AJH
eISSN- 0976-724X

THE ASIAN JOURNAL OF HORTICULTURE
Volume **11** | Issue 1 | June, 2016 | 136-140
Visit us -*www.researchjournal.co.in*

RESEARCH PAPER

DOI : 10.15740/HAS/TAJH/11.1/136-140

Article history :
Received : 10.04.2016
Revised : 27.04.2016
Accepted : 06.05.2016

Effects of Rhizobacteria strains in prolonging vase life of gladiolus cv. AMERICAN BEAUTY

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ABSTRACT : Gladiolus is one of the popular cut flowers that demonstrates postharvest problems which cause shorter vase life and loss of quality. The present study was undertaken to compare the efficiency of different rhizobactera strains application on vase life of gladiolus. A significant improvement was observed in all the parameters related to vase life with the application of *Azotobacter*, *Azospirillium*, *Bacillus* and *Pseudomonas* strains as biofertilizers. Maximum vase life 18.22 days was observed under T_7 (Pseudomonas sp. CPS20), which was at par with T_6 (*Pseudomonas* sp. CPS63) *i.e.* 18.17 days. The maximum spike weight (73.67 g) was noticed under T_1 (*Azotobacter chroococcum* Mac27) and highest transpirational loss was recorded on 8th day of vase life (27.33 g) whereas, minimum under control on 2[nd] day of vase life (9.67 g). Wilting of floret was delayed by 4.56 days under *Pseudomonas* sp. CPS20. Among all the vase solutions of biofertilizers, *Pseudomonas* sp. CPS20 was found to be the most effective, followed by *Pseudomonas* sp. CPS63 for improving vase life of cut spikes of gladiolus.

KEY WORDS : Gladiolus, Biofertilizer, Rhizobacteria, Vase life, Spike, Floret

HOW TO CITE THIS ARTICLE : Singh, Yogesh (2016). Effects of Rhizobacteria strains in prolonging vase life of gladiolus cv. AMERICAN BEAUTY. *Asian J. Hort.*, **11**(1) : 136-140, **DOI : 10.15740/HAS/TAJH/11.1/136-140.**

The commercial importance of floriculture has been realized throughout the world today. The global floricultural trade is estimated as $100 billion (Raza, 2014). The estimated area under flower crops in the country is about 2.55 lakh hectare (Saxena, 2014). Gladiolus is one of the four famous cut flowers in the world (Bai *et al*., 2009). In floriculture industry, gladiolus occupies prime position and ranks next to tulip in European market and occupies fourth place in the international floriculture trade and is being cultivated in almost all countries of world (Cohat, 1993). The genus *Gladiolus* belongs to family Iridaceae. Gladiolus is an economically important bulbous ornamental crop grown for its magnificent spikes but flowers longevity is very short. Vase life is an important consideration of choosing flowers. Consumers of cut flowers demand high quality flowers at the time of purchase and a guaranteed long vase life that the aesthetic value of the flowers will last since, gladiolus has many florets which open sequentially, extension of shelf life of the flower can help the flower industry and also for home consumers. The vase life of gladiolus is about 6-7 days under normal conditions (Reddy and Murali, 1994). Most of the cut flowers are highly perishable due to high respiration rate and excessive weight loss. Short postharvest vase life is one of the most important problems of the cut flowers. Enhancement of vase life of cut flowers is an important area in horticultural research. The longevity or potential vase life of flower is determined by the environmental conditions under which the flowers are produced and post-harvest factors. Cut flowers lose their freshness and quality during post-harvest period. The functional life of flower is terminated by senescence. Flower senescence represents the last stage of floral development and results in deteriorative changes which are manifest as petal wilting, color change or abscission of whole flower or flower part (Stead and Doorn, 1994). There are several reports on post-harvest treatment of cut flowers to increase the vase life by using growth regulators (kinetin and salicylic acid), sugar, macronutrients, micronutrients etc. It is now recognized that many rhizosphere bacteria including *Pseudomonas*, *Bacillus*, *Azospirillium* and *Azotobacter* have ability to increase mobilization of insoluble nutrients, produce hormone like substances particularly similar to auxins and suppress phytopathoganic organisms by production of antibiotics and hydrolytic enzymes (Sindhu *et al*., 2002). Microbial inoculants are the products containing the living cells that naturally activate the microorganisms found in the soil, restoring the soil fertility and improve physico-chemical and biological properties of soil (Vessey, 2003). Thus, biofertilizers can make a significant contribution towards the development of strategies for productivity improvement which do not lead to an exponential rise in the consumption of non-renewable forms of energy. But very little information is available regarding the role of biofertilizers in increasing the vase life of cut flowers. Keeping in view the above information, the present investigation was planned to compare the efficiency of different strain of four rhizobacteria *i.e. Azotobacter, Azospirillium, Bacillus* and *Pseudomonas*.

