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EFFECT OF POLYAMINES ON POSTHARVEST QUALITY AND VASELIFE OF ROSE VAR. SAMURAI

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ABSTRACT
Investigation was conducted to study the influence of different polyamines in spray form on post harvest life of rose var. Samurai. Polyamines *viz*. spermine, spermidine and putrescine at three different concentrations 10, 20, 50 ppm and water as control were used as postharvest spray treatments. Among all the treatments, cut roses var. Samurai sprayed with spermine @ 10ppm, followed by spermidine @10 ppm showed maximum water uptake (95.82 ml) and higher fresh weight retention (27.55, 26.03 and 18.97 g) as recorded respectively on 3rd, 5th and 7th day of vase life. Further, maximum total soluble sugars (65.32, 62.83 and 59.42μg/ml) and minimum electrolyte leakage (33.01, 63.09 and 75.70 %) in the petal tissue were observed with same treatments. Roses treated with 10 ppm spermine showed slower bud opening from day 1 to day 7) and enhanced vase life (8.03 days), followed by 10 ppm spermidine (7.76 days) as compared to control (4.24 days). Thus, the treatment 10 ppm of spermine improved flower quality and extended vase life by three days in rose cut flowers.

INTRODUCTION

Rose is the most preferred cut flower in the international market, accounting to about 19% of global trade. Though roses occupy the top places in all international cut flower markets, competitions are very intensive where quality plays a priority role. A fierce competition exists in the international flower market, where Indian roses suffer from poor prices due to improper pre and post harvest handling techniques (Kumar *et al*., 2012). Vase life termination for many cut flowers is characterized by wilting which is due to water loss from the cells (He *et al*., 2006, Halevy and Mayak, 1981) and electrolyte leakage (Singh *et al*., 2008). The optimum quality for export of cut roses can be achieved by adopting proper pre and post harvest handling techniques (Singh *et al*., 2013, Devecchi *et al*., 2003).

Many chemicals including antimicrobial agents, sugars and plant growth regulators have been used to improve the vase life of flowers. Most of these chemicals have been used as vase solution or pulsing treatment for enhancing vase life. Postharvest research employing treatments in the form of spray for improving post harvest flower quality is meager (Magave *et al*., 2013; Bagni and Tassoni, 2006). Polyamines are a new group of plant growth regulators wherein spermine and spermidine seem to be more effective in preventing senescence-related events than similar treatments with other known senescence retardants (Apelbaum *et al*., 1981; Kaur-Sawhney and Galston, 1991). Polyamines are known for their anti-senescence effects during ageing sequence of plant tissue by retarding ethylene synthesis by inhibiting ACC synthesis (Lee *et al*., 1997 and Hong and Lee, 1996). Polyamines in combination with sucrose in holding solutions extended the vase life of cut flowers of gladiolus (Singh *et al*., 2005) and of carnation and gerbera (Bagni and Tassoni 2006). Hence, this experiment was planned with the basic objective to study the influence of different polyamines *viz*., Spermine, Spermidine, Putrescine in spray form at three different concentrations 10, 20, 50 ppm on postharvest quality and vase life of rose cut flowers.

MATERIALS AND METHODS

Rose flowers were obtained from the green house complex of the department of Floriculture and Landscape Architecture at ACHF, NAU. Cut roses having first row of petals in unfurled stage were selected and sorted for uniform size (30 $\pm$5 cm) and fresh weight (23 $\pm$5 g) and held in glass bottles containing 400 ml vase solution for all treatments 8-HQC 100 mg/L + citric acid 300 mg/L + sucrose 2%. Spray solutions comprising of 10 ppm spermine (T_1) 20 ppm spermine (T_2), 50ppm spermine (T_3), 10 ppm spermidine (T_4), 20 ppm spermidine (T_5), 50 ppm spermidine (T_6), 10 ppm putrescine (T_7), 20 ppm putrescine (T_8), 50 ppm putrescine (T_9) and control (T_{10}) were freshly prepared. The experiment was done in a completely randomized design. The treatments were sprayed three times at an interval of two days with hand sprayer from first day of vase life.

