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Effect of pre-harvest foliar spray of plant growth regulators, vermiwash and cow urine on the vase life of gladiolus flower

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Abstract
A study was conducted at the Department of Horticulture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) in two consecutive seasons (February, 2012 and 2013) to find out the effect of the pre harvest foliar application of gibberellic acid (100, 200 and 300 ppm), salicylic acid (100, 200 and 300 ppm), cow urine and vermiwash each at 5% and 10% on the vase life of gladiolus cv. Candyman with randomized block design in factorial arrangements including twenty eight treatment combination and a single control (water spray). Results showed that SA @ 100 ppm was recorded to be an outstanding treatment in improving post harvest floral attributes *i.e.* largest basal floret (10.60cm) and maximum shelf life of basal floret (5.04 days) and maximum vase life of cult spikes (10.88 days).The maximum floret opening (89.86% (1.276) was noted under GA_3 200 ppm and recorded comparable to SA 200 ppm. Cow urine and vermiwash at both the levels also exhibited significant improvement in different post harvest parameters *i.e.* % opened flower in vase, diameter of basal floret, shelf life and vase life of cut spikes as compared to control however, no significant differences noted between both levels of them.

Keywords: gladiolus, vase life, cow urine, vermiwash, gibberellic acid, salicylic acid

Introduction
Gladiolus (*Gladiolus sp.*) is an important cut flower grown in many countries of the world including India. It has a great economic value and wide market in the country. The cut flowers of gladiolus are highly perishable due to high respiration rate and excessive weight loss. Enhancement of vase life of gladiolus cut flower is an important area in horticultural research.
The post-harvest quality and longevity of cut flowers is dependent on several pre and post harvest factors (Bhattacharjee and De, 2001) [1]. Senescence of cut flowers mainly depends on hormonal control and related to the changes in carbohydrate status of the petal (Mayak *et al.* 1972). Physiological parameters viz. daily elongation, days to elongation of cut-spike, length & diameter of floret, water uptake and loss, quality parameters of spike showed increased response with pre-soaking and foliar spray of GA_3 in gladiolus (Kumar and Gupta, 2014). GA_3 has also been reported to delay wilting and senescence associated proteolysis (Eason, 2002) [3], improving quality of spikes and flowers (Misra *et al.*, 1997) [12] and increasing the self and vase life of inflorescence (Mahesh and Misra, 1993) [9]. Salicylic acid helpful in delaying flower senescence, leakage of ion in petals (Hatamzadeh *et al.*, 2012) [5]; act as inhibitor of ethylene forming enzyme (Leslie and Romani, 1988) [8] and effective in extending vase life of cut gladiolus (Ezhilmathi *et al.* 2007) [4].

Reports indicated that vermiwash and cow urine contains N, P, K, Ca and hormones (auxin, cytokinine and some other secretions) which are helpful in plant growth and development. (Rai and Bansiwal, 2008; Kamalam Joseph and Rajappan Nair, 1989; Munoz, 1988) [18, 7, 13]. Extension of shelf life of the cut spikes can help the flower industry and also for home consumers. Keeping in view the above mentioned role of synthetic and bio-growth substances, present investigation was carried out to investigate the appropriate concentration and combination of these growth substances for better growth, flowering and post harvest management in gladiolus under Chhattisgarh conditions.