RESEARCH METHODS

The experiment was carried out at field and laboratory of Department of Horticulture and different rhizobactera strains obtained from Department of Microbiology, C.C.S. Haryana Agricultural University, Hisar, Haryana, using Completely Randomized design (C.R.D). The corms were spread out on a clean polyethene sheet. Jaggery (200 g) was dissolved in 1 litre of water which was sprinkled over the corms later on and mixed with both the hands so that corms became sticky. The biofertilizer inoculants were spread on to the corms and mixed well so that inoculants got coated on corms. The corms were dried in shade and planted in the fields of following treatments.

Treatment T_0 (without any bioinoculant)

Treatment T_1 (*Azotobacter chroococcum)* (Mac27)

Treatment T_2 (*Azospirillum brasilense* sp.)

Treatment T_3 (*Bacillus* sp. SYB 101)

Treatment T_4 (*Bacillus* sp. SB 155)

Treatment T_5 (*Bacillus* sp. SB127)

Treatment T_6 (*Pseudomonas* sp. CPS63)

Treatment T_7 (*Pseudomonas* sp. CPS20)

Treatment T_8 (*Pseudomonas* sp. CPS47)

Recommended doses of farm yard manure (FYM) was applied @ 50 tones per hectare, murate of potash @ 160 kg per hectare and single super phosphate @ 625 kg per hectare were applied at the time of field preparation. Urea @ 600 kg per hectare, half doses of urea was applied at the time of field preparation and remaining urea was applied in two split doses at 3 to 6 leaf stage and at spike initiation. The spikes of gladiolus cv. AMERICAN BEAUTY were harvested from rhizobactera strains applied plots with the help of sharp knife during morning hours. The basal ends of spikes were given a slanting cut and were kept in conical flasks at room temperature in the laboratory to study the fresh weight of spike, transpirational loss of water, floret life, diameter, and vase life of gladiolus.

All results were analyzed by statistical method described by Panse and Sukhatme (1967). The data were analyzed by the technique of analysis of variance described by Fisher (1958) using Analysis of Variance (ANOVA), with the help of a windows based computer package OPSTAT (Sheoran, 2004), which calculates standard error of means (SE_m), standard error of difference in mean (SE_d) and critical difference between the treatments (CD).

RESEARCH FINDINGS AND DISCUSSION

Investigation revealed a significant improvement in all the parameters related to vase life with the application of rhizobacteria strains. Fresh weight of spike, transpirational loss of water, floret life and vase life was significantly affected. Biofertilizers improve crop growth and quality of the produce by producing plant hormones and help in sustainable crop production through maintenance of soil productivity. They are useful as biological control agents, since they control many plant pathogens and harmful microorganisms. The similar findings regarding biofertilizers have been reported by other workers (Tilak *et al*., 1982; Subba Rao *et al*., 1983 and Sukhda, 1999). Transpirational loss interaction between days and treatments showed significant differences maximum transpirational loss (27. 3 g) were observed in treatment T_7 (*Pseudomonas* sp. CPS20) and T6 (*Pseudomonas* sp. CPS63), respectively (Table

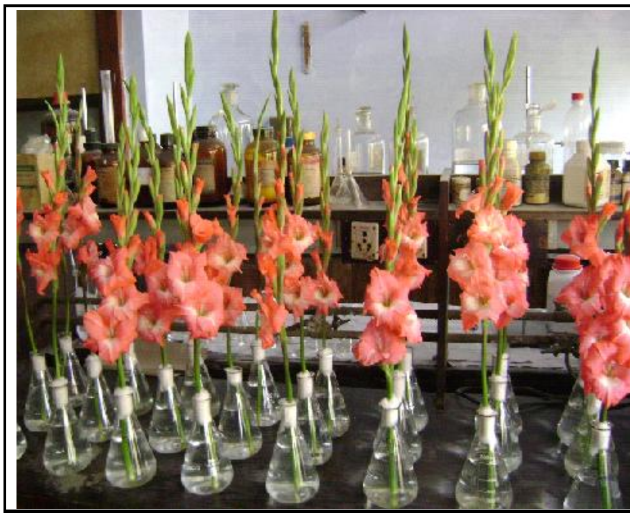

Fig. 1 : Experiment on vase life of gladiolus

Fig. 2 : Maximum vase life with *Pseudomonas* strain CPS 20

Table 1 : Effect of rhizobactera strains on transpirational loss of water (g) in gladiolus spike

