Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2020; 9(6): 2139-2141
Received: 19-10-2020
Accepted: 23-11-2020

Dhanshri P Ladhi
P.G. Student, Horticulture Section, College Agriculture, Nagpur, Maharashtra India

Dr. VU Raut
Professor, Horticulture Section, College of Agriculture, Nagpur, Maharashtra India

Akshay A Thakare
P.G. Student, Horticulture Section, College Agriculture, Nagpur, Maharashtra India

Aishwarya R Ingole
P.G. Student, Horticulture Section, College Agriculture, Nagpur, Maharashtra India

Aniket L Bijewar
P.G. Student, Horticulture Section, College Agriculture, Nagpur, Maharashtra India

Corresponding Author:
Dhanshri P Ladhi
P.G. Student, Horticulture Section, College Agriculture, Nagpur, Maharashtra India

Effect of foliar spray of GA_3 and KNO_3 on growth and yield of tuberose

Dhanshri P Ladhi, Dr. VU Raut, Akshay A Thakare, Aishwarya R Ingole and Aniket L Bijewar

Abstract
A study was conducted to evaluate the effect of foliar spray GA_3 and KNO_3 on growth and yield of tuberose at horticulture section, college of Agriculture, Nagpur, Dr. PDKV, Akola, India, in 2019-2020. Randomized Block Design was used consisting fifteen treatments and three replications. Treatments were T_1 - GA_3 100 ppm, T_2 - GA_3 200 ppm, T_3 - GA_3 300 ppm, T_4 - KNO_3 1 %, T_5 - KNO_3 1.5 %, T_6 - KNO_3 2 %, T_7 - GA_3 100 ppm + KNO_3 1%, T_8 - GA_3 100 ppm + KNO_3 1.5 %, T_9 - GA_3 100 ppm + KNO_3 2%, T_{10} - GA_3 200 ppm + KNO_3 1%, T_{11} - GA_3 200 ppm + KNO_3 1.5%, T_{12} - GA_3 200 ppm + KNO_3 2%, T_{13} - GA_3 300 ppm + KNO_3 1%, T_{14} - GA_3 300 ppm + KNO_3 1.5%, T_{15} - GA_3 300 ppm + KNO_3 2%. The results of the present investigation indicated that, significantly maximum vegetative growth of tuberose in respect of plant height at 30 DAS (35.18 cm), 60 DAS (46.23 cm), 90 DAS (55.80 cm), 120 DAS (60.58 cm), number of leaves plant^{-1} at 30 DAS (33.40), 60 DAS (46.13), 90 DAS (56.80), 120 DAS (66.69), and leaf area (48.87 cm) were recorded maximum with application of (T_{11}) GA_3 200 ppm + KNO_3 1.5%. The yield parameters *viz*., spikes plant^{-1} (6.67), spikes plot^{-1} (74.67), spikes ha^{-1}, florets spike^{-1}, in tuberose were recorded maximum with the treatment of (T_{11}) GA_3 200 ppm + KNO_3 1.5% and it found minimum in (T_4) KNO_3 1.5 %.

Keywords: Foliar spray, GA_3, KNO_3, spike, ppm

Introduction
Tuberose (*Polianthes tuberosa* L.) belongs to family Amaryllidaceae is native of Mexico. In India, it is popularly known as Rajanigandha, Nishigandha, Sugandharaja, Gulchadi and Gul-e-Shahu. Tuberose is much adorned for its colour, elegance and fragrance. It is grown mainly for cut flowers, interior and table decoration, bouquet, garland, veni and gajra. Tuberose is of good source of essential oil, which are utilized in preparation of various cosmetics and perfumes.

Among the commercially grown flowers, tuberose occupies prime position in India since it is used as cut flower, loose flower as well as for its potential in perfume industry. Tuberose is cultivated in many tropical and subtropical parts of world including India.

