



Response of Foliar Application of GA₃ and Paclobutrazol on Flowering and Vase Life of Tuberose (*Polianthes tuberosa* L.)

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

The present investigation "Response of foliar application of GA₃ and paclobutrazol on flowering and vase life of Tuberose (*Polianthes tuberosa* L.)" was carried out in Horticulture Research Farm at the Department of Floriculture and Landscape Architecture, IGKV, Raipur, Chhattisgarh, India, 2017-18 and 2018-19. The experiment was laid out in Factorial Randomized Block Design with three replication comprising treatment combination of two PGRs (GA₃ and Paclobutrazol) and two tuberose cultivars (Prajwal and Bidhan Ujjwal). Two PGR's namely Gibberellins (GA₃) and Paclobutrazol (PBZ) were taken as growth promoter and growth retardant, respectively. In this contest, an experiment was conducted to investigate the effect of different levels of growth promoter and retardant on growth, flowering and vase life of different cultivars of Tuberose. The result indicated that the vegetative growth, flowering and vase life were significantly influenced by different plant growth regulators and cultivars. The maximum plant height was recorded with cv. Prajwal (V₁) as compared to cv. Bidhan Ujjwal (V₂). While, minimum number days

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to first spike emergence (117.33 days), days to first flower opening (131.83 days) was recorded with cv. Bidhan Ujjwal. Among the growth regulators treatments GA₃ 150 ppm (30 and 50 DAP). However, maximum length of spike (94.72 cm), length of rachis (30.35 cm), length of florets (5.8 cm), diameter of florets (4.32 cm), Number of florets spike⁻¹ (43.41) and Vase life (10.17 days) was recorded with cv. Prajwal. Among the growth regulators treatments GA₃ 150 ppm (30 and 50 DAP).

Keywords: *Tuberose; PGR; gibberellic acid (GA₃); paclobutrazol (PBZ); prajwal; bidhan ujjwal; flowering; vase life.*

1. INTRODUCTION

“Among the commercially grown flowers in India. Tuberose (*Polianthes tuberosa* L.) occupies prime position because of its popularity as a cut flower, loose flower as well as its potential in perfume industry. It is a bulbous geophyte which produces white and waxy florets which are used mainly for making garlands, bouquets, bridal make up and other floral arrangements. The florets borne on long spike stand long distance transport, remain fresh for long and are excellent for table decoration. The plants are also used in landscaping as a component in beds and borders and as potted plants” [1] “Plant growth regulators are known to coordinate and control various phases of growth and development, including flowering at optimum concentrations. Gibberellic acid and Paclobutrazol are very important plant growth regulators and are widely used in horticulture. Therefore, the combination of both growth promoter and growth retardant at their right level and their right stage of crop is highly desired. The GA₃ regulation of growth itself is involved with both cell division and cell enlargements without cell division [2]. The application Paclobutrazol the so called growth retardant is generally used widely in the orchard plants like mango which regulates its alternate bearing habit but it is used very rarely in the flower crops. There is very mere information regarding paclobutrazol effect in the floriculture sector hence we conducted this experiment to asses effect of paclobutrazol in different doses of PGR's. Thus, keeping in view the potentialities of growth regulators like GA₃ and PBZ, the present study was undertaken to find out the suitable concentration of these PGR's for better flowering and vase life of tuberose” [3].

2. MATERIALS AND METHODS

The experiment was carried out during the years 2017-18 and 2018-19, was carried out in Horticultural Research cum Instruction Farm at the Department of Floriculture and Landscape Architecture, College of Agriculture, Indira

Gandhi Krishi Vishwavidyalaya, Raipur, (C.G.). The experiment was laid out in Factorial Randomized Block Design with three replications comprising sixteenth treatment combinations of Eight levels of PGR's viz., G₁ GA₃ 150 ppm at 30 DAP, G₂ GA₃ 150 ppm at 50 DAP, G₃ GA₃150 ppm at 30 and 50 DAP, G₄ PBZ 10 ppm at 70 DAP, G₅ GA₃ 150 ppm at 30 DAP + PBZ 10 ppm at 70 DAP, G₆ GA₃ 150 ppm at 50 DAP+ PBZ10 ppm at 70 DAP, G₇ GA₃150 ppm at 30 and 50 DAP + PBZ 10 ppm at 70 DAP, along with G₈ distill control (water spray) and two varieties viz., Prajwal and Bidhan Ujjwal of tuberose were taken.