Materials and Methods

A study was conducted at the Department of Horticulture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) in two consecutive seasons, February, 2012 and 2013. The corms were dipped for 24 hours and two foliar sprays (at three and six leaves stage) were applied as pre-harvest application of gibberellic acid (GA_3) and salicylic acid (SA) each at100,200 and 300 ppm, cow urine and vermiwash each at 5 % and 10 % in twenty eight different treatments combinations and a single control (water spray) to study their effect on the quality and vase life of cut *Gladiolus* cv 'Candyman'. All recommended cultural practices were followed to get a healthy crop. Gladiolus cv. Candyman spikes (two or three basal floret started opening) were selected and harvested at the morning hours with sharp knife to avoid any mechanical injury and kept immediately in the bouquet containing cool water to avoid transpiration loss. These spikes were re-cut to 80 cm of lengths before placing into 250 ml glass bottles containing 200 ml of vase solution supplemented with 4% sucrose and each treatment was replicated three times. The mouth of glass bottles were kept open. Minimum and maximum temperatures in the laboratory room were remained between 20ºC to 30ºC during the experimental period. The experiment was done strictly in ambient condition with keeping in mind the house condition. Data were recorded on percentage of floret opening, days taken to deterioration, number of florets opened at time, shelf life of basal florets and vase life (days). Recorded data were statistically analyzed and mean comparison was carried out as suggested by Steel and Torrie (1980).

Results and Discussion

Effect of Plant Growth Regulators

The effect of plant growth regulators on post harvest quality and vase life of cut spikes of gladiolus cv. Candyman showed that different levels of gibberellic acid and salicylic acid effectively improved the post-harvest quality and life of cut spike over control (water spray). The floret opening was influenced by all the plant growth regulators treatments over control, but significant differences was notice with 100, 200 and 300 ppm of GA_3 and 100 and 200 ppm of SA. The maximum opened flower in a spike (89.86 % (1.276)) was observed under 200 ppm of GA_3 with 33.81 % more opened florets than control, followed by SA @ 100 ppm while minimum was recorded in control (66.43 % (0.954)). The higher floret opening percentage attributed to better over all food and nutrient status of spike under these treatments. The results of present study are in conformity with earlier result of Namita *et al.* (2006) [14] and Ezhilmathi *et al.* (2007) [4].

Diameter of basal floret in vase significantly affected by SA @ 100, 200, 300 ppm than control. The largest basal flower (10.67 cm) was found in 100 ppm of SA recorded *at par* with its higher concentrations *i.e.* 200 and 300 ppm. The smallest basal flower (9.65 cm) was resulted in control. The plant growth regulators are found helpful in improving the carbohydrate levels of cut spikes by increasing water uptake and cell turgidity might be the possible reason of increased diameter of basal flower in vase. Our findings are in accordance with results of Padamlatha *et al.* (2012) found maximum diameter of flower in vase with SA @ 150 ppm.

The results of present study clearly showed that the shelf life of basal flower due to delay in petal senescence was greatly increased with pre-harvest spray of all plant growth regulator treatments than control. The maximum delay (5.04 days) in petal senescence was found in 100 ppm of SA and resulted in 1.54 days delayed petal senescence as compared to control. The same treatment observed *at par* with its higher concentration *i.e.* 200 ppm and GA_3 200 ppm. These results are in accordance with the finding of Emongor (2004) in gerbera and Namita *et al.* (2006) [14] in gladiolus with GA_3 @ 200 ppm in variety Jacksonville Gold (4.28 days). The increase in shelf life of basal floret might be attributed to the fact that SA have important role in decreasing transpiration and evaporation of tissue, as well as decreasing respiration which prevented water loss of fresh weight in cut flower (Hatamzadeh *et al.* 2012) [5] and GA_3 maintains higher spike length and fresh weight, improves anti oxidative defense and stabilizes member integrity leading to delay in folding petal cell (Singh *et al.* 2008).

The vase life of cut spikes of gladiolus var. Candyman influenced significantly by all the plant growth regulator treatments of study as compared to control. Further, SA @ 100 ppm recorded significantly maximum vase life (10.88 days) followed by GA_3@ 200 ppm (10.58 days) and SA 200 ppm (10.54 days). The pre- harvest treatment increased 2.88, 2.58 and 2.54 days of vase life respectively, over control which resulted minimum vase life (8.00days). The increased vase life of cut spike attributed to the fact that the spikes from these treatments might have accumulated sufficient food materials for longer vase life as it is evident from greater spike length. The results of present investigations showed that with increase of SA concentrations, vase life of cut spikes decreased. Probably high concentrations of SA may have injured xylem vessels and collapsed the water flux up to the petals. Hatamzadeh *et al.* (2012) [5] also reported that SA have

