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Effect of GA_3 and salicylic acid on flowering and quality of Static

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Abstract
A field experiment was conducted to study "Effect of GA_3 and salicylic acid on flowering and quality of static" at Horticulture section, College of Agriculture, Nagpur during rabi, 2022-23. The experiment was laid out in Randomized Block Design with three replications and seven treatments. Treatments comprised of GA_3 50 ppm, GA_3 100 ppm, GA_3 150 ppm, three levels of salicylic acid *viz*., salicylic acid 50 ppm, salicylic acid 100 ppm salicylic acid 150 ppm and control i.e. water spray. The treatments were imposed as foliar sprays twice at 30 and 45 days after transplanting. The results revealed that an application of 150 ppm GA_3 recorded significantly minimum days to first flower spike initiation (72.55 days), days to opening of cymes from spike initiation (16.26 days), days to 50 per cent flowering (93 days) and days to first harvesting of flower spike (120.67 days) in static. As regards the quality parameters maximum length of spike (52.41 cm), thickness of spike (0.73 cm) and number of cymes spike^{-1} (140.98) was found significantly maximum with the treatment of foliar application of GA_3 150 ppm whereas an application of salicylic acid 150 ppm recorded maximum longevity of flower (15.24 days) and vase life (16.28 days) in statice.

Keywords: Statice, flowering, quality, gibberellic acid, salicylic acid, cyme

Introduction
Statice is a best annual cut flower crop which is also highly suitable for filllers and dry flowers. Branches of statice are essentially used as filler material in bouquets, corsages, baskets and in other flower arrangements. It belongs to the family Plumbaginaceae and it was originated from Eastern mediterranian region. It is known for its papery flowers that can be used in dried arrangements. It is cultivated worldwide for its brightly colored, flat flower clusters and its everlasting calyx (the green leaf that encloses the flower bud), the tiny funnel shaped statice flowers have a delicate, airy, hazy appearance, almost like smoke, that are used in dried and fresh flower arrangements. Statice flowers appear in panicles of clustered spikelets a top distinctively winged, nearly leafless stems rising to 18" tall from basal rosettes of lyrate-pinnatifid wavy-margined leaves (to 4-6" long). Flower corollas are white and showy calyces are violet-blue (seed strains come in varying shades of violet, lavender, purple, pink, rose, orange, yellow and white). Calyces remain long after the corollas have disappeared. The growth regulators are used in plants to induce the earliness, increasing duration of flowering, etc. Among the management practices, plant growth regulators are important approaches affecting the quality and quantity of flower production of any species. Therefore, suitable plant growth regulator and its concentration would be vital role to ensure the best economic return. Gibberellic acid is familiar for its role in increasing reproductive growth, cell elongation, seed germination, flowering, sex expression, elimination of dormancy, reproductive growth and senescence (Rodrigues *et al*., 2011) [10]. Salicylic acid, a plant hormone plays an important role in induction of plant defense against a variety of biotic and abiotic stresses through morphological, physiological and biochemical mechanisms. The work on the response of foliar application of gibberellic acid and salicylic acid on *Limonium* is very meagre, thus, this experiment was taken under study

Materials and Methods
The experiment was successfully conducted at PG Research Farm of Horticulture Section, College of Agriculture, Nagpur during Rabi season 2022-23. The experiment was laid out in Randomized Block Design with three Replications Treatments comprised of GA_3 50 ppm, GA_3 100 ppm, GA_3 150 ppm, three levels of salicylic acid *viz*., salicylic acid 50 ppm, salicylic acid 100 ppm salicylic acid 150 ppm and control i.e. water spray.

The treatments were imposed as foliar sprays twice at 30 and 45 days after transplanting. The seedlings have raised in protrays of 60 cells in polyhouse and after 30 days healthy & uniform seedlings were selected for transplanting. During field preparation FYM @ 10 t/ha was mixed at last harrowingand raised bed layout of dimension of 1.80 m. x 1.50 m. was prepared. Seedlings were transplanted at spacing of 30 x30 cm spacing. A recommended dose of NPK is 100:50:50 kg /ha for statice. According to that inorganic fertilizer application was given through urea @ 21.7 g/m^2, SSP 31.25 g/m^2 and MOP 8.35 g/m^2 respectively at the time of transplanting. Standard cultural practices were followed during the entire crop period. Harvesting was done when 80 per cent cymes got completely open for fresh cut flower purpose.

Observations were recorded for flowering and quality parameters and analysed statistically as per the procedure described by Panse and Sukhatme (1967) [5].

Results and Discussions

Flowering parameters

The data recorded on different flowering parameters are presented in Table 1 and observed that there was a significant enhancement recorded in flowering parameter with the application of GA_3 and salicylic acid as compared to control. The data on flowering parameters showed that earlier spike initiation (72.55 days), minimum days to opening of cymes from spike initiation (16.26 days), minimum number of days to 50 per cent flowering (93 days), minimum days to first harvesting (120.67 days) and maximum yield of flower spike ha^{-1} were recorded with the application of GA_3 150 ppm as compared to control in statice var. Pacific mixed followed by GA_3 100 ppm. However significantly maximum days required for spike initiation (81.40 days), maximum days to opening of cymes from spike initiation (19.67 days), maximum number of days to 50 per cent flowering (110.33 days) and maximum days to first harvesting (146.33 days) with the treatment control (water spray).

