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The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(4): 226-229

www.thepharmajournal.com
Received: 20-01-2022
Accepted: 28-02-2022

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Influence of bulb treatment with bio-fertilizers and foliar spray of bio-stimulants on post-harvest and vase-life of tuberose (*Polianthes tuberosa* L.) cv. Suvasini

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Abstract
The experiment was conducted at College of Horticulture, Mojerla, Wanaparthy, SKLTSHU. Statistical design was Contrast Factorial Randomized Block Design (FRBD with Control) with two factors (Bio-Fertilizers and Bio-Stimulants) with three and eight levels respectively replicated thrice. Tuberose bulbs Cv. Suvasini were treated with Bio-Fertilizers (Phosphate Solubilizing Bacteria (PSB @ 200g/l), Azospirillum (AZO @ 200g/l), Phosphate solubilizing Bacteria (KSB @ 200g/l)) and were sown in the filed with ridges and furrow method of plots. 20 days after sowing when the bulbs were sprouted, they are foliar sprayed with Bio-Stimulants (Gibberellic acid (GA_3), salicylic acid (SA), cycocel (CCCC), Humic acid (HA) each at 200 ppm and 400 ppm). After harvest of the spikes the post-harvest studies were done such as vase life, transpiration loss, water uptake. Among the treatments PSB in Bio-Fertilizers, GA_3 400ppm in Bio-Stimulants while in the interaction effect of Bio-Fertilizers and Bio-Stimulants PSB + GA_3 400 ppm resulted best.

Keywords: Tuberose, bio-fertilizers, bio-stimulants

Introduction
Tuberose is one of the important bulbus crop used for both loose and cut flower purposes. It is originated from Mexico belongs to the family Amaryllidaceae. Also known as 'Rajanigandha' and 'Neelasamengi' in India. The generic name Polianthes is derived from Greek word Polis meaning white & Anthos meaning flower. In India, it is commercially grown in West Bangal, Karnataka, Tamil Nadu and Maharashtra. It is a multipurpose flower which is used for artistic garlands, floral ornaments, bouquets and buttonholes. Tuberose is commercially grown due to its potential for cut flower, loose flower, long vase life of spikes and pleasant fragrance. (Singh and Kumar, 1999) [2]. The flowers remain fresh for quite a long time and withstand distance transportation and occupy a prime place in the flower market (Patel, 2006) [3].

Material and Methods
Total 24 treatments and a Control were taken to carry out the post-harvest studies on tuberose Cv. Suvasini. Experiment was laid out in Contrast Factorial Randomized Block Design (FRBD with Control) with two factors (Bio-Fertilizers and Bio-Stimulants) with three and eight levels respectively replicated thrice. The treatment combinations were T_1 - PSB 200 g/l + GA_3 200 ppm, T_2 - PSB 200 g/l + GA_3 400 ppm, T_3 - Azospirillum 200g/l + GA_3 200 ppm, T_4 - Azospirillum 200g/l + GA_3 400 ppm, T_5 - KSB 200 g/l + GA_3 200 ppm, T_6 - KSB 200 g/l + GA_3 400 ppm, T_7 - PSB 200 g/l + Salicilic Acid 200 ppm, T_8 - PSB 200 g/l + Salicilic Acid 400 ppm, T_9 - Azospirillum 200g/l + Salicilic Acid 200 ppm, T_{10} - Azospirillum 200g/l + Salicilic Acid 400 ppm, T_{11} - KSB 200 g/l + Salicilic Acid 200 ppm, T_{12} - KSB 200 g/l + Salicilic Acid 400 ppm, T_{13} - PSB 200 g/l + CCC 200 ppm, T_{14} - PSB 200 g/l + CCC 400 ppm, T_{15} - Azospirillum 200g/l + CCC 200 ppm, T_{16} - Azospirillum 200g/l + CCC 400 ppm, T_{17} - KSB 200 g/l + CCC 200 ppm, T_{18} - KSB 200 g/l + CCC 400 ppm, T_{19} - PSB 200 g/l + Humic acid 200 ppm, T_{20} - PSB 200 g/l + Humic acid 400 ppm, T_{21} - Azospirillum 200g/l + Humic acid 200 ppm, T_{22} - Azospirillum 200g/l + Humic acid 400 ppm, T_{23} - KSB 200 g/l + Humic acid 200 ppm, T_{24} - KSB 200 g/l + Humic acid 400 ppm, T_{25} – Control.
From each treatment 5 flower spikes were selected after harvesting from every replication and were placed in conical flasks with distilled water and observations on various post-harvest parameters were taken.

