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Research Article

Performance of Tuberose cv. Prajwal as Influenced by Different Plant Growth Enhancers

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ABSTRACT

The present investigation on "Effect of plant growth enhancers on growth, flowering and yield of tuberose cv. Prajwal" was carried out at Floriculture Research Farm, ACHF, NAU, Navsari, Gujarat during the year 2017-2018. The experiment was laid out in a Randomized block design with three replication and thirteen treatments comprising four growth enhancers viz., enriched sap of banana pseudostem (@ 5000, 10000 and 15000 ppm), brassinosteroid (@ 0.25, 0.50 and 0.75 ppm), GA_3 (@ 50, 100 and 150 ppm), BA (@ 50, 100 and 150 ppm) along with control (no spray).The treatments were applied as foliar spray at 60, 90 and 120 days after sprouting of bulbs.

The experimental results revealed that foliar spray of enriched sap of banana pseudostem at 15,000 ppm (T_4) was found best with respect to all the growth & flowering parameters in terms of maximum plant height (74.8 cm), more number of leaves (70.20), greater leaf area (65.20 cm^2), minimum days to both rachis emergence (37.53 days) and floret opening (7 days), maximum length of spike (103 cm) and rachis (27.2 cm), more number of florets per plant (42.93), longevity of spike (12.73 days) and vase life (11.20 days). Similarly, yield attributes viz. number of spikes per plant (2.67) and per hectare (2.77 lakh), bulbs per plant (2.60) and per hectare (2.70 lakh were also found higher in T_4. In case of chemical attributes, maximum chlorophyll content (1.09 %) and essential oil (0.23 %) were also recorded in the same treatment.

Keywords: *Tuberose, banana pseudostem sap, brassinosteroid & BA.*

INTRODUCTION

Tuberose (*Polianthes tuberosa* L.) also known as *Rajnigandha* is native of Mexico and belongs to the family Asparagaceae.

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It is one of the most important bulbous plants of tropical and sub-tropical region not only due to its white colour flowers, attractive spike and delightful fragrance, but easy cultivation and wide adaptability to varying soils and agro-climatic conditions. Among ornamental bulbous plants as valued for their beauty and fragrance of the flowers, the tuberose occupies a very special and selective place and its flowers are very good source of essential oils which is used in the production of cosmetic and perfumery products. Increase in flower production, quality flowers and perfection in the form of plants are the important objectives in commercial flower production which can be obtained by using various growth enhancers within in a short period of time and at a least cost, so the present investigation on tuberose cv. Prajwal was carried out with objectives to find out the effect of different plant growth enhancers on growth, flowering, yield and quality of tuberose cv. Prajwal.

MATERIALS AND METHODS

The present experiment was carried out during March, 2017 to March, 2018 at Floriculture Research Farm, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari, Gujarat, India. The climate of this region is typical tropical, characterized by fairly hot summer, moderately cold winter and most humid and warm monsoon. The soil of Navsari campus is medium black, which is very deep, rich in organic matter and potash, having good water holding capacity and reasonably suitable for cultivation of annual chrysanthemum. The experiment was laid out in a Randomized Block Design (RBD) with three replication and thirteen treatments comprising four growth enhancers viz., enriched sap of banana pseudostem (at 5000, 10000 and 15000 ppm), brassinosteroid (at 0.25, 0.50 and 0.75 ppm), GA_3 (at 50, 100 and 150 ppm), BA (at 50, 100 and 150 ppm) along with control (no spray).The treatments were applied as foliar spray at 60, 90 and 120 days after sprouting of bulbs.

Healthy tuberose bulbs of cv. "Prajwal" free from pest and diseases and having homogenous size (2.5-3.0 cm) were procured from Floriculture Research Farm, ASPEE College of Horticulture and Forestry, NAU, Navsari and were soaked for 30 minutes in Carbendezim (0.1 %) solution and then dried in shade area. The planting was done by selecting weed free land which was properly ploughed followed by harrowing and levelling on raised beds with a spacing of 30 cm x 30 cm at about 5-7 cm below the ground and soil was pressed around the bulbs and all the standard package of practices were followed as per requirement of tuberose. The data collected for all the characters were subjected to the statistical analysis by adopting 'Analysis of Variance' technique as described by Panse and Sukhatme (1985) for Randomized Block Design.

