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Effect of dry and wet storage on post harvest life and flower quality in cut tulip cv. Cassini

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ABSTRACT

Experiments were conducted during 2002-03 and 2003-04 to study the influence of storage methods and duration on post harvest quality of cut tulip cv. Cassini. Cut tulips cv. Cassini stored either dry or wet at 4^0C for 0,2,4,6 and 8 days showed that days to flower opening was the lowest in those kept under wet storage for 6 and 8 days. Flower opening was better with 0.2 and 4 days of dry or wet storage whereas flowers stored dry for 8 days did not open at all. Flower size and vase life decreased with the increase in storage period. Larger flowers were obtained with dry and wet storage of 0 and 2 days whereas higher vase life was obtained with zero days of wet and dry storage and 4 and 6 days of wet storage.

Key words: Tulip, storage, vase life

INTRODUCTION

Tulips are hardy spring flowering bulbs with most stems terminating into a single flower which has six petals (Anonymous, 2001-2002) and represents the largest geophyte crop worldwide. It has gained popularity owing to its beauty and economic value. The use of tulips vary from cut flowers, formal plantings in borders and flower beds, indoor forcing and planting on the rock gardens. Tulips have tremendous potential both in the international and domestic markets (Desh Raj, 1999). However, the quality of cut tulips production are known to be influenced by both pre and post-harvest practices. Post harvest losses can be reduced by suitable pre and post harvest management practices. Information on the quality of clones of field grown cut tulip blooms at room temperatures following low temperature dry storage is essential for profitable storage and marketing of tulip blooms (New, 1964). Since the information available on storage of cut tulips in scanty, the present investigation was undertaken with the objective of finding out suitable storage duration for cut tulips.

MATERIAL AND METHODS

Healthy and blemish-free scapes were cut, pre-cooled in a refrigerator and were divided into two lots. The scapes were weighed and stored at 4^0C. One lot of scapes was kept in large beakers with their base dipped in distilled water and the other lot was bunched and stored dry at 4^0C. The control scapes were placed directly in distilled water for observations. Scapes were taken out from both the lots after 2, 4, 6 and 8 days of storage and placed in the distilled water for vase life studies. The observations on vase life were recorded as per the procedure given by Venketarayappa *et al.,* (1980).

Days taken to flower opening: Data of flower opening was recorded and then days calculated from the date of placing in the distilled water in vase.

Fresh weight changes (% of initial weight): The difference between the weight of flask solution + scape weight of flask + solution represented the fresh weight (g) of the scape on that particular date.

Fw= (C+S+F)- (C+S)

Where: Fw = Fresh weight
C = Container (flask)
S = Solution
F = Scape

After this the per cent fresh weight change was calculated by the formula:

$$\text{Fresh weight change (\%)} = \frac{\text{F.W of a particular day- initial fresh weight}}{\text{Initial fresh weight}} \times 100$$

Water uptake (g/scape): The difference between consecutive measurement of the flask + solution (without scape) represented the water uptake:

$W_U = \{C+S\}_1 - \{C+S\}_2$

Where W_U = water uptake

Water loss (g/scape) transpirational g/scape: The difference between consecutive measurements of flask + solution + flower scape represented the water loss.

W_1 (transpirational loss) = $\{C+S+F\}_1 - \{C+S+F\}_2$

Where W_1 = water loss

Water balance (g/scape): Water uptake minus transpirational loss of water represented water balance:

$W_U = W_U - W_1$

Where W_B = Water balance

Water loss/ water uptake ratio: Transpirational loss of water divided uptake represented the water loss/ water uptake ratio:

$$\text{Ratio} = \frac{W_1}{W_U}$$

Flower opening (%): Number of flowers that opened fully in the vase was counted and then per cent flower opening counted out of the total flowers placed in the containers.

Flower diameter (cm): Flower diameter was taken across the fully opened flowers.

Vase life (days): Number of days was counted from the date of opening till the tepals lost their decorative value.

RESULTS AND DISCUSSION

In general, number of days taken to flower opening decreased with the increase in storage period either in dry or wet storage. During first year significantly maximum days (7.0) to flower opening were taken by zero day storage in water which was at par with 0 and 2 days of dry storage (6.44 and 6.11, respectively). Cut scapes stored in water for 6 and 8 days took minimum days of 3.66 each for flower opening whereas tulip flowers stored dry for 8 days did not open at all. Similar trend was followed during the second year also (Table 1).

During both the years of study cut tulips stored in water for 8 days gave minimum flower opening percentage (54.73 and 48.24, respectively.) Whereas, significantly maximum flower opening was recorded with scapes stored for 0,2 and 4 days of dry and wet storage.

Aekyung *et al* (1996) reported that when cut lilium flowers were treated with certain preservatives before storage at 3 or 6 ^oC for 1-5 days, they failed to open after storage for 5 days or showed rolling of petals and sepal edges. In Narcissus cut flowers stored either dry or wet for 14 days at 1-2 ^oC at >90 per cent RH, some flowers failed to open when transferred to ambient temperatures (Nicholas and Wallis, 1972; Rees, 1985).