“Bulbs of tuberose cv. Prajwal were provided by Horticulture Research Farm at the Department of Floriculture and Landscape Architecture, Indira Gandhi Krishi Vishwavidyalaya, Raipur and the other cv. Bidhan Ujjwal were provided by Horticulture Research Farm, Mandouri, Bidhan Chandra Krishi Vishwavidyalaya, West Bengal” [3].

“Before planting the bulbs were stored in well ventilated semi shady place for two months. Older leaves emerging from the neck of the bulbs were trimmed off. Before planting, the bulbs were treated with fungicide copper oxychloride (0.1%) and the individual bulbs. weighing 15-30 g with 1.5- 2.5 cm in diameter were selected for planting. Five plants were selected randomly from each plot for recording data on various flowering attributes” [3]. In this article the data on flowering parameters like days to first spike emergence, days to first flower opening, spike length, rachis length, spike diameter and vase life were also recorded during the investigation.

3. RESULTS AND DISCUSSION

The flowering parameters discussed in this article are, days to first spike emergence, days to first flower opening, length of spike, length of rachis, length of florets, diameter of florets, number of florets spike⁻¹ and vase life.

Table 1. Response of foliar application of GA₃ and Paclobutrazol on days to first spike emergence, days to first flower opening and length of spike (cm) of tuberose (*Polianthes tuberosa* L.) in during the year 2017-18 and 2018 -19

Treatments Varieties	Days to first spike emergence			Days to first flower opening			Length of spike (cm)		
	2017-18	2018-19	Pooled Mean	2017-18	2018-19	Pooled Mean	2017-18	2018-19	Pooled Mean
Prajwal-V ₁	131.46	129.38	130.42	146.00	145.25	145.63	105.25	105.93	105.59
Bidhan Ujjwal- V ₂	120.13	119.38	119.75	133.75	132.96	133.35	69.76	70.79	70.27
Sem±	0.95	0.56	0.75	0.71	0.53	0.62	0.77	0.71	0.74
CD (0.05)	2.72	1.62	2.17	2.04	1.54	1.79	2.23	2.06	2.14
PGRs									
GA ₃ 150 ppm at 30 DAP	122.67	120.00	121.33	135.67	133.33	134.50	89.27	88.61	88.91
GA ₃ 150 ppm at 50 DAP	129.17	122.67	125.92	142.83	141.67	142.25	85.67	86.13	85.90
GA ₃ 150 ppm at 30 and 50 DAP	117.33	116.83	117.08	131.83	130.67	131.25	94.72	95.85	95.28
PBZ 10 ppm at 70 DAP	132.67	133.50	133.08	147.50	149.50	148.50	82.35	84.93	83.63
GA ₃ 150 ppm at 30 DAP + PBZ 10 ppm at 70 DAP	122.50	119.67	121.08	135.17	132.83	134.00	89.70	89.32	89.51
GA ₃ 150 ppm at 50 DAP + PBZ10 ppm at 70 DAP	126.67	130.83	128.75	142.00	141.00	141.50	85.14	86.03	85.58
GA ₃ 150 ppm at 30 and 50 DAP + PBZ10 ppm at 70 DAP	120.50	118.67	119.58	134.33	132.00	133.17	93.67	94.28	93.97
Control (water spray)	134.83	132.83	133.83	149.67	151.83	150.75	79.57	81.74	80.65
Sem±	1.88	1.23	1.50	1.41	1.07	1.24	1.54	1.43	1.48
CD (0.05)	5.44	3.24	4.34	4.08	3.08	3.58	4.45	4.12	4.28
Treatment combinations (PGR X V) CD (p=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 2. Response of foliar application of GA₃ and Paclobutrazol on length of rachis (cm), length of florets (cm) and diameter of florets (cm) of tuberose (*Polianthes tuberosa* L.) in during the year 2017-18 and 2018 -19