One of the most important growth substances is GA_3 which influence the growth and promote flowering in many flowering crops. The role of GA_3 stimulate vegetative growth by cell multiplication and cell elongation in ornamental bulbous plants has received considerable attention in recent years. Gibberellins function as controllers of growth in plants. They work to start the germination of seeds, shoot growth and maturation of leaves, and affect flowering with seed germination.

Similarly, KNO_3 contains the essential plants elements like nitrogen and potassium and is ideal for hydroponics, fertigation and foliar application. KNO_3 regulate physiological processes in plants. KNO_3 contains readily available nitrate nitrogen and readily available potassium as well as it is safe. KNO_3 combats salinity, efficient for plant nutrition, for stronger and healthier plants, improves water use efficiency and save water, increases the spike yield in tuberose.

Material and Methods
The present experiment was carried out at farm of Horticulture Section, College of Agriculture, Nagpur during 2019 - 2020. Nagpur city comes under Vidarbha region of Maharashtra state. An experiment was conducted in Randomized Block Design with 3 replications and fifteen treatments of foliar application of GA_3 and KNO_3 with different concentrations alone *viz*., T_1 - GA_3 100 ppm, T_2 - GA_3 200 ppm, T_3 - GA_3 300 ppm, T_4 - KNO_3 1 %, T_5 - KNO_3 1.5 %, T_6 - KNO_3 2 %, T_7 - GA_3 100 ppm + KNO_3 1%, T_8 - GA_3 100 ppm + KNO_3 1.5 %, T_9 - GA_3 100 ppm + KNO_3 2%, T_{10} - GA_3 200 ppm + KNO_3 1%, T_{11} - GA_3 200 ppm + KNO_3 1.5%, T_{12} - GA_3 200 ppm + KNO_3 2%, T_{13} - GA_3 300 ppm + KNO_3

1%, T_{14} - GA_3 300 ppm + KNO_3 1.5%, T_{15} - GA_3 300 ppm + KNO_3 2%. FYM was applied 20 tonnes ha^{-1} was mixed at the time of last harrowing in the field prior to application of chemical fertilizers. As per the recommendation of Dr. Panjabrao Deshmukh Krishi Vidyapeeth, recommended fertilizer dose of fertilizer (NPK) 200:300:200 kg ha^{-1} was applied. The plot size was 1.8 m x 1.2 m with plant to plant spacing 30 x 30 cm. The data were statistically analysed as per method suggested by Panse and Sukhatme (1967) [8] for Randomized block design.

Results and Discussion

1 Growth Parameter

The data regarding the effect of foliar application of GA_3 and KNO_3 on flower quality of tuberose are presented in table 1. showed that, the effect of foliar spray of GA_3 and KNO_3 on Growth parameter i. e. Plant height (cm), 30 DAS, 60 DAS, 90 DAS, 120 DAS, Number of leaves $plant^{-1}$, 30 DAS, 60 DAS, 90 DAS, 120 DAS and Leaf area (cm^2) in tuberose was found significant except plant height before spraying and number of leaves before spraying.

At 30 DAS, significantly maximum plant height was recorded with treatment T_{11} i.e. GA_3 200 ppm + KNO_3 1.5% (35.18 cm) which was found to be statistically at par with treatments T_{13} i.e. GA_3 300 ppm + KNO_3 1% (33.48 cm), T_{10} i.e. GA_3 200 ppm + KNO_3 1% (33.06 cm) and T_2 i.e. GA_3 200 ppm (32.19). Whereas, treatment T_4 i.e. KNO_3 1% recorded minimum plant height (26.56 cm).

At 60 DAS, the treatment T_{11} i.e. GA_3 200 ppm + KNO_3 1.5% (46.23 cm) recorded significantly maximum plant height which was found to be statistically at par with the treatment T_{13} i.e. GA_3 300 ppm + KNO_3 1% (45.29 cm), T_{10} i.e. GA_3 200 ppm + KNO_3 1% (44.10 cm), T_2 i.e. GA_3 200 ppm (43.84 cm), T_8 i.e. GA_3 100 ppm + KNO_3 1.5% (43.08 cm), T_7 i.e. GA_3 100 ppm + KNO_3 1% (42.92 cm) and T_{12} i.e. GA_3 200 ppm + KNO_3 2% (42.19 cm). Whereas, treatment T_4 i.e. KNO_3 1% recorded minimum plant height (36.60 cm).