Flower diameter also exhibited decreasing trend with the increase in dry or wet storage (Table1). During both the years larger flowers (6.90 and 7.0 cm, respectively) were obtained with zero day dry storage which was at par with zero day of wet storage (6.36 and 6.61 cm, respectively). Flower scapes stored dry for 6 days and wet for 8 days were at par with each other in recording the smaller flowers of 5.52 and 5.62 cm, respectively, during first year and 5.54 and 5.40 cm during second year. Wallis (1968) reported that increased storage duration reduced flower diameter in cut Narcissus. Katwata *et al* (1995) reported that size of the second floret of *Polianthes tuberosa* decreased with the increase in storage from 24-72 h at 4^oC.

Daily water uptake, water loss and water balance of cut tulips did not follow any general trend because all the treatments were not placed in vase on a single day.

Pooled data of two years revealed (Table 2) that on day 8, when all the treatments were in vase, maximum water uptake was recorded by zero day wet and dry stored samples (3.73 and 3.29 g/ scape, respectively) and minimum water uptake (1.47 g/scape) by 2 day dry stored samples Song *et al* (1992) reported that water uptake of cut roses cv. Sonia decreased with increased in length of dry storage. Song *et al* (1995) further reported that solution uptake decreased with the increase in storage duration of cut hybrid delphinium.

On day 8 and 10, maximum water loss was (Table 2) recorded by zero day in dry storage (3.59 and 3.38 g/ scape, respectively). Minimum water loss on day 8 was observed in scapes stored in water for 4 days (1.66 g/ scape) and on day 10 in scapes stored dry for 8 days (1.44 g/scape). The cut tulips did not open at all under later treatment and water loss was less owing to less surface available for transpirational loss. As per Sanket *et al* (1994) water loss slowed in cut Anthurium as the storage temperatures decreased.

Treatments exhibited negligible variation as regards water balance upto 6 days of storage whether dry or wet but on 8th and 10th day many treatments showed negative water balance. On day 8, lowest negative water balance (-0.60 g/ scape) was recorded by 4 days of dry storage and highest positive water balance was recorded by 6 days in dry storage

(0.50 g/ scape). Sanket *et al* (1994) reported that all the components of water balance declined rapidly at all storage temperatures for first 5 days when cut Anthuriums were held for 30 days at 8, 13, 18 and 28^{0}C (Table 2).

The trend depicted (Table 1) that vase life of cut tulips decreased with the increase in storage period. During both the years, significantly maximum vase life of 7.55 and 7.99 days, respectively was recorded with cut scapes when

Table 1. Effect of dry and wet storage on vase life studies of cut tulips (2002-04)

Treatments	Days to flower opening			Flower diameter(cm)			Vase life(day)			Flower opening(%)		
	1a	Highly significant	Mean	I	II	Mean	I	II	Mean	I	II	Mean
Dry storage (days)												
(0)	6.44	6.77	6.60	6.90	7.0	6.95	7.21	7.66	7.43	100.00 (90.00)**	88.89 (78.24)	94.44 (84.12)
(2)	6.11	6.55	6.33	6.71	6.30	6.50	7.10	6.77	6.93	100.00 (90.00)	88.89 (78.24)	94.44 (84.12)
(4)	6.11	6.44	6.27	5.59	5.58	5.58	6.10	5.70	5.60	88.89 (78.24)	77.77 (66.48)	83.33 (72.36)
(6)	4.88	4.11	4.49	5.52	5.54	5.53	4.74	4.99	4.86	77.77 (66.48)	66.66 (54.73)	72.21 (60.60)
(8)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 (-0.00)	0.00 (-0.00)	0.00 (-0.00)
Wet storage (days)												
(0)	7.0	6.88	6.94	6.36	6.61	6.48	7.55	7.99	7.78	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)
(2)	5.66	5.33	5.49	6.13	6.38	6.25	7.44	7.88	7.66	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)
(4)	4.55	4.44	4.49	5.91	6.19	6.05	6.88	6.44	6.66	100.00 (90.00)	88.89 (78.24)	94.44 (84.12)
(6)	3.66	4.00	3.83	5.80	4.48	5.64	4.99	5.33	5.16	77.77 (66.48)	66.66 (54.73)	72.21 (60.60)
(8)	3.66	3.88	3.77	5.62	5.40	5.51	4.66	4.22	4.44	66.66 (54.73)	55.55 (48.24)	61.10 (51.48)
CD *(P=0.05)*	2.50	2.22	-	0.86	1.33	-	0.73	1.94	-	18.99	26.44	-

a Year 2002-03

b Year 2003-04 * Data in parenthesis are the arc sin transformed values.

Table 2. Effect of dry and wet storage on daily water uptake , water loss and water balance (g/scape) of cut tulips cv. *Cassini* (Pooled data of two years).