Treatment/Days	2	4	6	8	10	12	14	Mean
T_0 (Control)	9.67	12.00	15.33	18.67	18.00	14.67	11.00	14.19
T_1(*Azotobacter chroococcum)* (Mac27)	14.67	16.33	20.00	26.33	24.67	16.00	12.67	18.67
T_2(*Azospirillum brasilense* sp.)	12.67	15.33	20.67	24.33	20.33	13.33	10.67	16.76
T_3(*Bacillus* sp. SYB 101)	13.00	17.33	23.00	26.67	25.33	19.67	15.00	20.00
T_4 (*Bacillus* sp. SB 155)	12.33	16.00	22.67	26.00	24.33	20.00	13.67	19.29
T_5 (*Bacillus* sp. SB127)	11.00	14.33	19.33	24.33	20.67	17.33	12.67	17.10
T_6(*Pseudomonas* sp. CPS63)	11.67	12.00	20.00	25.67	22.00	18.33	14.00	17.67
T_7 (*Pseudomonas* sp. CPS20)	12.67	16.67	25.67	27.33	23.00	18.00	13.33	19.52
T_8 (*Pseudomonas* sp. CPS47)	10.33	12.33	18.67	24.67	20.67	16.67	12.33	16.52
Overall mean	12.00	14.70	20.59	24.89	22.11	17.11	12.81	
C.D. (P=0.05)								
Treatments	1.15							
Days	1.02							
Treatments x Days	3.05							

Table 2 : Effect of rhizobactera strains on vase life of gladiolus cv. AMERICAN BEAUTY

Treatments	Fresh weight of spike (g)	Diameter of florets (cm)	Wilting of floret (Days)	Opening of last florets (Number of days)	Vase life of spike (Days)
T_0 (Control)	42.00	8.33	2.45	8.33	12.78
T_1(*Azotobacter chroococcum)* (Mac27)	73.67	9.18	3.26	9.18	15.59
T_2(*Azospirillum brasilense* sp.)	49.00	9.08	3.89	9.08	15.89
T_3(*Bacillus* sp. SYB 101)	59.33	9.30	3.47	9.30	15.81
T_4 (*Bacillus* sp. SB 155)	54.33	8.83	3.05	8.83	14.71
T_5 (*Bacillus* sp. SB127)	53.00	9.55	2.72	9.55	14.06
T_6(*Pseudomonas* sp. CPS63)	58.67	9.82	3.83	9.82	18.17
T_7 (*Pseudomonas* sp. CPS20)	71.00	9.62	4.56	9.62	18.22
T_8 (*Pseudomonas* sp. CPS47)	47.67	9.58	3.21	9.58	15.88
Overall mean	56.52	9.25	3.38	9.25	15.68
C.D. (P=0.05)	5.39	NS	0.54	NS	1.44

NS=Non-significant

1). Transpirational loss first increased after that decreased with the increase in vase period. Maximum transpirational loss was recorded on 8th day of vase life (29.33 g) whereas, minimum under control on 2nd day of vase life (9.67 g). Fresh weight of spike at the time of cutting was significantly increased with the application of rhizobacteria strains in comparison to the T_0 (without any bioinoculant) (42 g) (Table 2). The maximum spike weight was noticed under treatment T_1 (*Azotobacter)* (73.63 g) which was at par with T_7 (*Pseudomonas* sp. CPS20). Wange and Patil (1994) recorded significant increase in number of florets per spike, spike quality, number of bulbs, flower yield by application of *Azotobacter* with nitrogen in tuberose (*Polianthes tuberosa* L.).Biofertilizers are efficient strains of micro-organisms which are capable of mobilizing nutritive elements from non-available form to usable form through biological process (Murugesan and Prasad, 2006). During period of vase life the diameter of floret was not affected by the application of rhizobacteria strains. Numbers of days to wilting of florets were significantly increased with the application of *Bacillus* and *Pseudomonas* strains, T_0 (without any bioinoculant) recorded the earliest wilting of floret 2.45 days, however, maximum numbers of days required for wilting of floret were noticed under T_7 (*Pseudomonas* sp. CPS20) 4.56 days, which was immediately followed by T_2 (*Azospirillum*) 3.89 days and T_6 (*Pseudomonas* sp. CPS63) 3.83 days. The number of days required for opening of last floret was significantly increased by all the treatments in comparison to control (10.33 days). It is evident from the data that vase life of cut spikes was significantly increased by all the treatments in comparison to the control. Maximum vase life 18.22 days was observed under T_7 (*Pseudomonas* sp. CPS20), which was at par with T_6 (*Pseudomonas* sp. CPS63) *i.e.* 18.17 days. Longer vase life with more number of florets, longer vase life might be attributed to the better overall food and nutrient status under these treatments. 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 dehydration thereby increasing post-harvest character (Lodhi *et al*., 1991). Increased availability of phosphorus and subsequent uptake by crops might also have improved storability, since phosphorus is known to improve keeping quality (Tiruneh, 1999). Similar findings were reported in increasing vase life in gerbera by Wen (1991) and Kumar (2002) in China aster.

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