At 90 DAS, the treatment T_{11} i.e. GA_3 200 ppm + KNO_3 1.5% (55.80 cm) recorded significantly maximum plant height which was found to be statistically at par with treatment T_{13} i.e. GA_3 300 ppm + KNO_3 1% (55.19 cm), T_{10} i.e. GA_3 200 ppm + KNO_3 1% (54.43 cm), T_2 GA_3 200 ppm (53.84), T_8 i.e. GA_3 100 ppm + KNO_3 1.5% (53.29 cm) and T_7 i.e. GA_3 100 ppm + KNO_3 1% (52.91 cm). Whereas, treatment T_4 i.e. KNO_3 1% recorded minimum plant height (46.60 cm).

Similarly, at 120 DAS, the treatment T_{11} i.e. GA_3 200 ppm + KNO_3 1.5% (60.58 cm) recorded maximum plant height which was found to be statistically at par with the treatment T_{13} i.e. GA_3 300 ppm + KNO_3 1% (59.33 cm), T_{10} i.e. GA_3 200 ppm + KNO_3 1% (59.00 cm), T_2 i.e. GA_3 200 (58.67 cm), T_8 i.e. GA_3 100 ppm + KNO_3 1.5% (58.00 cm) and T_7 i.e. GA_3 100 ppm + KNO_3 1% (57.85 cm), Whereas, treatment T_4 i.e. KNO_3 1% recorded minimum plant height (50.68 cm).

At 30 DAS, the treatment T_{11} i.e. GA_3 200 ppm + KNO_3 1.5% (33.40 cm) recorded maximum number of leaves $plant^{-1}$ which was found to be statistically at par with the treatment T_{13} i.e. GA_3 300 ppm + KNO_3 1% (33.13 cm), T_{10} i.e. GA_3 200 ppm + KNO_3 1% (32.60 cm), T_2 i.e. GA_3 200 (32.47 cm), T_8 i.e. GA_3 100 ppm + KNO_3 1.5% (31.53 cm) and T_7 i.e. GA_3 100 ppm + KNO_3 1% (31.27 cm). Whereas, treatment T_4 i.e. KNO_3 1% recorded minimum number of leaves $plant^{-1}$ (25.87 cm).

At 60 DAS, maximum number of leaves $plant^{-1}$ was observed under the treatment T_{11} i.e. GA_3 200 ppm + KNO_3 1.5% (46.13) which was found to be at par with each other T_{13} i.e. GA_3 300 ppm + KNO_3 1% (43.13) and T_{10} i.e. GA_3 200 ppm + KNO_3 1% (45.07), T_2 (44.00), T_8 (43.93), T_7 (43.20) were found in second trend respectively. However, the minimum number of leaves was noticed under the treatment T_4 i.e. KNO_3 1% (39.00).

Similarly, at 90 DAS, significantly the maximum number of leaves $plant^{-1}$ (56.80) were recorded with the treatment T_{11} i.e. GA_3 200 ppm + KNO_3 1.5% and it was at par with the treatment T_{13} i.e. GA_3 300 ppm + KNO_3 1% (56.53), T_{10} i.e. GA_3 200 ppm + KNO_3 1% (55.40 cm), T_2 i.e. GA_3 200 (54.60 cm), T_8 i.e. GA_3 100 ppm + KNO_3 1.5% (53.60 cm) and T_7 i.e. GA_3 100 ppm + KNO_3 1% (53.07 cm). However, minimum number of leaves $plant^{-1}$ (48.67) were recorded under T_4 i.e. KNO_3 1%.

