The Pharma Innovation Journal 2018; 7(6): 470-473

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.03
TPI 2018; 7(6): 470-473

www.thepharmajournal.com
Received: 11-04-2018
Accepted: 12-05-2018

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Effect of pre harvest sprays of hormones on spike quality and vase life of *Asiatic lilium* cv. tresor

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Abstract
This experiment was conducted at Model Floriculture Centre, G. B. Pant University of Agriculture and Technology, Pantnagar (India) in the year 2016. This experiment was laid out in completely randomized block design with nine treatments and three replications. Pre harvest foliar spray was used with two different concentrations of each harmones, Benzyl Adenine (50 µM/L and 100 µM/L), salicylic acid (50 µM/L and 100 µM/L), NAA (10 ppm/L and 20 ppm /L), GA_3 (250 ppm/L and 500 ppm/L) with one control. Results revealed that treating Salicylic Acid @ 100 µM showed significant increase in the length of basal (10.22 cm) and upper bud (8.37 cm), diameter of basal (5.81 cm) and upper bud (4.65 cm), spike weight (113.89 g), diameter of basal (19.93 cm) and upper flower (16.91 cm), vase life (16.00 days) and water uptake (143.90 ml).

Keywords: Pre harvest, foliar, hormones, benzyl adenine, salicylic acid

Introduction
Lilies are great economic important bulbous flowering plant that belongs to the genus *lilium*. Lilies are used as cut flower, pot plant and plant material used for garden landscaping. As a cut flower, the lily is now the fourth most important crop in the world. In India it is used as cut flower and pot plant. In India lilies are grown in the temperate regions of the northern hemisphere like as Himachal Pradesh, hilly region of Uttarakhand, Jammu and Kashmir and northern- east region. Now-a-day's Asiatic *lilium* and *Oriental lilium* are grown under protected conditions in plains region of India Uttar Pradesh, Punjab. Lilies are an export flower crop along with rose, chrysanthemum, carnation, and tulip in Korea, USA. Maintaining the freshness, post-harvest quality of cut lilies is very important to the increase export (Bose and Yadav, 2002 and Bose, 2003) [5, 4].

At global scale and local market increased the demand of cut flowers. So, we have needed to maintain postharvest quality as long as possible, both during the market chain and at the consumer's (Rabiza-Świde *et al*., 2015) [20]. Lilium have post-harvest problems like as tepal wilting, change in sepals colour and sometimes abscission is the common symptoms. These problems are limiting factor of short length of vase life of cut lilies (Van and Han 2011) [25]. Another major problem is early leaf yellowing (Han, 1997 and 2001) [10, 11].

In floriculture industry has 10-30 per cent loss due to unawareness of post-harvest management in cut flowers. The major problem of the floriculture industry in particular is the postharvest loss, because flowers are highly perishable and short vase life, once harvested from plant, they are deprived of their natural sources (Sheela, 2008) [23] Hence the crops are being alive for a certain period but they are liable to deterioration and loss. It is clear that unless they are preserved the ultimate fate of such produce is senescence and/or death. Harmones are delay the senescence (Sui *et al*., 2015) [24] and increase the cell permeability of petals enhance water uptake, increase fresh weight, number of florets. However it is possible to extend the postharvest life of flowers by spray of different hormones.

Materials and methods
The present investigation was carried out at Modern Floriculture Centre of the University G.B. Pant University of Agriculture and Technology; Pantnagar located at 29°N latitude, 79.3°E longitude in the Tarai belt of Himalayas. The crop was raised under shade net house with uniform standard cultural practices. The sprays of different harmones were done after bud initiation stage. Two foliar sprays were done three and two week before the spike harvesting and the bud length 8-10 cm with basal buds unopened but show color develop.

The pre harvest foliar sprays of hormones having two different concentration of each harmones with one control. They are Control (T_1), Benzyl Adenine @ 50 µM (T_2), Benzyl Adenine @ 100 µM (T_3), salicylic acid @ 50 µM/L (T_4), salicylic acid @ 100 µM/L (T_5), NAA @ 10 ppm/L (T_6), NAA @ 20 ppm/L (T_7), GA_3 @ 250 ppm/L (T_8) and GA_3 @ 500 ppm/L (T_9). The experiment was laid out in completely randomized block design with three replications. Observations like length of basal and upper bud, diameter of basal and upper bud, diameter of basal and upper flower, vase life and water uptake were recorded and data analyzed statistically.