Treatments	Days in vase																	
	0			2			4			6			8			10		
	WU	WL	WB	WU	WL	WB	WU	WL	WB	WU	WL	WB	WU	WL	WB	WU	WL	WB
Dry storage (days)																		
(0)	5.57	3.60	1.96	4.17	2.69	1.48	3.59	3.31	0.29	3.01	3.70	0.81	3.29	3.59	-0.29	2.57	3.38	-0.80
(2)	-	-	-	3.58	1.85	1.73	3.01	2.07	0.94	2.13	1.88	0.24	1.47	1.89	-0.42	1.28	1.47	-0.14
(4)	-	-	-	-	-	-	3.96	9.48	0.98	2.36	1.22	1.26	2.20	2.70	-0.60	1.49	2.20	-0.63
(6)	-	-	-	-	-	-	-	-	-	2.97	1.63	1.34	2.28	1.43	0.84	1.97	1.46	0.50
(8)	-	-	-	-	-	-	-	-	-	-	-	-	2.20	1.24	0.97	1.43	1.44	0.31
Wet storage (days)																		
(0)	4.67	3.24	1.49	3.85	2.86	0.99	3.49	2.96	0.69	2.12	1.32	0.96	3.73	2.82	0.90	1.73	2.76	-1.01
(2)	-	-	-	4.33	3.29	2.20	3.56	3.06	0.49	3.11	3.45	-0.33	1.93	2.43	-0.16	1.51	2.53	-1.02
(4)	-	-	-	-	-	-	4.77	3.63	1.40	3.22	2.83	0.67	2.29	1.66	0.63	2.10	3.32	-0.87
(6)	-	-	-	-	-	-	-	-	-	4.85	3.44	1.40	2.45	2.33	0.31	3.13	2.66	0.47
(8)	-	-	-	-	-	-	-	-	-	-	-	-	2.0	1.79	0.21	2.47	2.35	0.12
CD *(P=0.05)*	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

NS: Non-significant; WU: Water uptakeWL: Water lossWB: Water balance

Table 3. Effect of dry and wet storage on fresh weight changes (%) of cut tulips scapes in vase (pooled data of two years)

Treatments	Days in vase					
	0	2	4	6	8	10
Dry storage (days)						
(0)	14.71	15.31	25.66	28.65	33.05	32.67
		(22.32)*	(30.13)	(31. 79)	(34.88)	(34.22)
(2)	10.59	4.05	18.51	26.08	28.51	25.52
		(10.86)	(24.88)	(30.51)	(32.22)	(30.17)
(4)	12.63	-	9.17	13.63	18.84	20.98
			(16.66)	(20.91)	(25.60)	(26.78)
(6)	12.14	-	-	7.16	11.51	14.00
				(14.39)	(18.80)	(19.00)
(8)	08.84	-	-	-	14.08	18.10
					(20.73)	(23.09)
Wet storage (days)						
(0)	11.11	19.24	38.75	45.22	41.07	41.70
		(25.07)	(38.39)	(42.84)	(39.61)	(40.05)
(2)	11.96	14.74	23.56	28.32	22.35	22.79
		(21.11)	(28.42)	(31.61)	(27.16)	(26.22)
(4)	12.55	-	15.26	20.29	35.92	29.84
			(21.65)	(26.00)	(35.99)	(32.98)
(6)	11.73	-	-	27.84	34.58	36.39
				(29.08)	(35.37)	(36.81)
(8)	11.98	-	-	-	37.01	39.86
					(36.31)	(38.33)
CD *(P=0.05)*	NS	9.52	13.03	12.80	11.28	13.05

NS : Non-significant

* Data in parentheses are the arc sin transformed values.

stored wet for zero day. Minimum vase life of 4.66 and 4.22 days was recorded with wet storage for 8 days whereas flowers did not open when tulip cut scapes were dry stored for 8 days. Swart (1986) reported that a long period of dry storage (3 days at 2 ^{o}C) had an adverse effect on vase life of cut tulips but storing cut flowers by placing them in water prevented these negative effects. Vase life of tulips decreased as the storage temperature increased (Doss, 1986) and longer periods of storage were possible at 1.10 ^{o}C than at 4-5 or 10 ^{o}C. Mor *et al.* (1989) also reported that vase life of roses cv. Gabriella stored at 1^{o}C for 3 weeks was less than vase life of fresh flowers.

Changes in fresh weight were influenced significantly by dry and wet storage (Table-3) throughout the period of study though all treatments were not placed in vase on one single day. The general trend revealed that tulip scapes gained weight upto 8 days of observation, thereafter, some of the treatments showed decrease in fresh weight. Swart (1991) reported that flowers stored in water showed an increase in fresh weight. After all storage period, dry stored flowers showed increase in fresh weight upto day three thereafter, it decreased and the decrease in fresh weight corresponded with a visual decline in flower quality.

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