At 120 DAS, significantly the maximum number of leaves $plant^{-1}$ (66.69) were recorded with the treatment T_{11} i.e. GA_3 200 ppm + KNO_3 1.5% and it was at par with the treatment T_{13} i.e. GA_3 300 ppm + KNO_3 1% (65.99), T_{10} i.e. GA_3 200 ppm + KNO_3 1% (65.84), T_2 i.e. GA_3 200 (64.27 cm), T_8 i.e. GA_3 100 ppm + KNO_3 1.5% (63.60 cm) and T_7 i.e. GA_3 100 ppm + KNO_3 1% (63.20 cm). However, minimum number of leaves $plant^{-1}$ (58.07) were recorded under T_4 i.e. KNO_3 1%.

Maximum leaf area at 50 % flowering stage (48.87 cm^2) was noticed in the treatment T_{11} i.e. GA_3 200 ppm + KNO_3 1.5% which was found at par with the treatment T_{13} i.e. GA_3 300 ppm + KNO_3 1% (48.00 cm^2), T_{10} i.e. GA_3 200 ppm + KNO_3 % (47.92 cm^2), T_2 i.e. GA_3 200 (47.75 cm), T_8 i.e. GA_3 100 ppm + KNO_3 1.5% (45.90 cm^2), T_7 i.e. GA_3 100 ppm + KNO_3 1% (45.73 cm^2) and T_{12} i.e. GA_3 200 ppm + KNO_3 2% (45.28 cm^2).

This might to be due to the fact that, an application of gibberellic acid at different concentrations might have increased the plant height, number of leaves and leaf area by increasing internodal length and the growth stimulation due to GA_3 is attributed to both cell division and cell enlargement. And KNO_3 is supplementary source of nitrogen and potassium. Significantly, increase in plant height due to nitrogen involved in various metabolic processes of plant and potassium increases protein synthesis in the plants.

Devadanam *et al*. (2007) [2] observed that, the plant height was although found increased in all the GA_3 treatment (50, 100 and 150 ppm), but maximum height of plant (59.13 cm) was recorded under the treatment of foliar application of GA_3 at 150 ppm in tuberose cv. Single. Khan *et al.* (2004) [7] observed that, addition of nitrogen and potassium increased the plant height and number of suckers in petunia. The optimum dose was found to be 30 g per m2 of nitrogen and 20 g m^2 of potassium.

2. Yield Parameter

The data regarding the effect of foliar application of GA_3 and KNO_3 on flower quality of tuberose are presented in table 1. showed that, the effect of foliar spray of GA_3 and KNO_3 on Growth parameter i. e. spike $plant^{-1}$, spike $plot^{-1}$ spike ha^{-1} spike $plant^{-1}$ in tuberose was found significant. Significantly maximum number of spike $plant^{-1}$ was noticed in the treatment T_{11} i.e. GA_3 200 ppm + KNO_3 1.5% (6.67) which was found at par with the treatment T_{13} i.e. GA_3 300 ppm + KNO_3 1% (6.33), T_{10} i.e. GA_3 200 ppm + KNO_3 1% (6.00) and T_2 i.e. GA_3 200 ppm (5.67). Whereas, minimum number of spike $plant^{-1}$ was recorded in T_4 i.e. KNO_3 1% (2.00).

The same pattern like spike $plant^{-1}$ was observed in spike $plot^{-1}$ respect of maximum number of spike $plot^{-1}$ Significantly maximum number of spike $plot^{-1}$ was noticed in the treatment T_{11} i.e. GA_3 200 ppm + KNO_3 1.5% (74.67) which was found