Results

The data pertaining to the effect of pre harvest foliar sprays significantly influenced the spike quality and vase life and the data are present in Table 1 and Table 2. The results of investigation revealed that plant height (cm), number of leaves per plant, stem diameter (cm) and number of bud per plant were found non- significant but the spike parameters *viz.*, diameter of upper bud (cm), length of upper bud (cm), diameter of basal bud (cm), length of basal bud (cm), weight of spike (g), diameter of upper flower (cm), diameter of basal flower (cm), vase life (days) and water uptake (ml) were found to be significant.

It is evident from table 1 and table 2 the maximum diameter of upper bud (4.65 cm), diameter of basal bud (5.81 cm), length of upper bud (8.37 cm) and length of basal bud (10.22 cm) were recorded under the treatment salicylic acid @100µM/L. The least diameter of upper bud (4.15 cm), diameter of basal bud (4.95 cm), length of upper bud (7.73 cm) and length of basal bud (9.60 cm) were recorded in control. The maximum diameter of basal bud was observed under the treatment salicylic acid@100µM/L (19.34 cm) followed by GA_3 @ 500 ppm(19.50cm), NAA @10ppm (19.16 cm), NAA @20ppm (19.03 cm) and salicylic acid @50µM/L (19.00cm).The maximum vase life 16 days was observed under the treatment salicylic acid@100µM/L followed by salicylic acid @50µM/L (14.33 days), NAA @10 ppm (13.16 days) and Benzyl Adenine @100µM (13 days). However, the minimum vase life of spike was found under control (9 days). The maximum water uptake was observed under the treatment salicylic acid@100µM/L (143.90 ml) the minimum water uptake was recorded under control (120.00 ml).

Table 1: Effect of pre harvest sprays on vegetative characters of Asiatic *lilium* cv. Tresor

Treatments	Plant height (cm)	Number of leaves per plant	Stem diameter (cm)	Plant spreading (cm)	Number of bud per plant	Diameter of upper bud (cm)	Length of upper bud (cm)
Control	117.66	75.16	10.16	33.00	5.16	4.157	7.733
Benzyl Adenine @ 50 µM	120.50	80.50	10.64	33.66	5.00	4.240	7.983
Benzyl Adenine @ 100 µM	110.83	81.00	11.63	34.00	4.50	4.130	8.060
salicylic acid @ 50 µM/L	114.66	78.83	10.75	32.66	5.33	4.367	7.863
salicylic acid @ 100 µM/L	113.16	81.00	11.41	32.50	4.50	4.650	8.370
NAA @ 10 ppm	119.50	82.83	11.85	33.50	4.66	4.138	7.943
NAA @ 20 ppm	119.16	82.83	11.19	32.66	5.33	4.333	8.230
GA_3 @ 250 ppm	118.83	81.83	11.86	33.00	4.55	4.215	7.900
GA_3 @ 500 ppm	118.80	80.77	11.49	33.33	5.0 0	4.258	8.347
F-test	NS	NS	NS	NS	NS	S	S
S. Ed. (±)	2.47	5.00	0.45	1.71	0.91	0.095	0.368
C.D (P = 0.05)	7.36	1.68	1.33	2.12	0.30	0.032	0.123

Table 2: Effect of pre harvest sprays on vegetative and flowering characters of Asiatic *lilium* cv. Tresor

Treatments	Diameter of basal bud (cm)	Length of basal bud (cm)	Diameter of upper flower (cm)	Diameter of basal flower (cm)	Vase life (days)	Water uptake (ml)
Control	4.953	9.607	15.010	18.330	9.000	120.000
Benzyl Adenine @ 50 µM	5.290	9.783	16.000	18.167	11.167	125.000
Benzyl Adenine @ 100 µM	5.263	9.793	15.774	18.777	13.000	123.992
salicylic acid @ 50 µM/L	5.467	10.133	16.819	19.000	14.333	130.553
salicylic acid @ 100 µM/L	5.810	10.223	16.910	19.934	16.000	143.905
NAA @ 10 ppm	5.070	10.053	16.030	19.167	13.167	120.500
NAA @ 20 ppm	5.403	10.070	16.450	19.033	10.167	130.500
GA_3 @ 250 ppm	5.077	10.097	16.780	19.000	11.277	123.000
GA_3 @ 500 ppm	5.470	10.173	16.690	19.500	10.333	131.667
F-test	S	S	S	S	S	S
S. Ed. (±)	0.080	0.072	0.568	0.935	0.701	5.124
C.D (P = 0.05)	0.027	0.024	0.190	0.312	0.234	1.711

