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Research Article

EFFECT OF POST HARVEST TREATMENTS ON THE FLORET OPENING AND VASE LIFE OF CUT SPRAY CHRYSANTHEMUM

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Abstract: The experiment was carried out in the laboratory, Department of Horticulture, School of Agriculture Sciences and Rural Development, Nagaland University, Medziphema Campus during 2013-14 and 2014-15. The objective was to determine the effect of post harvest treatments *viz*., pulsing, packaging and storage conditions and its interactions on the floret opening percentage and vase life of cut chrysanthemum. Results showed that, pulsing of cut chrysanthemum in sucrose 5% + 8-HQC 200ppm for 24h enhanced the floret opening percentage as well as vaselife. Packaging in polysleeves enhanced floret opening percentage but its effect on vaselife was non-significant. Cut chrysanthemums stored in refrigerator for 96h and ZECC 48h exhibited enhanced floret opening while ZECC 48 exhibited maximum vase life. The effect of different interaction treatments also recorded enhanced floret opening percentage and but its effect vase life was non-significant.

Keywords: *Cut chrysanthemum, Pulsing, Packaging, Storage conditions, Floret opening, Vase life*

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Introduction

Chrysanthemum is one of the most common cut flowers and of the highest economic importance in floriculture industry for decoration and adornment having a long post harvest life when properly handled [1]. The high perish-ability of flowers and foliage plants renders them vulnerable to large post harvest losses [2]. In chrysanthemums, the chief post harvest problems experienced are failure to draw water resulting in premature leaf wilting, leaf yellowing and flower opening ultimately affecting its vaselife [3]. A chain of post-harvest operations *viz*., harvesting, grading, pulsing, bunching, sleeving, packing, precooling, storage and transportation has been found to maximize post-harvest life of the cut flowers and minimize economic loss in the cut flower trade. Therefore, and attempt has been made in this experiment to find out the effect of pulsing, packaging and storage conditions and its interactions in enhancing the floret opening and vase life of cut chrysanthemum.

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Materials and Methods

The experiment was carried out in the laboratory, Department of Horticulture, School of Agricultural Sciences and Rural Development, Nagaland University during 2013-14 and 2014-15. Cut chrysanthemums for the experiment were raised in greenhouse condition and harvested when 50 percent of the florets have shown colour. After harvest, cut chrysanthemums were pulsed in the designated pulsing treatments for 24 hours. After pulsing, cut chrysanthemums were bundled and wrapped with the different packaging materials and subjected to the different storage condition for 48 hours and 96 hours respectively.

Methodology employed is detailed as below,

Experimental Design: Split Split Plot Design (SSPD)

Number of replications: 3 (three)
Number of flower stems per treatment: 3 (three)
Interval of observation: 3 days
Period of Investigation: 2 years (2013-14 and 2014-15)

Treatment details

Pulsing (P)
P0 - Control (without pulsing)
P1 - Sucrose 5% + BA 10ppm
P2 - Sucrose 5% + 8-HQC 200ppm

Packaging (W)

W0 - Control (without packaging)
W1 - Plastic coated brown wrapping paper
W2 - Polysleeves
W3 - Newspaper

Storage conditions (S)

S1 - Ambient condition 48h
S2 - Ambient condition 96h
S3 - Refrigerator storage (4°C) 48h
S4 - Refrigerator storage (4°C) 96h
S5 - Zero Energy Cool Chamber (ZECC) 48h
S6 - Zero Energy Cool Chamber (ZECC) 96h

Observation

Floret opening (percentage)

The numbers of fully opened flowers in a cut stem were counted at senescence and the percentage was calculated as,

Percentage open florets = [Total opened florets / Total florets] x 100

Vase life (days)

The time elapsed between the cut flowers in holding solution till the time when the wilted florets on the cut stem reached 75% was counted and recorded.