at par with the treatment T_{13} i.e. GA_3 300 ppm + KNO_3 1% (71.33) and T_{10} i.e. GA_3 200 ppm + KNO_3 1% (68.00) Whereas, minimum number of spike plot^{-1} was recorded in T_4 i.e. KNO_3 1% (35.83). The maximum number of spike hectare^{-1} was also noticed in the treatment T_{11} i.e. GA_3 200 ppm + KNO_3 1.5% (7.11) which was found at par with the treatment T_{13} i.e. GA_3 300 ppm + KNO_3 1% (7.00), T_{10} i.e. GA_3 200 ppm + KNO_3 1% (6.67) and T_2 i.e. GA_3 200 ppm (6.33). Whereas, minimum number of spike hectare^{-1} was recorded in T_4 i.e. KNO_3 1% (3.07). Maximum florets spike^{-1} was observed under the treatment T_{11} i.e. GA_3 200 ppm + KNO_3 1.5% (28.33), T_{13} i.e. GA_3 300 ppm + KNO_3 1% (27.67) and T_{10} i.e. GA_3 200 ppm + KNO_3 1% (27.00) which were found at par with each other. The treatments T_2 (25.67), T_8 (25.33), T_7 (25.00) were found in second trend respectively. However, the minimum florets spike^{-1} was noticed under the treatment T_4 i.e. KNO_3 1% (18.67).

Significantly maximum number of bulbs plant^{-1} was noticed in the treatment T_{11} i.e. GA_3 200 ppm + KNO_3 1.5% (6.59) which was found at par with the treatment T_{13} i.e. GA_3 300 ppm + KNO_3 1% (6.00) and T_{10} i.e. GA_3 200 ppm + KNO_3 1% (5.85). whereas, minimum number of bulbs plant^{-1} was recorded in T_4 i.e. KNO_3 1% (2.89).

The result revealed that, GA_3 resulted in increase in spike yield due to cell multiplication and cell elongation characters. Also, additional KNO_3 provided significant enhancement in all three parameters. The number of flower per spike increased significantly with the application of GA_3 and KNO_3. Mahajan *et al.* (2012) [3] observed that, number of floret spike^{-1} (38.00), length of spike (112.86cm) length of rachis (34.46), diameter of spike (0.946 cm), length of fully open floret (6.71) and diameter of floret (3.92) were found maximum in application of GA_3 200 ppm and KNO_3 1.5%.