Treatments Varieties	Length of rachis (cm)			Length of florets (cm)			Diameter of florets (cm)		
	2017-18	2018-19	Pooled Mean	2017-18	2018-19	Pooled Mean	2017-18	2018-19	Pooled Mean
Prajwal-V ₁	30.29	28.48	29.38	5.71	5.63	5.67	4.56	4.55	4.55
Bidhan Ujjwal- V ₂	24.31	22.67	22.72	5.26	5.24	5.25	3.72	3.72	3.72
Sem±	0.43	0.45	0.29	0.06	0.06	0.06	0.01	0.03	0.02
CD (0.05)	1.26	1.29	0.83	0.18	0.17	0.17	0.03	0.09	0.06
PGR _s									
GA ₃ 150 ppm at 30 DAP	27.49	24.96	26.22	5.55	5.56	5.55	4.17	4.15	4.16
GA ₃ 150 ppm at 50 DAP	26.34	24.85	25.59	5.45	5.34	5.39	4.13	4.10	4.11
GA ₃ 150 ppm at 30 and 50 DAP	30.35	28.92	29.63	5.86	5.67	5.76	4.32	4.33	4.32

Treatments Varieties	Length of rachis (cm)			Length of florets (cm)			Diameter of florets (cm)		
	2017-18	2018-19	Pooled Mean	2017-18	2018-19	Pooled Mean	2017-18	2018-19	Pooled Mean
PBZ 10 ppm at 70 DAP	25.84	24.33	25.08	5.27	5.27	5.27	4.06	4.03	4.04
GA ₃ 150 ppm at 30 DAP + PBZ 10 ppm at 70 DAP	28.09	26.37	27.23	5.59	5.59	5.59	4.22	4.22	4.22
GA ₃ 150 ppm at 50 DAP + PBZ 10 ppm at 70 DAP	25.60	25.24	25.42	5.39	5.33	5.37	4.03	4.14	4.09
GA ₃ 150 ppm at 30 and 50 DAP + PBZ 10 ppm at 70 DAP	29.59	28.16	28.88	5.65	5.65	5.65	4.30	4.29	4.30
Control (water spray)	25.30	22.55	23.92	5.13	5.07	5.10	3.87	3.80	3.83
Sem±	0.87	0.89	0.58	0.12	0.12	0.12	0.02	0.06	0.04
CD (0.05)	2.51	2.58	1.66	0.35	0.34	0.35	0.06	0.18	0.12
Treatment combinations (PGR X V) CD (p=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 3. Response of foliar application of GA₃ and paclobutrazol on number of florets spike⁻¹ and vase life of tuberose (*Polianthes tuberosa* L.) during the year 2017-18 and 2018 -19

Treatments Varieties	Number of florets spike ⁻¹			Vase Life (days)		
	2017-18	2018-19	Pooled Mean	2017-18	2018-19	Pooled Mean
Prajwal-V ₁	42.20	41.45	41.82	11.75	10.63	11.69
Bidhan Ujjwal- V ₂	39.59	39.47	39.53	9.46	9.71	9.58
Sem±	0.43	0.50	0.47	0.19	0.17	0.18
CD (0.05)	1.25	1.45	1.35	0.49	0.43	0.46
PGR _S						
GA ₃ 150 ppm at 30 DAP	41.22	41.30	41.26	9.50	9.33	9.42
GA ₃ 150 ppm at 50 DAP	40.33	39.83	40.08	9.00	9.00	9.00
GA ₃ 150 ppm at 30 and 50 DAP	42.39	41.95	42.17	10.00	10.00	10.00
PBZ 10 ppm at 70 DAP	39.34	39.74	39.54	8.17	8.50	8.33
GA ₃ 150 ppm at 30 DAP + PBZ 10 ppm at 70 DAP	42.37	41.77	42.07	9.67	9.50	9.58
GA ₃ 150 ppm at 50 DAP + PBZ 10 ppm at 70 DAP	40.06	39.80	39.93	8.67	8.67	8.67
GA ₃ 150 ppm at 30 and 50 DAP + PBZ 10 ppm at 70 DAP	43.41	42.09	42.75	10.17	10.17	10.17
Control (water spray)	38.02	37.22	37.62	7.67	8.17	7.92
Sem±	0.86	1.00	0.93	0.34	0.30	0.32
CD (0.05)	2.49	2.89	2.69	0.97	0.85	0.91
Treatment combinations (PGR X V) CD (p=0.05)	NS	NS	NS	NS	NS	NS

