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Effect of different packing methods on vase life and quality of cut flowers in tuberose (*Polianthes tuberosa* L.) cv. Double

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A study was carried out to evaluate the role of packing methods on vase life of tuberose. The packing methods in which the spikes wrapped in 200 gauge polyethylene sheet (P_2) were found for longest vase life of spike, maximum uptake of water, lowest loss-uptake ratio, better freshness as well as lowest wilting of florets and highest percentage of opened florets. However, packing method P_2 was found at par with wrapping the spike in metal paper (P_7). Similarly, the poor response was obtained by the packing in craft paper (P_6) and control (P_8) in which the bunch of spikes were packed in CCBB without wrapping.

Key words : Packing, Tuberose, Spikes, Polyethylene, Sheet

INTRODUCTION

Flowers are one of the most important and unique gifts of nature. They are the adornments of the world with their valuable aesthetic, environmental, economic and medicinal properties. The estimated area under flower growing in the country is about 1.06 lakh hectares (Jain *et al.* 2003). The cut flowers like rose, gladiolus, tuberose, chrysanthemum etc. have commonly and frequently demanded in both the local as well as international market. Among them, tuberose is one of the most important cut flower. The tuberose is grown on a wide range of soil and climatic conditions, but it flowers best in warm and humid climate. Among four types of tuberose, the Double type is mainly cultivated for cut flowers. The post harvest management is one of the most important factors for cut flower industries. The best quality of the spike is very important for marketing point of view. Improvement of the keeping quality and enhancement of vase life of cut flowers are important areas of floricultural research. Presently, our cultivators are not aware about standardized post harvest technology including treatment of packing methods and materials extends the vase life. So it is great need to standardize the packing methods.

MATERIALS AND METHODS

The healthy and good appearance of spikes was used for this investigation. The trial was conducted with 8 different packing methods during the year 2004 in C.R.D. (Factorial) design with three replications at P.G. laboratory, Department of Horticulture, Junagadh Agril. University, Junagadh (Gujarat) and the same was repeated for second year (2005). The spike were packed in different packing methods viz., wrapping the spike in 100 gauge polyethylene (P_1), 200 gauge polyethylene (P_2), radium paper (P_3), cut flower stem is kept in water saturated cotton then wrapped with polyethylene sheet (P_4), corrugated sheet (P_5), craft paper (P_6), metal paper (P_7) and control (P_8) in which the bunch of spikes were packed in CCBB without wrapping. The wrapped bunch of spikes were arranged in CCBB and then the boxes were kept in cooling chamber for 72 hours at 15-20^{0}C, which was considered as cargo (transportation) period. After storage period (72 hours), the boxes were opened carefully and the spikes from the different wrapping materials were kept in vase container as distilled water for vase life. Necessary observations were recorded during vase life period.

RESULTS AND DISCUSSION

Vase life of spike :

The packing in 200 gauge polyethylene sheet (P_2)shown significantly longest vase life (14.43 days) followed by P_7, whereas, minimum vase life (10.64 days) was noticed at control (P_8)(Table 1).

The result may be due to polyethylene sheet and metal paper, attributed to provided modified atmosphere, which increased the CO_2 concentration as well as humidity and slow down the transpiration inside the package leading to slow down the respiration process (Hardenburg, 1971). Furthermore, it might have higher

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turgidity and freshness, contains more amount of carbohydrates and energy because of reduced permeability of polyethylene sheet. The polyethylene reduced the permeability to moisture and air, thereby reducing the weight loss probably due to a reduction in the moisture loss, respiration and cell division processes. Thus, water balance in spike was increased. Higher water balance is associated with gain in fresh weight and it seems to be the most important aspect in extension of longevity of cut flower (Rogers, 1973). These results were in accordance with observations made by Madaiha and Reddy (1994) and Michael (1996) in tubersoe; Ahn and Ahn (1997), Jothi and Balakrishnamoorthy (1999), Rajni *et al.* (2000), Khan *et al.* (2003) and Meir *et al.* (1995), Sharma *et al.* (1999) and Sashikala and Singh (2003) in gladiolus.