RESULTS

Effect on growth parameters

It is perceptible from the data as presented in Table-1 that, the various plant growth enhancers with their different concentration significantly influenced the growth attributes *viz.* plant height, number of leaves and leaf area. Significantly maximum plant height (74.80 cm), number of leaves per plant (70.20) and leaf area (65.20 cm^2) were recorded under the treatment T_4 (enriched sap of banana pseudostem @ 15000 ppm) which was statistically at par with T_{10}, T_{13}, T_6 and T_3 for all the three growth parameters and also with T_{12}, T_5 and T_{11} for plant height and leaf area,

while the minimum plant height (55.20 cm), number of leaves per plant (20.20) and leaf area (50.60 cm^2) were recorded with BR @ 0.75 ppm (T_7).

Enriched sap of banana pseudostem contain some biochemical such as gibberellic acid, NAA, cytokinin, chemicals i.e. N, P, K, Ca, Mg, S, micronutrients (Mn, Cu, Zn, Zn) and beneficial microbes (PSB, Rhizobium, Azotobacter and Fungus). The most pronounced effect of gibberellins on the plant growth is an elongation of internodes. This increase in plant height might be due to increased meristimatic activity due to enhance cell division and cell elongation. The similar results were also obtained by Padmalatha et al. (2013), Sable et al. (2015) and Sajid et al. (2015) in gladiolus; Asil et al. (2011) and Singh and Shankar (2011) in tuberose. The marked improvement in growth attributes i.e. plant height, number of leaves per plant and leaf area of the crop by enriched sap of banana pseudostem might be due to increasing auxin level of tissue or enhance the conversion of tryptophan to IAA leading to the enhanced activity of cell division and cell elongation through the effect of gibberellic acid and cytokinin singly or due to combine effect of both. This kind of results was also observed by Jadhav et al. (2015) in gladiolus cv. American Beauty.

Effect on flowering parameters

Concerning the effect of various plant growth enhancers on flowering parameters in tuberose (Table-1), it was observed that enriched sap of banana pseudostem @ 15000 ppm (T_4) resulted in significantly minimum days for emergence of rachis (37.53 days) as well as that for floret opening (7.00 days) but was at par with T_{10}, T_{13} and T_6 for both the parameters and also with T_3 for days to rachis emergence, while the maximum days for both were recorded in T_7. This might be due to reduction in juvenile period due to gibberellins and convention of apical meristem into flowering primodia instead of production of leaves at the determination of juvenile phase and the results are in accordance to those obtained by Wagh et al. (2012) in tuberose.

The significantly maximum spike and rachis length of 103.00 and 27.20 cm, respectively was also obtained with the application of enriched sap of banana pseudostem @ 15000 ppm (T_4), which was statistically at par with T_{10}, T_{13}, T_6, T_3, T_{12} and T_5, whereas minimum value of spike length (78 cm) and rachis length (19.10 cm) were recorded in treatment of BR @ 0.75. Increased spike length might be due to rapid internode elongation as a result of increased cell division and cell elongation in intercalary meristem, Kumar et al. (2011) and Shanker et al. (2011) in tuberose.

Application of enriched sap of banana pseudostem sap @ 15000 ppm was also found to significantly increased the number of florets per spike (42.93) as well as longevity and vase life of spikes up to 12.73 and 11.20 days, respectively but was at par with $T_{10,}$ $T_{13,}$ T_3 and $T_{12,}$ for all the three parameters and also with T_6 and T_{11} in case of longevity and vase life of spikes. Whereas, minimum values of 30.00, 8.87 days & 7.73 days, respectively were obtained under T_7 (BR @ 0.75 ppm). This results might be due to fact that gibberellic acid might be responsible for the continuous supply of food at the time of flowering from leaves, leading the longer floral longevity of spike in tuberose which is also supported by

Singh and Shanker (2011). The beneficial effect of plant growth enhancers on vase life were might be due to PGR especially cytokinins and gibberellins have positive effects on post-harvest life of cut flowers.