important role in decreasing transpiration and evaporation of tissue as well as decreasing respiration which caused preventing water from loss of fresh weight in cut flower. Increased vase life due to SA application was reported by Ezhilmathi *et al.* (2007) [4] and Padamlatha *et al.* (2014) [16] in gladiolus. Longest vase life of cut spike with GA_3 application has also been reported Sharma *et al.* (2006) [20] in cultivar Red Beauty and Namita *et al.* (2006) [14] in cv. Jacksonville Gold (7.88 days) with GA_3 @ 200 ppm.

Effect of Vermiwash and cow urine

All the post harvest parameters significantly influenced by both levels of cow urine and vermiwash and produced increased values over control except for floret opening at a time. However, Non- significant variation was observed between 5% and 10% of cow urine as well as vermiwash for all post harvest parameters. Application of 5% and 10% of cow urine resulted 5.17 % and 5.19 % increased diameter of basal flower, 17.94 % and 16.20 % increased floret opening, 1.08 and 1.18 days increased flower shelf life and 2.11 and 2.31 days increased vase life of cut spikes, respectively. Similarly, 4.98 % and 5.38 % increased diameter of basal flower, 17.71 % and 15.97 % increased floret opening, 1.05 and 1.22 days increased flower shelf life and 2.17 and 2.25 days increased vase life of cut spikes than control were observed with 5% and 10% of vermiwash application, respectively. The increase in the length of spike with greater food and nutrients produced by cow urine and vermiwash might be possible reason of increasing the floret opening percentage shelf life, diameter of basal flower and vase life with cow urine and vermiwash.

Increased values over control have been observed with application of different levels of plant growth regulators as well as cow urine and vermiwash for floret opening at a time in vase but difference was not found significant among different plant growth regulators, cow urine and vermiwash as well as over control during both the years of study.

Table 1: Effect of plant growth regulators, cow urine and vermiwash on post-harvest parameters of gladiolus

Treatments	Floret Opening (%)	Diameter of Basal Floret (cm)	Shelf Life of Basal Floret (Days)	Floret Opened at a Time (Days)	Vase Life (Days)
Plant Growth Regulators					
P_0 (No PGR)**	69.74 (0.991)	9.85	4.29	2.21	9.29
P_1 (GA_3 @ 100ppm)	83.12 (1.166)	9.95	4.46	2.25	9.88
P_2 (GA_3 @ 200ppm)	89.86 (1.276)	9.96	4.94	2.25	10.58
P_3 (GA_3 @ 300ppm)	83.36 (1.159)	9.96	4.50	2.25	10.13
P_4 (SA @ 100ppm)	90.24 (1.273)	10.60	5.04	2.04	10.88
P_5 (SA @ 200ppm)	79.64 (1.110)	10.51	4.79	2.17	10.54
P_6 (SA @ 300ppm)	75.37 (1.055)	10.41	4.42	2.33	10.17
SEm±	1.63 (0.03)	0.08	0.10	0.07	0.14
CD $_{0.05\%}$	4.61 (0.07)	0.23	0.29	NS	0.41
Cow urine					
C_1 (Cow urine @5%)	82.41 (1.156)	10.18	4.58	2.15	10.11
C_2 (Cow urine @10%)	80.82 (1.138)	10.18	4.68	2.27	10.31
SEm±	0.87 (0.01)	0.04	0.05	0.04	0.08
CD $_{0.05\%}$	NS	NS	NS	NS	NS
Vermiwash					
V_1 (Vermiwash@5%)	82.34 (1.159)	10.16	4.55	2.20	10.17
V_2 (Vermiwash@10%)	80.89 (1.135)	10.20	4.72	2.23	10.25
SEm±	0.87 (0.01)	0.04	0.05	0.04	0.08
CD $_{0.05\%}$	NS	NS	0.15	NS	NS
Control	66.44 (0.954)	9.65	3.50	2.00	8.00
SEm±	2.34 (0.04)	0.12	0.15	0.14	0.21
CD $_{0.05\%}$ (Control vs. Treats)	6.64 (0.11)	0.33	0.41	NS	0.59