Uptake of water, Loss of water and water loss uptake ratio :

Maximum uptake of water as well as lowest water loss-uptake ratio (122.83 g & 1.79) was observed in P_2 followed by the P_3, respectively (Table 1). Whereas, the loss of water reduced (167.17 g) when packed in metal paper (P_7). It might be due to lower permeability of polyethylene sheet with high concentration of CO_2 as compared to O_2 leads to higher retention of water in the spike with higher turgidity, freshness and better transpiration pool. Whereas for lower loss-uptake ratio, higher amount of humidity with lower transpiration rate and respiration might be responsible. The another reason may be that the maintenance of carbohydrates level in the spike leading to stomatal closure resulted for minimum loss of water. Similarly, the decreased water uptake by the stem might be mainly due to plugging of xylem vessels caused by bacteria (Van Doorn *et al.* 1986).

Physiological loss of weight :

The result was found significant and minimum physiological loss of weight (34.24%) was registered in metal paper (P_7) (Table 2). However, it was statistically found at par with treatment P_2. The lowest physiological loss of weight by metal paper may be due to modified atmosphere in spike. It was probably due to the gaseous composition and higher relative humidity in packing (Anzueto and Rizvi, 1985). It also provided mechanical strength to the spike caused by simulated transit (Rajni *et al.* (2000). Similar findings were recorded by Madaiha and Reddy (1994) and Michael (1996) in tuberose; Ahn and Ahn (1997) in rose; Meir *et al.*, (1995) in gladiolus; Yamashita *et al.*

Table 1 : Effect of packing methods on vase life, uptake of water, loss of water and loss-uptake ratio during vase life period.

Treatments	Vase life of spike (days)			Uptake of Water (g)			Loss of water (g)			Loss-uptake ratio		
	2004	2005	Pooled	2004	2005	Pooled	2004	2005	Pooled	2004	2005	Pooled
P_1	12.99	12.38	12.68	100.67	97.00	98.83	185.83	193.83	189.83	1.86	2.02	1.94
P_2	14.83	14.03	14.43	124.67	121.00	122.83	207.67	215.83	211.75	1.73	1.86	1.79
P_3	13.76	12.96	13.36	115.67	111.83	113.75	195.83	204.33	200.08	1.77	1.93	1.85
P_4	12.37	11.53	11.95	104.50	101.50	103.00	213.00	220.00	216.50	2.18	2.35	2.26
P_5	12.42	11.68	12.05	101.33	98.00	99.67	195.00	199.00	197.00	2.00	2.12	2.06
P_6	12.25	12.00	12.13	107.00	103.33	105.17	196.50	204.00	200.25	1.93	2.08	2.01
P_7	13.99	13.49	13.74	92.83	88.67	90.75	163.17	171.17	167.17	1.83	2.03	1.93
P_8	10.92	10.36	10.64	92.33	88.33	90.33	197.00	205.00	201.00	2.18	2.38	2.28
S.Em. ±	0.208	0.214	0.170	2.622	1.969	1.709	4.056	3.720	3.138	0.045	0.043	0.035
C.D. at 5%	0.63	0.65	0.50	6.90	6.01	5.03	12.39	11.36	9.23	0.14	0.13	0.10
C.V.%	2.79	3.01	3.30	3.74	3.37	4.06	3.62	3.20	3.88	4.07	3.52	4.31

Table 2: Effect of packing methods on physiological loss of weight, freshness of spike and percentage of wilted florets during vase life of tuberose.

Treatments	Physiological loss of weight (%)			Freshness of spike (marks)			Wilted florets (%)		
	2004	2005	Pooled	2004	2005	Pooled	2004	2005	Pooled
P_1	36.15	36.98	36.57	4.61	4.15	4.38	38.28	40.03	39.16
P_2	34.50	34.42	34.46	5.84	5.34	5.59	26.00	27.86	26.93
P_3	37.90	38.39	38.14	4.92	4.45	4.69	40.99	42.01	41.50
P_4	40.60	41.32	40.96	3.23	2.79	3.01	42.12	43.86	42.99
P_5	39.78	40.31	40.04	3.66	3.17	3.42	43.45	44.61	44.03
P_6	37.78	38.38	38.08	4.21	3.81	4.01	52.56	54.00	53.28
P_7	33.06	35.43	34.24	5.26	4.76	5.01	42.71	44.22	43.46
P_8	43.62	44.72	44.17	2.95	2.44	2.69	51.27	52.90	52.09
S.Em. ±	0.960	0.680	0.671	0.159	0.130	0.117	1.023	0.863	0.763
C.D. 5%	2.93	2.08	1.97	0.48	0.40	0.34	3.12	2.63	2.24
C.V.%	4.39	3.04	4.28	6.35	5.84	7.00	4.20	3.42	4.35