The Vase life of tuberose spikes was determined by observing the number of days taken for withering of more than 50 per cent of the florets was recorded and expressed in days. Water uptake (g/spike) is determined by observing the difference between consecutive measurements of container + solution (without flower) recorded once in two days to measure the water uptake within that particular duration of period and represented as gram per flower.

Transpiration loss of water (TLW g/spike) is determined by the difference between consecutive measurements of container + solution + flowers recorded once in two days to measure the transpiration loss of water within that particular duration of period and represented as gram per spike.

$$(WU) = \frac{\text{Initial wt of Container without spike} - \textit{final wt of the container with spike}}{\textit{no.of spikes}}$$

$$TLW = \frac{\text{Initial wt of Container with spike} - \text{Final wt of container with spike}}{\text{No. of Splikes in bottle}}$$

Results and Discussion

Vase life

(Table 1) Bio-Fertilizers P_1 (PSB) recorded highest vase life period of cut tuberose (12.42 days) followed by P_3 (KSB) (12.33 days). The treatment P_2 (AZO) recorded minimum vase life period (12.23 days). In Bio-Stimulants highest vase life period (13.46 days) was observed with S_6 (CCC 400 ppm) followed by S_5 (CCC 200 ppm) (13.14 days) whereas, the minimum vase life period (11.60 days) was observed from S_1 (GA_3 200 ppm). Coming to the interaction effect the treatment combination P_1S_6 (PSB + CCC 400 ppm) recorded maximum vase life period (14.33 days) followed by P_1S_5 (PSB + CCC 200 ppm) (13.87 days). The treatment combination P_2S_4 (AZO + SA 400 ppm) recorded minimum vase life period (10.77 days) which is lesser than the vase life period in control treatment (10.80 days). The remaining treatment combinations recorded intermediary values. The increase in vase life of flowering might be due to the fact that CCC acted as growth retardants that may reduce the cell size and stomatal opening and thereby reduce the area for transpiration. Where PSB influenced the plants with good vegetative and floral growth. This is in line with the findings of Talukdar and Paswan (1988) in chrysanthemum.

Water uptake (g)

(Table 2) The observations for water uptake were recorded at 2, 4 and 6 days interval. Bio-Fertilizers P_1 (PSB) recorded highest water uptake of cut tuberose (16.29 g) (16.61 g) & (8.83 g) respectively followed by P_3 (KSB) (16.12 g), (16.50 g) & (8.65 g). The treatment P_2 (AZO) recorded minimum uptake of water (15.75 g), (16.03 g) & (8.14 g). In Bio-Stimulants the highest water uptake (16.76 g), (16.90 g) & (9.38 g) was observed with S_2 (GA_3 400 ppm) followed by S_1 (GA_3 200 ppm) (16.29 g), (16.80 g) & (9.07 g). whereas, the minimum water uptake (15.61 g), (15.92 g) & (8.00 g) was observed from S_6 (CCC 400 ppm). Coming to the interaction effect the treatment combination P_1S_2 (PSB + GA_3 400 ppm) recorded maximum water uptake (18.03 g), (18.36 g) & (11.36 g) followed by P_1S_1 (PSB + $GA_3$200 ppm) (17.83 g), (17.88 g) & (10.77 g). The treatment combination P_1S_5 (PSB + CCC 200 ppm) recorded minimum water uptake (14.33 g) at 2nd day whereas P_3S_6 (KSB + CCC 400 ppm) recorded minimum water uptake (14.66 g) & (7.13 g) at 4th and 6th day interval. Whereas control recorded least water uptake (14.27 g), (14.27 g) & (6.28 g) than all the other treatments. The remaining treatment combinations recorded intermediary values. The increase in water uptake of flowering may be due to the application of GA_3 and PSB which influenced the continuity in the water conductance by the tissues without any blockage and GA_3 might have also increased the osmotically driven water uptake by the flower stalks. Similar findings of increase in the vase life of flowers with GA_3 application was reported by Delvadia *et al*., (2009) [4] in gaillardia.

Transpiration loss of water (g)