Observations on vase life and different postharvest parameters at different intervals in vase were recorded during vase life. Total water uptake by the cut roses were determined by summation of water uptake recorded every alternate day. Fresh weight of the cut roses was recorded on 3rd, 5th and 7thday of vase life. Petal sugar status as total soluble sugars from the petal tissue was recorded according to the method described by Franscisttet *et al.*, (1971) on 3rd, 5th and 7thday of vase life. Percent bud opening was measured on the basis of flower bud diameter and converted into percentage basis as per the earlier method (Singh *et al.*, 2013). Electrolyte leakage (ion leakage) of the petal tissue was determined according to the earlier method (Singh *et al.*, 2008).The vase life of cut rose was evaluated by counting the number of days taken from the day one till the day of the appearance of the first symptom of petal shriveling and wilting.The statistical analysis was done by adopting the appropriate standard error (S.Em $\pm$) method in each case as suggested by Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

Cut flowers sprayed with different concentrations of polyamines showed longer vase life than control. Among all the treatments, significantly maximum water uptake (95.82 mL) and fresh weight retention (27.55, 26.03 and 18.97 g) was observed in cut roses sprayed with 10 ppm spermine, followed by 10 ppm spermidine. Fresh weight retention is dependent on maintenance of carbohydrate level and water uptake. The effectiveness of polyamines (Spermine and Spermidine) treatments in improving the fresh weight was due to their facilitation in improving the water uptake, high TSS and low electrolyte leakage. Earlier studies on polyamines as a vase solution have shown enhanced water uptake and consequently retained higher fresh weight in carnation (Fracassini*et al.*, 2002), gerbera (Bagni and Tassoni, 2006) and in gladiolus (Singh *et al.*, 2005).

Total soluble sugar levels (TSS) in the petal tissue of rose flowers sprayed with 10 ppm spermine (65.32, 62.83 and 59.42 µg/ml), followed by 10 ppm spermidine (65.31, 61.51 and57.37 µg/ml) as recorded respectively on 3rd, 5th and 7th day was much higher than control (45.82, 39.61 µg/ml) as recorded on 3rd and 5th day of vase life. Polyamines act as growth regulator and involved in many biological activities and have been shown to be closely associated with sugar and carbohydrate biosynthesis (Farahi *et al.*, 2012). Further, higher water uptake and retained fresh weight (Table 1) also contributes in restriction of degradation of macromolecules *viz.*, starch, proteins, nucleic acid, lipids and stimulate their synthesis (Graham *et al.*, 1994) in the petal cells and thus contributes to maintained higher levels of TSS. Further, protective and stabilizing influence of Spermine on petal cell integrity (Bagni *et al.*, 2004) may have contributed to maintained TSS status in petals.

Spray of polyamines significantly influenced bud opening of rose cut flowers. Cut rose stems treated with 10 ppm spermine

Table 1: Effect of different polyamines as post harvest spray on total water uptake (ml), change in fresh weight (g) and total soluble sugars (µg/mL) in rose cv. Samurai

Treatments	Total water uptake (ml)	Fresh weight (g)			Total soluble sugars (µg/mL)		
		3 rd day	5 th day	7 th day	3 rd day	5 th day	7 th day
T_1 - Spermine 10ppm	95.82	27.55	26.03	18.97	65.32	62.83	59.42
T_2 - Spermine 20ppm	74.73	28.25	18.15	-	60.86	54.97	49.27
T_3 - Spermine 50ppm	76.14	27.56	15.29	-	54.80	49.13	0.00
T_4 - Spermidine 10ppm	91.45	27.00	25.25	16.42	65.31	61.51	57.37
T_5 - Spermidine 20ppm	66.46	29.84	17.31	-	57.34	52.46	-
T_6 - Spermidine 50ppm	65.91	29.92	19.27	-	47.90	43.51	-
T_7 - Putrescine 10ppm	87.01	25.53	20.27	14.82	63.66	59.00	53.76
T_8 - Putrescine 20ppm	70.44	27.81	18.04	-	60.36	54.41	-
T_9 - Putrescine 50ppm	65.36	28.55	19.08	-	53.19	47.20	-
T_{10}- Control	58.22	24.73	14.70	-	45.82	39.61	-
CD 5 %	0.714	0.63	0.92	0.34	2.88	1.93	0.94

