 89.
21. Tilak, K.V.B.R. and Annapurna, K. 1993. Role of Azospirillum in the improvement of crop production and plant nutrition. *Proc. Indian National Sci. Acad*. **59**: 315-24.
22. Verma, D.P. and S.P. Shinde, 1993. Azotobacter, a biofertilizer for vegetable crops. *Biofertilizer Newsletter,* **1**: 6-10.
23. Woltz, S.S., 1972. The World of Gladiolus. NAGC, U.S.A. pp. 143-149.

Received: April, 2007; Revised: January, 2010
Accepted: March, 2010