Table 1: Effect of foliar spray GA_3 and KNO_3 on growth and yield of tuberose

Tr. No.	Treatments	Plant height (cm)					Number of leaves plant^{-1}					Leaf area	Spike plant^{-1}	Spike plot^{-1}	Spike ha^{-1}(lakh)	Spike plant^{-1}
		Before spraying	30 DAS	60 DAS	90 DAS	120 DAS	Before spraying	30 DAS	60 DAS	90 DAS	120 DAS					
T_1	GA_3 100 ppm	14.76	29.59	40.00	50.04	56.00	13.33	29.13	41.93	51.00	61.67	44.00	4.00	53.33	5.23	22.67
T_2	GA_3 100 ppm	15.69	32.19	43.84	53.84	58.67	15.07	32.47	44.00	54.60	64.27	47.25	5.67	65.68	6.23	25.67
T_3	GA_3 100 ppm	14.19	28.48	38.04	48.00	53.19	12.40	27.33	40.47	49.93	59.26	42.27	3.00	46.41	5.04	20.67
T_4	KNO_3 1%	13.63	26.54	36.60	46.60	50.68	12.40	25.87	39.00	48.67	58.07	42.00	2.00	35.83	3.07	18.67
T_5	KNO_3 1%	13.79	28.00	37.85	47.85	52.76	11.73	26.80	40.20	49.80	59.00	42.20	2.67	40.79	4.67	20.00
T_6	KNO_3 1%	13.63	27.69	37.67	47.68	51.81	12.40	26.53	40.00	48.93	58.87	42.17	2.33	37.67	4.00	19.00
T_7	GA_3 100ppm + KNO_3 1%	15.42	31.00	42.92	52.81	57.85	14.60	31.27	43.40	53.07	63.20	45.73	4.67	61.77	6.00	25.00
T_8	GA_3 100ppm + KNO_3 1%	15.43	31.12	43.08	53.29	58.00	15.07	31.53	43.93	53.60	63.60	45.90	5.33	62.33	6.20	25.33
T_9	GA_3 100ppm + KNO_3 1%	15.23	30.08	41.23	51.25	56.00	13.80	29.67	42.47	52.67	62.00	44.08	4.33	55.60	5.50	22.67
T_{10}	GA_3 100ppm + KNO_3 1%	16.04	33.06	44.10	54.43	59.00	16.00	32.60	45.07	55.40	65.84	47.92	6.00	68.00	6.67	27.00
T_{11}	GA_3 100ppm + KNO_3 1%	15.69	35.18	46.23	55.80	60.58	16.30	33.40	46.13	56.80	66.69	48.87	6.67	74.67	7.11	28.33
T_{12}	GA_3 100ppm + KNO_3 1%	15.23	30.40	42.19	51.62	57.20	15.07	30.13	43.13	52.73	62.47	45.28	4.33	57.18	5.67	24.00
T_{13}	GA_3 100ppm + KNO_3 1%	16.10	33.48	45.29	55.19	59.33	16.00	33.13	45.27	56.53	65.99	48.00	6.33	71.33	7.00	27.67
T_{14}	GA_3 100ppm + KNO_3 1%	14.82	29.48	39.30	49.30	55.93	12.33	28.67	41.67	50.47	60.73	43.18	3.67	51.67	5.05	21.67
T_{15}	GA_3 100ppm + KNO_3 1%	14.76	29.36	38.99	48.92	54.09	12.33	28.00	41.13	50.00	60.40	43.17	3.33	48.37	4.67	21.00
	SE (m)±	0.69	1.05	1.40	1.42	1.31	1.25	1.51	1.27	1.30	1.36	1.37	0.54	2.32	0.56	1.59
	CD at 5%	-	3.05	3.05	4.12	3.79	-	4.36	3.68	3.77	3.95	3.97	1.57	6.71	1.61	4.60

Reference

1. Amin MR, Pervin N, Nusrat A, Mehraj H, Jamal Uddin AFM. Effect of plant growth regulators on growth and flowering of tuberose (*Poilanthes tuberosa* L.) cv. Single. J Biosci. Agric. Res 2017;12(1):1016-1020.
2. Devadanam A, Shinde BN, Sable PB, Vedpathale SG. Effect of foliar spray of plant growth regulators on flowering and vase life of tuberose (*Polianthes tuberosa* L.). J Soils Crops 2007;17(1):86-88.
3. Mahajan YA, Khiratkar SD, Chopde NK, Gawali RP, Ghule PS. Influence of foliar application of GA_3 and KNO_3 on flower yield and quality of tuberose. J Soils and Crops 2012;22(1):212-215.
4. Memon SA, Baloch AR, Baloch MA, Keerio MI. Presoaking treatment and foliar application of KNO_3 on growth and flower production of gladiolus. Int. J Agric. Technology 2013;9(5):1347-1366.
5. Nagmani T, Panchbhai DM, Reshma VS. Effect of chemicals and yield of gladilous cv. American Beauty. Int. J Pure App. Biosci 2017;5(6):437-442.
6. Padmalatha T, Reddy GS, Chandrashekar R, Shankar AS, Chaturvedi A. Effect of pre-planting soaking of corms with chemicals and plant growth regulators on dormancy breaking and corms and cormels production in gladiolus. Int. J Plant Animal Env. Sci 2013;3(1):28-33.
7. Khan RU, Khan IT, Khan FS, Jhon AQ. Growth and seed yield of petunia hybrid as influenced by different levels of nitrogen, phosphorus and potassium. J Orna Hort 2004;7(1):575-579.
8. Panse SK, Sukhatme PV. Statistical methods for Agricultural Research, New delhi, 3rd edition 1967, 341.
9. Singh P, Desai JR. Growth and flowering response to GA_3 and CCC concentration in tuberose cv. Single. Int. J Agric. and Medicinal Plants Res 2013;1(3):1-5.