Effect on yield parameters

The data as presented in Table-2 revealed that the foliar application of enriched sap of banana pseudostem @ 15,000 ppm resulted in maximum number of spikes per plant (2.67) and per hectare (2.77 lakh) in tuberose but was on the same bar when compared to T_{10}. Increase in number of spike per clump may be due to increase in cell division and cell elongation with GA_3 and lower concentration of BA and NAA. Similar result ware also reported by Kumar et al. (2011), Singh and Shanker (2011) and Shanker et al. (2011) in tuberose cv. Double, Jadhav et al. (2015) in gladiolus cv. American Beauty.

Number of bulbs per plant and per hectare of tuberose was also influenced by different plant growth enhancers (Table-2). The maximum values for number of bulbs per plant (2.60) and per hectare (2.70 lakh) were recorded with enriched sap of banana pseudostem at 15,000 ppm (T_4) and was at par with T_{10}, T_{13}, T_{12} and T_5, whereas the minimum values of 1.33 per plant and 1.24 lakh per hectare, respectively were obtained in BR at 0.75 ppm (T_7). Similarly, maximum values of number of bulblets per plant (11.33) and per hectare (11.77 lakh) were also recorded T_4 which was at par with T_{10} and T_{13}, whereas the minimum values were obtained in BR @ 0.75 ppm (T_7). Increase in bulb yield might be due to bulbs used for planting has a reserved food material in the initial stage and that photosynthesized in leaves. Likewise it has two competing sinks i.e. flower spike or inflorescence and development of buds, supported by Kumar et al. (2011), Shanker et al. (2011) in tuberose cv. Double. BA promotes the sink activity of developing corm and cormels at expense of flower spike; this might be the reason for increase in number of corms and cormels, supported by Baskaran and Mishra (2007) in gladiolus cv. Chandini. Gibberellic acid is also known to enhance the role of photosynthesis by increasing chlorophyll content in leaves that further increases the availability of metabolites to the developing corms and cormels, supported by Jadhav et al. (2015) in gladiolus cv. American Beauty. BA is known to promote cell division and anabolism, which might have been resulted into increase in number of daughter corms as well as cormels per plant, supported by Chopde et al. (2015) in gladiolus cv. American Beauty.

Effect on chemical attributes

Chlorophyll content of the leaves plays a vital role in photosynthesis process for making the food. The data on effect of different plant growth enhancers on chlorophyll and essential oil content of tuberose cv. Prajwal as presented in Table-2 revealed that the significantly maximum chlorophyll content (1.09 %) was recorded under T_4 which was at par with T_{10} (1.03 %), T_{13} (0.98 %) while minimum was observed in T_7 (0.35 %). Further, there was a non-significant effect of different treatments on essential oil content but higher essential oil (0.23 %) was recorded in treatment T4 and the least in T_7. It might be due to fact that the GA_3 retards chlorophyll degradation and helps in retaining high leaf chlorophyll content, Faraji et al. (2011) in gladiolus cv. White Prosperity and BAP (cytokinin) also had an effective role in preventing

chloroplast and chlorophyll degradation which resulted into decrease in leaf senescence and increase in total chlorophyll content, Sajid et al. (2015) in gladiolus.

Table 1: Effect of plant growth enhancers on growth and flowering in tuberose cv. Prajwal