(Table 3) The observations for transpiration loss were recorded at 2, 4 and 6 days interval. Bio-Fertilizers P_1 (PSB) recorded transpiration loss of water in cut tuberose (18.91) (16.61 g) & (12.80 g) respectively followed by P_2 (AZO) (18.61 g), (16.31 g) & (12.62 g). The treatment P_3 (KSB) recorded minimum transpiration loss of water (18.24 g), (15.60 g) & (12.38 g). In Bio-Stimulants the highest transpiration loss (19.43 g), (16.84 g) & (12.99 g) was observed with S_2 (GA_3 400 ppm) followed by S_1 (GA_3 200 ppm) (19.14 g), (16.39 g) & (12.95 g). Whereas, the minimum transpiration loss (17.03 g) was observed at 2nd day interval from S_5 (CCC 200 ppm) while minimum transpiration loss of (15.40 g) & (12.12 g) was observed from S_6 (CCC 400 ppm). Coming to the interaction effect the treatment combination P_1S_2 (PSB + GA_3 400 ppm) recorded maximum transpiration loss (20.32 g), (17.92 g) & (13.76 g) followed by P_1S_1 (PSB + GA_3 200 ppm) (20.27 g), (17.71 g) & (13.46 g). The treatment combination P_3S_5 (PSB + CCC 200 ppm) recorded minimum transpiration loss (14.51 g) & (11.81 g) at 2nd and 6th day interval whereas P_3S_6 (KSB + CCC 400 ppm) recorded minimum transpiration loss (14.20 g) at 4th day interval. whereas control recorded least transpiration loss (17.58 g), (14.04 g) & (11.85 g) than all the other treatments. The remaining treatment combinations recorded intermediary values. The increase in transpiration loss of water may be due to the application of GA_3 and PSB which influenced the continuity in the water conductance by the tissues without any blockage Similar findings of increase in the transpiration loss of flowers with GA_3 application was reported by Delvadia *et al*., (2009) [4] in gaillardia.

Table 1: Influence of bulb treatment with bio-fertilizers and foliar spray of bio-stimulants on vase life in tuberose cv. Suvasini

(Factor-2) Bio stimulants	(Factor-1) Bio fertilizers			
	P_1 – PSB (200g/l)	**P_2 – AZO (200g/l)**	**P_3 – KSB (200g/l)**	**Mean**
S_1 - GA_3 200 ppm	10.83	12.80	11.17	11.60
S_2 - GA_3 400 ppm	11.53	13.37	11.77	12.22
S_3 - SA 200 ppm	12.13	11.23	12.80	12.05
S_4 - SA 400 ppm	13.47	10.77	12.43	12.22
S_5 - CCC 200 ppm	13.87	11.87	13.67	13.14
S_6 - CCC 400 ppm	14.33	12.20	13.86	13.46
S_7 – HA 200 ppm	11.17	13.20	10.90	11.76
S_8 – HA 400 ppm	12.03	12.37	12.00	12.13
Mean	12.42	12.23	12.33	
Control	10.80			
	P	S	P×S	Control
S.E(m) ±	0.02	0.06	0.17	0.30
LSD@5%	0.06*	0.16*	0.48*	0.59*

GA_3 = Gibberellic acid, SA = Salicylic acid, CCC = Cycocel, HA = Humic acid, (P_1) PSB = Phosphate solubilizing bacteria, (P_2) AZO = Azospirillum, (P_3) KSB = Potassium solubilizing Bacteria.

Table 2: Influence of Bulb treatment with Bio-fertilizers and Foliar spray of Bio-stimulants on water uptake at 2nd, 4th and 6th day interval in tuberose cv. Suvasini

Bio stimulants (Factor - 2)	Bio fertilizers (Factor - 1)											
	2nd day				4th day				6th day			
	P_1	**P_2**	**P_3**	**mean**	**P_1**	**P_2**	**P_3**	**mean**	**P_1**	**P_2**	**P_3**	**mean**
S_1 - GA_3 200 ppm	17.83	15.22	15.82	16.29	17.88	16.15	16.38	16.80	10.77	7.96	8.48	9.07
S_2 - GA_3 400 ppm	18.03	15.53	16.71	16.76	18.36	16.19	16.15	16.90	11.36	8.55	8.22	9.38
S_3 - SA 200 ppm	16.53	14.64	16.78	15.98	17.53	14.97	16.78	16.43	9.25	7.71	8.4	8.45
S_4 - SA 400 ppm	16.46	15.99	15.93	16.13	16.6	15.8	17.53	16.64	7.45	7.3	9.63	8.13
S_5 - CCC 200 ppm	14.33	16.83	16.29	15.82	14.85	15.11	17.83	15.93	7.17	8.83	8.16	8.05
S_6 - CCC 400 ppm	17.55	14.77	14.51	15.61	16.79	16.32	14.66	15.92	8.4	8.47	7.13	8.00
S_7 – HA 200 ppm	15.1	16.90	15.74	15.91	15.43	16.90	16.41	16.25	7.81	8.11	9.01	8.31
S_8 – HA 400 ppm	14.47	16.13	17.20	15.93	15.47	16.83	16.29	16.20	8.42	8.18	10.18	8.93
mean	16.29	15.75	16.12		16.61	16.03	16.50		8.83	8.14	8.65	
control	14.27				14.27				6.28			
	P	S	P × S	control	P	S	P × S	control	P	S	P × S	control
S.Em±	0.03	0.09	0.27	0.47	0.04	0.09	0.28	0.50	0.02	0.05	0.15	0.27
LSD@5%	0.09*	0.25*	0.76*	0.95*	0.10*	0.27*	0.81*	1.01*	0.05*	0.14*	0.43*	0.54*

GA_3 = Gibberellic acid, SA = Salicylic acid, CCC = Cycocel, HA = Humic acid, (P_1) PSB = Phosphate solubilizing bacteria, (P_2) AZO = Azospirillum, (P_3) KSB = Potassium solubilizing Bacteria.