Discussion

Membrane deterioration is an early and characteristic feature of petal irreversible senescence of cut flowers. Increased lipid peroxidation, mediated and sustained by phospholipid-degrading enzymes, such as phospholipase D (PLD) and lipoxygenase (LOX), results in a loss of membrane integrity, which has been noted in the senescing petal tissues (Brown *et al*., 1990) [6]. Reezi *et al*. (2009) [22] reported that flower senescence is accompanied with increased permeability of petal cells and increased ROS production. ACC oxidase activity and SOD activity on vase solution between cut flowers were main cause of differences in vase life. Salicylic acid is an ethylene biosynthesis inhibitor that blocks the induction effect of ethylene on AC Coxidase activity inhibition reduced the senescence of the flowers and consequently, the advance in increase vase life. Mei-hua *et al*. (2008) [15] and Yuping *et al*. (2009) [26] reported that treatment with salicylic acid significantly extends the vase life. Kazemi

et al., 2011 [12] reported that decrease the membrane senescence in cut carnation. Ataii *et al.* (2015) [3] concluded that exogenous SA supply could maintain membrane integrity by increasing antioxidant system activity, thereby retarding the senescence of cut lisianthus flower during vase life. Zamani *et al*. (2011a) [27] reposrted that salicylic acid increased cut flower water absorption, fresh weight and vase life, while descreased the MDA content, ACCoxidase activity and membrane premeability together with total delay of senescence and peroxidation of lipids. According to MacKay *et al.* (2000) [13] addition of low level of salicylic acid delayed senescence. Peng *et al*. (2007) [19] reported that application of salicylic acid prolongs the vase life of cut flower lilies by reducing respiration rate. Salicylic acid inhibited climacteric ethylene synthesis in cut carnation and significantly delayed senescence (Anwar *et al*., 2014) [2]. Salicylic acid increased the vase life of Gerbera and Gladiolus (Dumitras *et al*., 2002) [7], tuberose (Anwar *et al*., 2014) [2]. Alaey *et al*. (2011) [1] reported that the SA is able to increase the vase life of cut rose flowers and delay senescence by regulating the plant water and increasing the scavenging capacity of cells. SA delayed gladiolus and rose cut flower senescence (Ezhilmathi *et al*., 2007; Alaey *et al*., 2011) [8, 1]. Ramtin *et al*., 2015 [21] revealed that applying of salicylic acid increased vase life cut carnations and increased total length of plants. Padmapriya and Chezhiyan, (2002) [18] reported that at high concentration of salicylic acid has greater flower diameter as compared to control. Mortazavi *et al*. (2015) [16] reported that pre-harvest treatment of flowers with 600 mg/L calcium chloride increased florets' diameter, relative water content, chlorophyll *b* content and shelf life of lilium. According to Anwar *et al*., (2014) [2] Salicylic acid has positive effect on photosynthesis in leaves and carbohydrate in leaves and stem due to this reason flower size increased. The increase in flower diameter could be due to the synergism between SA and auxins. SA might have altered the biophysical properties of cell wall. Revealed effect of different levels of salicylic acid on vase life of cut Lisianthus (*Eustoma grandiflora*) and reported that 100 mg l^{-1} of Salicylic Acid improved vase life. SA treatment showed the best effect on the fresh weight (%), water uptake (cm^3) and vase life of cut flowers (Marandi *et al*., 2011) [14]. Zamani *et al*. (2011b) [28] suggest that Salicylic acid and glutamin increases vase life by affecting many of the age-related changes associated with Rose petal senescence.

Conclusion

Conclusively, it might state that the maximum length of basal (10.22 cm), diameter of basal bud (5.81 cm), length of upper bud (8.37 cm), diameter of upper bud (4.65 cm), diameter of basal flower (19.93 cm) and diameter of upper flower (16.91 cm), vase life (16.00 days) and water uptake was (143.90 ml) were found pre harvest spray of salicylic acid @100µM/L as compare to control on Asiatic lilium cv. Tresor.

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