Table 2: Effect of different polyamines as post harvest spray on electrolyte leakage (%), percent bud opening and vase life in rose cv. Samurai

Treatments	Electrolyte leakage (%)			Per cent bud opening			Vase life
	3 rd day	5th day	7th day	3 rd day	5th day	7th day	(Days)
T_1 - Spermine 10ppm	33.01	63.09	75.70	35.03	67.34	99.60	8.03
T_2 - Spermine 20ppm	87.05	94.03	-	87.14	99.53	-	5.86
T_3 - Spermine 50ppm	71.12	83.03	-	82.87	99.90	-	5.41
T_4 - Spermidine 10ppm	38.06	64.04	78.66	42.77	75.17	99.30	7.76
T_5 - Spermidine 20ppm	67.17	79.01	-	72.98	99.53	-	5.03
T_6 - Spermidine 50ppm	89.10	97.16	-	81.20	99.60	-	5.13
T_7 - Putrescine 10ppm	38.80	68.34	80.17	70.36	96.67	-	7.36
T_8 - Putrescine 20ppm	88.00	94.83	-	83.00	99.90	-	5.49
T_9 - Putrescine 50ppm	56.01	78.87	-	86.65	99.53	-	5.02
T_{10}- Control	90.01	98.68	-	99.63	-	-	4.24
CD 5 %	1.24	0.60	0.54	1.235	0.840	0.654	0.25

and 10 ppm spermidine showed progressively slower bud opening as compared to other treatments and controls. Further, flower opening was maximum (99.60%) in cut roses sprayed with 10 ppm spermine and spermidine on 7th day of vase life. High petal sugar status and water balance in flowers is suggested to improve bud opening (Halevy and Mayak, 1981). Thus, higher water uptake, retained fresh weight along with higher sugar status in petals contributed to better bud opening of rose flowers.

Electrolyte leakage from the petal tissue is an important parameter that decided the vase life of the cut flowers. Significantly least electrolyte leakage was found in flowers treated with spermine 10ppm (33.01, 63.09, 75.70 %), followed by 10 ppm spermidine (38.06, 64.04, 78.66 %) where as highest leakage observed in control (56.01, 87.87, - %) on 3rd , 5th , 7th day of vase life. Vase life was found to be enhanced of the cut roses treated with 10 ppm spermine (8.03 days), followed by spermidine (7.76 days) as compared to the controls (4.24 days). The leakage of ions is known to coincide with the decrease in water content of the flower petals and senescence (Meeteren, 1979). Bors*et al.*, (1989) have indicated free radical scavenging effect of polyamines that reduce electrolyte leakage. Correlation of polyamines with integrity of cell membranous system has been earlier elucidated due to their protein binding property (Roberts *et al.*, 1986) as also indicated by Bagni *et al.,* 2004. Further, Slocum *et al.*, 1985 observed influence of spermine on stability characters of cell membrane.

Enhanced vase life of rose flowers with polyamines spray treatments can be attributed to increased water uptake in cut roses, higher retention of fresh weight and petal sugar status and lower electrolyte leakage from the petal tissue. Spermine has been reported to delay the senescence in cut carnation flowers by reducing ethylene production (Lee *et al.*, 1997). Sperminehas well established role in the stimulation of cell division and in the delay of senescence (Kitada*et al.*, 1979) and is known for its anti-senescence effects during ageing sequence of plant tissue (Kaur-sawhney and Galston, 1991).Significant role of polyamines in delaying flower senescence has been also been suggested by Cavaiuolo *et al.*, 2013and also been reviewed by Pandey *et al.*, 2000. Similar effects of reduced the electrolyte leakage with enhanced vase life with spermine has been earlier indicated gladiolus (Dantuluri *et al.*, 2008), gerbera and carnation (Bagni and Tassoni, 2006). Thus, reduced water stress and low electrolyte leakage from the petal tissue ultimately delayed petal senescence and increased vase life as compared to untreated roses.

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