Table-1 *Influence of pulsing, packaging and storage conditions on the floret opening and vase life of cut chrysanthemum*

Treatments	Floret opening%			Vase life (days)		
	2013-14	2014-15	Pooled	2013-14	2014-15	Pooled
Pulsing (P)						
P_0	51.42	69.89	60.65	27.07	28.26	27.67
P_1	60.03	65.18	62.60	30.19	30.22	30.21
P_2	66.89	70.73	68.81	30.51	30.79	30.65
Sem±	1.78	2.06	1.36	0.57	0.33	0.33
CD at 5%	6.97	NS	4.44	2.23	1.30	1.07
Packaging (W)						
W_0	53.54	64.84	59.19	28.26	29.54	28.90
W_1	61.29	69.73	65.51	30.35	30.17	30.26
W_2	67.38	71.22	69.30	29.44	29.85	29.65
W_3	55.57	68.60	62.09	28.98	29.48	29.23
Sem±	1.56	1.66	1.14	0.75	0.62	0.49
CD at 5%	4.64	NS	3.26	NS	NS	NS
Storage conditions (S)						
S_1	52.43	65.48	58.95	29.61	29.67	29.64
S_2	57.72	68.88	63.30	27.47	28.14	27.81
S_3	56.46	67.49	61.98	30.14	30.39	30.26
S_4	65.99	70.25	68.12	26.75	28.83	27.79
S_5	63.10	69.27	66.18	30.78	31.78	31.28
S_6	60.97	70.22	65.60	30.81	29.75	30.28
Sem±	2.38	2.10	1.59	0.81	0.72	0.54
CD at 5%	6.67	NS	4.42	2.27	2.01	1.51

Statistical analysis

The data recorded during the period of investigation were subjected to 3-way ANOVA by Split Split Plot Design following the procedure outlined by Gomez and Gomez (1984) [4]. Fischer Snedecor 'F' test was used to determine the significance and non significance of the variance from the critical difference (CD) due to individual treatment combinations at 5% level of significance.

Result & Discussion

The effect of pulsing, packaging and storage conditions on the floret opening and vase life of cut chrysanthemum in depicted in [Table-1]. Pulsing of cut chrysanthemum in sucrose 5% + 8-HQC 200ppm (P2) exhibited maximum floret opening percentage (68.81%) and vase life (30.65 days). However, the effect of P1 and P2 on the vase life of cut chrysanthemum were statistically at par with each other. Sucrose supplied the cut flower with required substrates for respiration and permits opening of the cut flowers harvested at bud stage which otherwise cannot occur normally [5] and the anti-microbial and acidifying nature of 8-HQC prevented the vascular blockage and finally increased water uptake retention of solution resulting in enhanced floret opening [6-8]. Sugar concentration in petals affects the vase life of cut flowers through ethylene production [9]. Providing cut flowers with exogenous sugar maintained the pool of dry matter and respiratory substrate in flower petals and induces osmotic adjustment [2] and reduced stomatal opening [10]. 8-HQC retards the growth of all bacteria, fungi and yeast present in cut flower in vase solution and enhances vaselife [11].

Cut chrysanthemum wrapped in polysleeves (W2) exhibited the highest floret opening percentage (69.30%). Flowers packed in polysleeves exhibited maximum moisture retention capacity resulting in enhanced floret opening [12], [13]. However, the effect of packaging on the vase life of cut chrysanthemum was non significant during both the years.

Among all storage conditions, cut chrysanthemum stored in refrigerator 96h(S4) recorded the highest floret opening percentage (68.12%) followed by ZECC 48h (S5) (66.18%). Effect of all storage conditions *viz*., S1, S2, S3, S4, S5, S6 on the floret opening of cut chrysanthemum were found to be statistically at par with each other. While, cut chrysanthemum stored in ZECC 48h (S5) recorded the highest vaselife (31.28 days) followed by S6 (30.28 days) and S3 (30.26 days) which were found to be statistically at par with each other. Low temperature not only affects the metabolic and physical activities of microbes but also decreased the rate of ethylene biosynthesis as well as effectiveness of ethylene in promoting the breakdown processes that may have led to petal damage and shrinking [14].