Treatments	Plant height (cm)	No. of leaves/ plant	Leaf area (cm^2)	Days to rachis emergence	Days to first floret opening	Spike length (cm)	Rachis length (cm)	No. of florets/ spike	Longevity of spike (days)	Vase life (days)
T_1: Control (no spray)	57.40	35.47	52.10	50.53	13.80	80.00	19.90	31.00	9.53	8.00
T_2: Enriched sap of banana pseudostem @ 5000 ppm	59.20	40.27	53.20	49.40	13.40	82.00	20.40	31.67	10.07	8.53
T_3: Enriched sap of banana pseudostem @ 10000 ppm	71.60	63.73	62.00	44.60	8.67	95.00	25.10	38.40	11.87	10.47
T_4: Enriched sap of banana pseudostem @ 15000 ppm	74.80	70.20	65.20	37.53	7.00	103.00	27.20	42.93	12.73	11.20
T_5: BR @ 0.25 ppm	68.90	56.73	60.80	45.87	9.67	92.00	23.40	34.93	10.07	9.87
T_6: BR @ 0.50 ppm	72.50	65.27	62.90	42.47	8.27	97.00	25.90	39.00	10.80	10.60
T_7: BR @ 0.75 ppm	55.20	20.20	50.60	52.07	14.27	78.00	19.10	30.00	8.87	7.73
T_8: GA_3 @ 50 ppm	62.30	46.20	55.00	48.07	12.27	84.00	21.10	32.53	10.40	9.00
T_9: GA_3 @ 100 ppm	64.20	48.80	56.30	46.93	11.67	87.00	21.80	33.60	10.73	9.20
T_{10}: GA_3 @ 150 ppm	73.90	69.20	64.10	39.73	7.40	101.00	26.80	40.93	12.53	10.93
T_{11}: BA @ 50 ppm	67.40	51.80	58.40	46.33	10.53	89.00	22.30	34.73	10.87	9.47
T_{12}: BA @ 100 ppm	70.40	60.73	61.20	45.00	9.13	94.00	24.30	36.93	11.53	10.07
T_{13}: BA @ 150 ppm	73.20	65.80	63.50	41.60	7.87	99.00	26.10	40.80	12.47	10.53
S.Em. ±	3.16	2.99	3.02	2.46	0.46	5.13	1.30	2.26	0.66	0.59
C.D. at 5 %	9.23	8.73	8.80	7.19	1.34	14.98	3.79	6.58	1.93	1.73
CV %	8.18	9.70	8.87	9.40	7.73	9.79	9.64	10.86	10.46	10.64

Table 2: Effect of plant growth enhancers on yield & chemical attributes in tuberose cv. Prajwal.

Treatments	No. of spikes/ plant	No. of spikes/ha lakh)	No. of bulbs/ plant	No. of bulbs/ha (lakh)	No. of bulblets/ plant	No. of bulblets/ha (lakh)	Chlorophyll content (%)	Essential oil content (%)
T_1: Control (no spray)	1.33	1.27	1.40	1.33	4.53	4.31	0.38	0.20
T_2: Enriched sap of banana pseudostem @ 5000 ppm	1.40	1.36	1.53	1.49	5.80	5.64	0.41	0.20
T_3: Enriched sap of banana pseudostem @ 10000 ppm	2.00	2.03	2.13	2.17	9.20	9.35	0.92	0.21
T_4: Enriched sap of banana pseudostem @ 15000 ppm	2.67	2.77	2.60	2.70	11.33	11.77	1.09	0.23
T_5: BR @ 0.25 ppm	1.80	1.77	2.33	2.29	9.80	9.63	0.86	0.22
T_6: BR @ 0.50 ppm	2.20	2.21	2.13	2.14	10.00	10.06	0.97	0.22
T_7: BR @ 0.75 ppm	1.27	1.18	1.33	1.24	3.33	3.10	0.35	0.19
T_8: GA_3 @ 50 ppm	1.53	1.53	1.73	1.72	6.20	6.16	0.53	0.21
T_9: GA_3 @ 100 ppm	1.60	1.56	1.93	1.88	7.80	7.58	0.86	0.21
T_{10}: GA_3 @ 150 ppm	2.47	2.53	2.53	2.60	11.20	11.51	1.03	0.22
T_{11}: BA @ 50 ppm	1.67	1.62	2.07	2.01	8.93	8.68	0.69	0.21
T_{12}: BA @ 100 ppm	1.93	1.92	2.47	2.45	9.00	8.95	0.70	0.21
T_{13}: BA @ 150 ppm	2.40	2.41	2.53	2.55	11.00	11.06	0.98	0.22
S.Em. ±	0.11	0.10	0.15	0.14	0.32	0.31	0.04	0.008
C.D. at 5 %	0.31	0.30	0.43	0.42	0.93	0.90	0.11	NS
CV %	9.89	9.66	12.37	12.12	6.61	6.43	8.40	6.61

CONCLUSION

On the basis of the results obtained in the present investigation it may be concluded the foliar application of enriched sap of banana pseudostem @ 15,000 ppm sprayed at 60, 90 and 120 days after sprouting was found beneficial to obtained highest yield with quality flower production in tuberose cv. Prajwal.

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