Earliness in flowering by GA_3 treatment might be due to increase in indigenous level of gibberellic acid that increase photosynthesis area and respiration which enhance CO_2 fixation and increase N ratio in plant that associate with early flowering (Patil, 2001) [8] thus GA_3 is quite effective for reducing juvenile period for plant for early flowering (Singh and Barad, 2002) [11]. The early floret opening in GA_3 treated plant can be attributed to rise in indigenous GA_3 level and it might also be due to increase in efficiency of GA_3 treated plants with respect to synthesis of metabolites. Similar results were reported by Garner *et al.* (1996) [2] in *Limonium* x Misty blue, Patel *et al.* (2010) [6] in chrysanthemum and Vijaykumar *et al.* (2017) [13] in China aster.

Table 1: Effect of GA3 and Salicylic acid on flowering and yield of statics

Treatments	Days to first flower spike initiation (days)	Days to opening of cymes from spike initiation (days)	Days to 50% flowering (days)	Days to 1st harvesting (days)	Number of spikes ha^{-1} (lakh)
T_1 -GA_3 50ppm	77.87	18.03	96.00	127.33	6.80
T_2 - GA_3 100 ppm	75.43	17.00	94.37	124.33	7.56
T_3 -GA_3 150ppm	72.55	16.26	93.00	120.67	8.17
T_4 - Salicylic acid 50 ppm	80.63	18.99	109.00	142.00	6.49
T_5- Salicylic acid 100 ppm	79.53	18.70	107.00	140.33	6.74
T_6 - Salicylic acid 150 ppm	79.01	18.36	102.67	131.33	7.08
T_7 - Control (Water spray)	81.40	19.67	110.33	146.33	6.37
'F' Test	Sig.	Sig.	Sig.	Sig.	Sig
SE (m) ±	0.43	0.31	0.80	1.12	0.10
CD at 5%	1.31	0.94	2.47	3.46	0.30

Quality parameters

The data from Table 2 recorded on quality parameters was found significant effect with GA_3 and salicylic acid as compared to control. Significantly maximum length of spike (52.41 cm), thickness of spike (0.73 cm) and number of cyme spike^{-1} (140.98) were recorded with the application of $GA_3$150 ppm whereas maximum longevity (15.24 days) and vase life (16.28 days) of flower were recorded in the treatment of foliar application of salicylic acid 150 ppm as compared to control.

The length of spike was increased because of application of GA_3 might increase the auxin content in tissue as it was involved in auxin synthesis and greater amount of carbohydrate by accumulation which increase metabolic activities. This was noted by Tyagi and Singh in tuberose in 2006 [12]. The increase in thickness of spike is might bedue to decrease in photosynthesis of flower as a consequence of intensification of sink increase in thickness of flower spike by Patel *et al.* 2018 [7] in *Limonium*. Similar results observed by Maheshwari *et al.* (2019) [3] in tuberose.

Longevity and vase life of flower was increased because of the growth promoting properties of salicylic acid which could be related to change in hormonal status improves the sugar translocation in plants which could accumulate more resources and exert turgor pressure for cell division and elongation. Increased turgidity and resource accumulation in turn improve the flower longevity and vase life. Similar observations were reported by Nisar*et al.* (2018) [4] in petunia hybrid Vilm. Salicylic acid maintains higher protein, sugar content and reducing lipid peroxidase activity during the process of flower senescence. Salicylic acid also inhibited climacteric ethylene synthesis which leads to prolong vase life. Similar results were reported by Anwar *et al.* (2014) [1] in tuberose.

Table 2: Quality parameters as influenced by GA_3 and salicylic acid in statice var. Pacific mixed

Treatments	Length of spike (cm)	Number of cymes spike^{-1}	Thickness of spike (cm)	Longevity of flower (days)	Vase life (days)
T_1 -GA_3 50ppm	42.02	92.94	0.63	10.30	11.50
T_2 - GA_3 100 ppm	47.03	119.46	0.69	12.28	12.37
T_3 -GA_3 150ppm	52.41	140.98	0.73	14.85	14.22
T_4 - Salicylic acid 50 ppm	41.27	89.67	0.57	9.91	11.29
T_5- Salicylic acid 100 ppm	44.11	106.33	0.65	13.11	15.41
T_6 - Salicylic acid 150 ppm	47.73	113.23	0.67	15.24	16.28
T_7 - Control (Water spray)	38.88	79.56	0.51	9.73	10.84
'F' test	Sig.	Sig	Sig	Sig	Sig
SE (m) ±	0.59	1.65	0.02	0.34	0.45
CD at 5%	1.82	5.08	0.05	1.06	1.39

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