Table-2 *Interaction effect of pulsing, packaging and storage on the floret opening and vase life of cut chrysanthemum*

Treatments	Floret opening%			Vase life (days)		
	2013-14	2014-15	Pooled	2013-14	2014-15	Pooled
Pulsing x Packaging (PxW)						
P_0W_0	49.95	67.85	58.90	26.28	27.94	27.11
P_0W_1	57.45	68.46	62.95	28.89	28.11	28.50
P_0W_2	61.22	71.35	66.28	24.44	26.89	25.67
P_0W_3	56.11	68.36	62.23	28.67	30.11	29.39
P_1W_0	47.95	60.64	54.29	29.17	30.44	29.81
P_1W_1	61.32	67.70	64.51	30.44	30.22	30.33
P_1W_2	50.47	66.27	58.37	31.33	32.17	31.75
P_1W_3	54.55	66.09	60.32	28.61	28.06	28.33
P_2W_0	57.29	66.03	61.66	29.33	30.22	29.78
P_2W_1	72.18	73.05	72.61	31.72	32.17	31.94
P_2W_2	65.34	72.50	68.92	32.56	30.50	31.53
P_2W_3	79.51	74.89	77.20	29.67	30.28	29.97
Sem±	2.71	2.87	1.97	1.30	1.08	0.84
CD at 5%	8.04	NS	NS	NS	NS	2.24
Pulsing x Storage (PxW)						
P_0S_1	35.66	68.45	52.06	26.17	26.42	26.29
P_0S_2	68.00	71.97	69.98	26.33	27.67	27.00
P_0S_3	60.62	69.55	65.08	28.42	26.58	27.50
P_0S_4	39.04	72.81	55.92	23.25	30.58	26.92
P_0S_5	63.45	70.84	67.15	29.17	30.50	29.83
P_0S_6	62.36	65.71	64.04	29.08	27.83	28.46
P_1S_1	63.08	62.06	62.57	30.50	30.42	30.46
P_1S_2	55.61	63.07	59.34	28.58	29.25	28.92
P_1S_3	66.71	64.11	65.41	30.75	31.50	31.13
P_1S_4	71.29	72.33	71.81	27.58	28.75	28.17
P_1S_5	58.16	62.53	60.34	32.17	32.17	32.17
P_1S_6	65.15	65.62	65.39	29.50	29.92	29.71
P_2S_1	68.18	65.93	67.06	31.33	31.33	31.33
P_2S_2	46.01	71.59	58.80	27.50	27.50	27.50
P_2S_3	57.38	68.83	63.10	32.58	33.50	33.04
P_2S_4	68.92	73.67	71.30	29.42	27.17	28.29
P_2S_5	74.75	74.44	74.60	32.50	32.92	32.71
P_2S_6	45.66	71.27	58.46	31.83	31.67	31.75
Sem±	4.12	3.63	2.75	1.40	1.24	0.94
CD at 5%	11.55	NS	7.66	NS	3.48	NS
Packaging x Storage (WxS)						
W_0S_1	67.61	67.52	67.56	30.33	30.00	30.17
W_0S_2	61.46	61.46	61.46	28.33	27.44	27.89
W_0S_3	68.86	71.56	70.21	26.00	29.22	27.61
W_0S_4	46.92	59.74	53.33	23.78	29.00	26.39
W_0S_5	60.52	62.42	61.47	30.89	31.67	31.28
W_0S_6	57.57	65.08	61.33	30.22	29.89	30.06
W_1S_1	60.19	66.85	63.52	29.89	29.11	29.50
W_1S_2	57.12	71.74	64.43	29.11	29.56	29.33
W_1S_3	52.77	63.07	57.92	32.11	32.11	32.11
W_1S_4	39.78	66.50	53.14	27.00	30.33	28.67
W_1S_5	76.61	76.60	76.61	32.56	32.22	32.39
W_1S_6	55.98	72.83	64.40	29.89	29.33	29.61
W_2S_1	63.49	67.29	65.39	29.78	30.78	30.28
W_2S_2	65.29	69.78	67.54	28.56	29.00	28.78
W_2S_3	51.84	72.95	62.40	29.89	30.56	30.22
W_2S_4	74.70	74.56	74.63	28.22	27.00	27.61
W_2S_5	76.68	77.29	76.98	32.89	33.11	33.00
W_2S_6	50.71	71.18	60.94	30.33	29.67	30.00
W_3S_1	63.68	60.28	61.98	28.44	28.78	28.61
W_3S_2	46.79	72.53	59.66	23.89	26.56	25.22
W_3S_3	61.53	61.12	61.33	31.11	29.56	30.33
W_3S_4	49.86	69.42	59.64	28.00	29.00	28.50
W_3S_5	69.23	72.96	71.10	31.22	30.22	30.72
W_3S_6	47.53	71.64	59.59	29.78	30.11	29.94
Sem±	4.76	4.19	3.17	1.62	1.43	1.08
CD at 5%	13.33	NS	8.84	NS	NS	NS