(1999) in chrysanthemum and Srinivas and Reddy (1994) in jasmine.

Freshness of the spike :

Significantly maximum freshness of the spike (5.59 marks) was noticed in P_2 followed by P_7(Table 2). The result might have been due to the higher humidity in polyethylene sheet packing increased turgidity and freshness of spike. Similar result was obtained by Madaiha and Reddy (1994) in tuberose and Srinivas and Reddy (1994) in jasmine.

Wilted flowers :

Minimum wilted florets (26.93%) was recorded in P_2 followed by P_1(Table 2) . Similarly, highest percentage of wilted floret was noted with treatment P_6. It might be due to higher turgidity and freshness because of higher amount of carbohydrates leading to more uptake of water. It also reduces the permeability of moisture and air from the package and maintains higher amount of humidity with lower rate of transpiration and respiration. It also maintains the balance between CO_2 and O_2. These results were also in conformity with those of Madaiha and Reddy (1994) in tuberose.

Percentage of opened florets and partial opened florets :

Packing of spike in 200 gauge polyethylene sheet obtained significantly maximum percentage of opened florets (5.72%)(Table 3). In case of percentage of partial opened florets, the result was found similar and highest (4.76%) showed in 200 gauge polyethylene sheet (P_2). The result may be due to modified atmosphere created in

Table3 : Effect of packing methods on percentage of opened florets (%) and partial opened florets (%) during vase life period

Treatments	Opened florets (%)			Partial opened florets (%)		
	2004	2005	Pooled	2004	2005	Pooled
P_1	5.54(29.72)	5.71(31.59)	5.63 (30.65)	4.19(16.57)	4.37 (18.13)	4.28 (17.34)
P_2	5.64(30.84)	5.79(32.53)	5.72 (31.68)	4.68(20.86)	4.84 (22.43)	4.76 (21.63)
P_3	5.27(26.81)	5.44(28.60)	5.36 (27.70)	4.34(17.87)	4.52 (19.43)	4.43 (18.64)
P_4	4.98(23.75)	5.17(25.73)	5.07 (24.73)	4.42(18.51)	4.59 (20.03)	4.50 (19.26)
P_5	5.19(25.94)	5.34(27.57)	5.27 (26.75)	4.56(19.75)	4.72 (21.29)	4.64 (20.52)
P_6	5.18(25.88)	5.34(27.53)	5.26 (26.70)	4.59(20.05)	4.74 (21.47)	4.66 (20.76)
P_7	4.96(23.58)	5.15(25.52)	5.05 (24.54)	4.48(19.03)	4.64 (20.52)	4.56 (19.77)
P_8	4.37(18.09)	4.56(19.80)	4.46 (18.93)	4.48(19.03)	4.64 (20.57)	4.56 (19.79)
S.Em. ±	0.067	0.580	0.507	0.486	0.489	0.393
C.D. 5%	2.05	1.77	1.49	1.48	1.49	1.16
C.V.%	4.52	3.64	4.65	4.43	4.13	4.86

polyethylene sheet retained maximum water and maintained higher level of CO_2 concentration, which reduced floret metabolism and improved floret opening. These results found similar with the report of Meir et al. (1995) in gladiolus, they observed that MA (Modified Atmosphere) packaging may reduced floret metabolism, thereby reducing carbohydrate consumption as the respiratory substrate and improved floret opening. In addition, it retarded leaf and bract senescence, due to the high CO_2 concentrations accumulated within the package. Hence, these vegetative parts may serve as a possible source for assimilate import to the floret sink, which is necessary to maintain appropriate floret opening after storage.

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