Table 3: Influence of bulb treatment with bio-fertilizers and foliar spray of bio-stimulants on transpiration loss of water at 2nd, 4th and 6th day interval in tuberose cv. Suvasini

Bio stimulants (Factor - 2)	Bio fertilizers (Factor - 1)											
	2nd day				4th day				6th day			
	P_1	**P_2**	**P_3**	**mean**	**P_1**	**P_2**	**P_3**	**mean**	**P_1**	**P_2**	**P_3**	**mean**
S_1 - GA_3 200 ppm	20.27	19.42	17.74	19.14	17.71	16.34	15.12	16.39	13.46	12.58	12.80	12.95
S_2 - GA_3 400 ppm	20.32	19.38	18.60	19.43	17.92	16.53	16.08	16.84	13.76	13.06	12.14	12.99
S_3 - SA 200 ppm	20.13	17.53	18.56	18.74	16.64	15.33	16.60	16.19	12.36	12.26	12.87	12.50
S_4 - SA 400 ppm	17.59	17.87	20.18	18.55	16.47	17.31	15.1	16.29	13.15	12.37	13.21	12.91
S_5 - CCC 200 ppm	17.09	19.49	14.51	17.03	15.83	16.54	15.28	15.88	12.89	11.95	11.81	12.22
S_6 - CCC 400 ppm	18.12	18.40	17.67	18.06	15.56	16.44	14.2	15.40	11.83	12.53	11.99	12.12
S_7 – HA 200 ppm	19.60	17.81	19.74	19.05	15.39	16.09	17.31	16.26	12.17	13.04	12.12	12.44
S_8 – HA 400 ppm	18.19	18.98	18.89	18.69	17.37	15.87	15.13	16.12	12.79	13.17	12.07	12.68
mean	18.91	18.61	18.24		16.61	16.31	15.60		12.80	12.62	12.38	
control	17.58				14.04				11.85			
	P	S	P × S	control	P	S	P × S	control	P	S	P × S	control
S.Em±	0.04	0.09	0.28	0.50	0.03	0.09	0.28	0.49	0.02	0.05	0.14	0.26
LSD@5%	0.10*	0.27*	0.80*	1.00*	0.10*	0.26*	0.79*	0.99*	0.05*	0.14*	0.41*	0.51*

GA_3 = Gibberellic acid, SA = Salicylic acid, CCC = Cycocel, HA = Humic acid, (P_1) PSB = Phosphate solubilizing bacteria, (P_2) AZO = Azospirillum, (P_3) KSB = Potassium solubilizing Bacteria.

Conclusion

From the results, it can be concluded that among the Bio-Fertilizers Phosphate solubilizing bacteria (PSB) 200g/l, Bio-Stimulants GA_3 400 ppm while in interaction effect of Bio-Fertilizers and Bio-Stimulants where the combination of PSB 200 g/l (Phosphate solubilizing bacteria) + GA_3 400 ppm has

significantly resulted best in all post-harvest parameters such as, vase life, water uptake (g) (2^{nd}, 4^{th} and 6^{th} day interval), transpiration loss of water (g) (2^{nd}, 4^{th} and 5^{th} day interval) when compared with all the other treatment combinations and control.

References

1. Singh PV, Kumar M. Effect of spacing, depth and time of planting on growth, flowering and bulb production of tuberose Cv. Single. Horticultural Science. 1999;2(2):127-130.
2. Patel MM, Parmer PB, Parmer BR. Effect of nitrogen, phosphorus and spacing on growth and flowering in tuberose Cv. Single. Journal of Ornamental Horticulture. 2006;9(4):286-289.
3. Singh J, Nigam R, Singh R, Kumar A, Kumar A. Effect of gibberellic acid and cycocel on growth flowering and yield of chrysanthemum (*Dendranthema grandiflora ramat*) cv. birbal sahni. Journal of Pharmacognosy and Phytochemistry. 2018;7(1):2753-2758.
4. Delvadia DV, Ahlawat TR, Meena BJ. Effect of Different GA_3 Concentration and Frequency on Growth, Flowering and Yield in Gaillardia (*Gaillardia Pulchella*) Cv. Lorenziana. Journal of horticulture sciences. 2009;4(1):81-84,