As depicted in pooled date, [Table-3] &[Table-4] the effect of interaction treatments most showed non-significant result. Interaction effect of pulsing and packaging on the floret opening was non-significant, while, cut chrysanthemum pulsed and packed in (Sucrose 5% + 8-HQC 200ppm) + PCBWP (P2W1)

Table-3 *Interaction effect of pulsing, packaging and storage on the floret opening and vase life of cut chrysanthemum*

Treatments	Floret opening%			Vase life (days)		
	2013-14	2014-15	Pooled	2013-14	2014-15	Pooled
Pulsing x Packaging x Storage (PxWxS)						
$P_0W_0S_1$	62.74	68.89	65.81	27.67	27.67	27.67
$P_0W_0S_2$	56.93	74.17	65.55	25.67	21.67	23.67
$P_0W_0S_3$	71.61	81.94	76.78	28.67	28.67	28.67
$P_0W_0S_4$	30.00	56.41	43.21	16.67	29.00	22.83
$P_0W_0S_5$	74.44	64.88	69.66	31.67	31.67	31.67
$P_0W_0S_6$	60.83	60.83	60.83	27.33	29.00	28.17
$P_0W_1S_1$	71.82	71.16	71.49	30.00	27.00	28.50
$P_0W_1S_2$	34.13	67.27	50.70	28.67	30.00	29.33
$P_0W_1S_3$	64.27	63.88	64.08	30.00	22.33	26.17
$P_0W_1S_4$	61.62	79.80	70.71	22.33	31.00	26.67
$P_0W_1S_5$	62.96	56.26	59.61	31.00	32.67	31.83
$P_0W_1S_6$	49.89	72.38	61.14	31.33	25.67	28.50
$P_0W_2S_1$	73.33	71.10	72.22	23.00	26.00	24.50
$P_0W_2S_2$	74.21	74.21	74.21	26.00	26.00	26.00
$P_0W_2S_3$	60.45	75.93	68.19	23.00	24.67	23.83
$P_0W_2S_4$	39.53	77.14	58.34	24.67	30.00	27.33
$P_0W_2S_5$	58.86	83.33	71.10	21.67	28.33	25.00
$P_0W_2S_6$	60.93	67.60	64.27	28.33	26.33	27.33
$P_1W_0S_1$	73.17	65.14	69.16	30.33	29.33	29.83
$P_1W_0S_2$	80.77	48.93	64.85	28.00	29.33	28.67
$P_1W_0S_3$	82.14	67.59	74.87	27.67	32.00	29.83
$P_1W_0S_4$	72.73	58.24	65.48	27.33	30.67	29.00
$P_1W_0S_5$	75.48	58.93	67.20	29.67	32.00	30.83
$P_1W_0S_6$	92.78	65.02	78.90	32.00	29.33	30.67
$P_1W_1S_1$	62.50	64.17	63.33	29.33	30.00	29.67
$P_1W_1S_2$	87.22	67.20	77.21	30.00	30.00	30.00
$P_1W_1S_3$	51.82	52.78	52.30	32.33	32.33	32.33
$P_1W_1S_4$	88.21	71.65	79.93	28.33	29.67	29.00
$P_1W_1S_5$	21.67	77.98	49.82	34.33	31.33	32.83
$P_1W_1S_6$	56.53	72.42	64.47	31.33	28.00	29.67