3.1 Influence of Varieties

Data presented in (Tables 1, 2 & 3) revealed that the cultivars of Tuberose had significantly influenced on flowering and vase life parameters characters. The pooled mean data revealed that the minimum period for days taken to first spike emergence (120.13 and 119.38 days) and less number of days from days after planting to first flower opening (133.75 and 132.96 days) were recorded under cv. Bidhan Ujjwal (V_2) as compared to Prajwal (V_1) during in the year 2017-18 and 2018-19, respectively. While, maximum length of spike (105.25 cm), length of rachis (30.29 cm), length of florets (5.71cm), diameter of florets (4.56 cm), number of florets spike⁻¹ (42.20) and vase life of cut spike (11.75 days) were recorded under cv. Prajwal (V_1) as compared to Bidhan Ujjwal (V_2). The two years results indicated that there was highly significant difference in early and late flowering behavior, length of spike, length of rachis, length of florets, diameter of florets and vase life within the varieties. It could be stated that variation within the varieties might be due to genotypic and environmental differences. Similar results were reported by Devadanam et al. [4], Sateesha et al. [5], Vanlalruati et al. [6], Krishanmoorthy [7], Dimri et al. [8], Madhumati et al. [9] in tuberose.

3.2 Effect of Plant Growth Regulators

During the first year of the investigation, the application of growth regulators, GA₃ 150 ppm (30 and 50 DAP) recorded early days to spike emergence (117.33 days), earliest flower opening (131.83 days). The maximum length of spike (94.72 cm), length of rachis (30.35 cm), length of florets (5.86 cm), diameter of florets (4.32 cm), number of florets spike⁻¹ (43.41) and vase life of cut spike (10.17 days) as compared to control. Similar trend was observed in second year of trial as well as in pooled mean data. The early days to spike emergence and earliest flower opening in GA₃ treatments may be due to increase in the endogenous level of gibberellins which by virtue of its flower inducing characteristics might have also promoted the early days to spike emergence and earliest flower opening. The results obtained in this study are in close agreement with the findings of Bhosale et al. [10], Shanker and Sharma [11] in tuberose, Rana et al. [12] in gladiolus, Sunitha et al. [13] in marigold. Increase in length of spike, length of rachis and length of florets might be due to increase in the cell division and cell

elongation of intercalary meristem resulting in rapid internode and floret elongation. These finding were corroborated with the finding of Singh and Srinivastava [14], Padaganur et al. [15], Rani and Singh [16] in tuberose. The role of GA₃ in improving the florets size may be ascribed to the translocation of metabolites at the site of florets development. Increase in diameter of florets might be due to cell elongation in the floret. Gibberellins are also known to increase the sink strength of actively growing parts. The similar findings were also noted by Bhosale et al. [10] in tuberose, Rana et al. [12] in gladiolus and by Salem et al. [17] in gerbera. The significantly maximum number of florets spike⁻¹ with foliar spray of GA₃ at 150 ppm concentration was mainly due to an increase in the cell division and cell elongation in in the intercalary tissue. whereas, application of PBZ 70 ppm in mid growth stage suppress the growth resulting in length of spike. These results are in consonance with finding of Asgarian et al. [18], Nishith et al. [19] in tuberose. The longer vase life of cut spike with higher concentration of GA₃ might be attributed to higher auxin activity which has been reported to delay senescence and enhance the translocation of metabolites. An increased better quality of spike might be caused by drawing of photosynthesis to flower as a consequence of intensification of the sink which also increased cell division and cell elongation due to the foliar application of GA₃ which might have been utilized for the production of the better quality spike in tuberose. The results obtained in this study are in close agreement with the findings of Dani et al. [20], Nellipali and Pal [21] in tuberose.

For all the characters, it was determined that the interaction between the growth regulator and variety treatments was not significant. This might be because plant growth regulators have a similar effect on both kinds of tuberose.

4. CONCLUSION

The study concluded that cultivar Prajwal and Bidhan Ujjwal was observed to be superior in terms of growth, flowering and vase life attributes. The flowering parameters viz., days to first spike emergence and days to first flower opening were found early with GA₃150 ppm (30 and 50 DAP) and for variety in Bidhan Ujjwal. The combination of PGR, GA₃ and paclobutrazol gave positive impact on growth and flower yield over the sole application of GA₃ and

paclobutrazol at 30,50 and 70 DAP. Thus, the present investigation clearly indicates that the application of GA₃ 150 ppm at early growth stage and paclobutrazol 10 ppm at later stage have been found effective in the direction of increasing length of spike, length of rachis, length of florets, diameter of florets, number of florets spike⁻¹ and vase life of Tuberose.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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