** Treatment comprises of the average effect of cow urine and vermiwash each @ 5% and 10% levels without PGR.

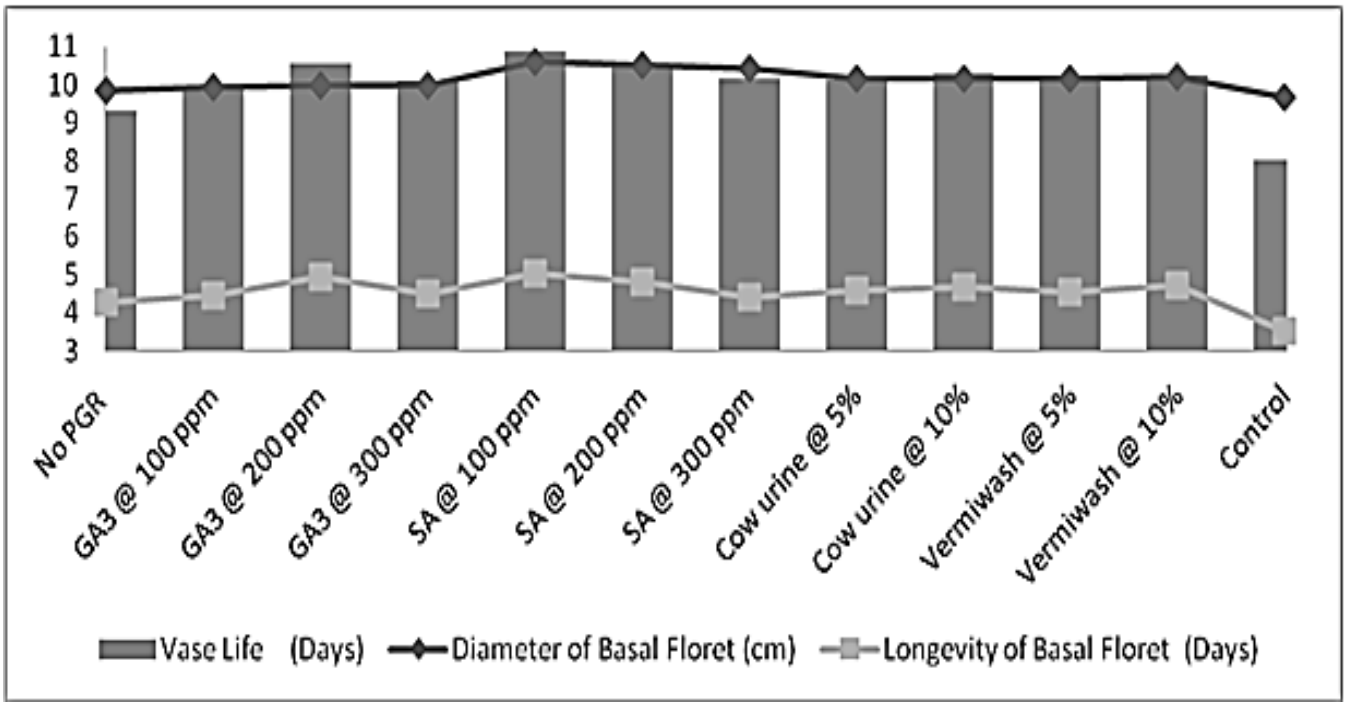

Fig 1: Effect of plant growth regulators, cow urine and vermiwash on shelf life, diameter of basal floret and vase life of cut spike of gladiolus cv. Candyman

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