$P_1W_2S_1$	59.03	61.86	60.44	33.33	33.33	33.33
$P_1W_2S_2$	67.12	61.54	64.33	29.67	31.00	30.33
$P_1W_2S_3$	78.49	79.19	78.84	31.00	31.00	31.00
$P_1W_2S_4$	87.30	72.74	80.02	31.00	31.00	31.00
$P_1W_2S_5$	78.57	49.26	63.92	33.67	34.33	34.00
$P_1W_2S_6$	62.58	73.04	67.81	32.33	32.33	32.33
$P_1W_3S_1$	57.64	57.07	57.36	29.00	29.00	29.00
$P_1W_3S_2$	40.56	74.63	57.59	26.67	26.67	26.67
$P_1W_3S_3$	72.73	56.85	64.79	34.33	31.33	32.83
$P_1W_3S_4$	50.76	59.87	55.31	23.67	23.67	23.67
$P_1W_3S_5$	92.42	63.93	78.17	27.67	27.67	27.67
$P_1W_3S_6$	48.70	84.21	66.46	30.00	30.00	30.00
$P_2W_0S_1$	53.01	68.52	60.77	33.00	33.00	33.00
$P_2W_0S_2$	50.91	61.28	56.10	31.33	31.33	31.33
$P_2W_0S_3$	52.83	68.95	60.89	21.67	27.00	24.33
$P_2W_0S_4$	38.04	64.59	51.31	27.33	27.33	27.33
$P_2W_0S_5$	31.64	63.44	47.54	31.33	31.33	31.33
$P_2W_0S_6$	76.42	69.40	72.91	31.33	31.33	31.33
$P_2W_1S_1$	46.24	65.21	55.73	30.33	30.33	30.33
$P_2W_1S_2$	50.00	80.75	65.38	28.67	28.67	28.67
$P_2W_1S_3$	42.21	72.54	57.38	34.00	34.00	34.00
$P_2W_1S_4$	93.92	86.97	90.44	30.33	30.33	30.33
$P_2W_1S_5$	34.70	65.28	49.99	28.00	35.33	31.67
$P_2W_1S_6$	61.51	74.07	67.79	31.33	33.67	32.50
$P_2W_2S_1$	58.11	68.90	63.50	33.00	33.00	33.00
$P_2W_2S_2$	54.55	73.59	64.07	30.00	30.00	30.00
$P_2W_2S_3$	68.75	63.74	66.25	36.00	36.00	36.00
$P_2W_2S_4$	57.55	73.79	65.67	29.00	20.00	24.50
$P_2W_2S_5$	35.27	82.09	58.68	34.67	34.33	34.50
$P_2W_2S_6$	28.61	72.91	50.76	30.33	30.33	30.33
$P_2W_3S_1$	74.44	61.11	67.78	32.33	32.33	32.33
$P_2W_3S_2$	28.57	70.74	49.65	20.00	20.00	20.00
$P_2W_3S_3$	65.71	70.08	67.90	35.33	34.67	35.00
$P_2W_3S_4$	73.82	70.51	72.17	31.00	31.00	31.00
$P_2W_3S_5$	41.05	80.42	60.74	33.67	33.67	33.67
$P_2W_3S_6$	16.11	68.69	42.40	30.00	30.00	30.00
Sem±	8.25	7.27	5.50	2.80	2.49	1.87
CD at 5%	23.09	NS	15.31	NS	6.96	NS

exhibited highest vaselife (31.94 days) followed by P1W2 (31.75days), P2W2 (31.53 days), P2W3 (30.33 days), P1W0 (29.97 days), P2W0 (29.81 days) which were found to be statistically at par with each other.

In the interaction effect of pulsing and storage, cut chrysanthemums pulsed and stored in (Sucrose 5% + 8-HQC 200ppm) + ZECC 48h (P2S5) recorded the highest floret opening percentage (74.60%). Effect of interaction treatment of packaging and storage exhibited maximum floret opening percentage (76.98%) with cut chrysanthemums packed and stored in polysleeves + ZECC 48h (W2S5). Interaction effect of pulsing, packaging and storage conditions on cut chrysanthemum exhibited maximum floret opening percentage (90.44 %) in (Sucrose 5% + 8-HQC 200ppm) + PCBWP+ refrigerator 96h (P2W1S4). The effect of different interaction treatments *viz*., pulsing x storage; packaging x storage; pulsing x packaging x storage was non-significant on its vaselife as depicted in the pooled data. Sucrose in the pulsing solution provided the necessary substrate for respiration, materials for cell wall synthesis and osmolyte and HQC acidified and lowered pH of the solution keeping it free from micro-organism, reducing vascular blockage in the stem and enhancing solution uptake. Further packaging in PCBWP and polysleeves created a modified atmospheric situation conserving and moisture within the flowers and the cool or low temperature storage minimized the respiration and transpiration process causing maintenance of wet weight and thereby enhancing the floret opening of cut chrysanthemums.

Conclusion

The various pulsing, packaging and storage conditions and its interaction treatments employed had a significant effect on the floret opening percentage of cut chrysanthemum. However, the interaction treatments on the vase life were non-significant. Cut chrysanthemum subjected to pulsing for 24h in (Sucrose 5% + 8-HQC 200ppm), Packaging in polysleeves and PCBWP and storage in refrigerator 96h and ZECC 48h exhibited highest floret opening percentage and vase life.

Application of research: The different post harvest treatments had a significant effect on the floret opening and vaselife of cut chrysanthemum when employed individually as compared to the interaction treatments. Pulsing in (Sucrose 5% + 88-HQC 200ppm), Packaging in polysleeves and PCBWP, and storage in refrigerator 96h and ZECC 48h, employment of either one of these treatments in cut chrysanthemum can be an effective post harvest management strategy in enhancing its vase life.

Research Category: Floriculture

Abbreviations: °C: degree celsius, ANOVA: Analysis of Variance
BA: Benzyladinine, HQC: Hydro Quinoline Citrate, h: hours, ppm: parts per million

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Cultivar / Variety / Breed name: *Chrysanthemum morifolium* cv. Carnival Pride

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
Ethical Committee Approval Number: Nil

References

[1] Abou El-Ghait E.M., Goma A.O., Yuossef A.S.M. and Mohamed Y. F. (2012) *Research Journal of Agriculture and Biological Sciences*, 8(2), 261-271.
[2] Bhattacharjee S.K. (1999) *Advance Horticulture and Forestry*, 7, 117-148.
[3] Reid M.S. (2001) *Acta Horticulture*, 543, 279-284.
[4] Gomez K.A. and Gomez A.A. (1984) *John Wiley and Sons (2nd edition)*, 139-153.
[5] Pun U.K. and Ichimura K. (2003) *Japan Agriculture Research Quarterly*, 4, 219-224.
[6] Kumar J., Mirza Anis and Pal Krishan (2010) *Journal of Ornamental Horticulture*, 13(2), 107-111.
[7] Pal A., Kumar S. and Srivastava R. (2003) *Journal of Ornamental Horticulture*, 6(4), 367-371.
[8] Jain Ritu, Bhalla Rajesh and Dhimam S.R. (2007) *Journal of Ornamental Horticulture*, 10(3), 143-147.
[9] Kazoo C. and Kenichi S. (1999) *Plant Growth Regulation*, 28, 483-485.
[10] Marousky F.J. (1969) *Journal of American Society of Horticulture Science*, 94, 223-226.
[11] Marousky F.J. (1971) *Journal of American Society of Horticulture Science*, 96, 38-41.
[12] Kumar S. Muthu, Ponnuswami V. and Jawarharlal M. (2014) *Journal of Applied Horticulture*, 16(3), 225-230.
[13] Waters W.E. (1966) *Florida Agricultural Experiment Stations Journal*, 2504, 452-556.
[14] Srivastava R., Sharma G. and Chand S. (2015) *Journal of Ornamental Horticulture*, 2(1), 123.