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Synergistic effect of natural sugars and botanical extracts on vase life of cut Dutch rose (*Rosa hybrida* L.) cv. Top Secret

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Abstract

The present investigation was conducted to evaluate the effect of organic vase solutions on postharvest quality and vase life of cut Dutch rose (*Rosa hybrida* L.) cv. Top Secret. The experiment was carried out during 2025–26 using a Completely Randomized Design with ten treatments and three replications. The organic vase solutions comprised sucrose, honey, coconut water and their combinations with lemon juice and selected botanical extracts. The treatments significantly influenced physiological weight loss, water loss, flower diameter, bent neck incidence, petal wilting, flower freshness, pH of vase solution, microbial load and vase life. Among the treatments, Honey 2% (T₂) recorded the minimum physiological weight loss (19.10%) and maximum water loss (39.17%), indicating higher water uptake by the flower stems. The maximum flower diameter (8.60 cm) was recorded under T₂, while the minimum (5.80 cm) was observed under Coconut water 10% (T₃). On the 10th day, T₂ recorded the lowest bent neck incidence (14.00%) and petal wilting (10.00%) and maintained the best flower freshness score (1.60). The lowest initial and final pH of vase solution were recorded under T₄ - Sucrose 2% + Lemon juice 1% (3.75 and 3.37, respectively). The minimum microbial load was recorded under T₇ - Sucrose 2% + Aloe vera gel extract 2% (0.006 OD₆₀₀), whereas the maximum was observed under T₈ - Coconut water 10% + Lemon juice 1% (0.529 OD₆₀₀). The maximum vase life (11.20 days) was recorded under T₂, while the minimum (1.26 days) was observed under T₈. Thus, Honey 2% was found to be the most effective organic vase solution for maintaining postharvest quality and extending the vase life of cut Dutch rose cv. Top Secret.

Keywords: Cut rose, honey, organic vase solution, postharvest quality, vase life

Introduction

Rose (*Rosa hybrida* L.) is one of the most important commercial cut flowers, valued for its attractive flower form, colour, fragrance and high demand in the floriculture industry. Globally, rose occupies a prominent position in the cut flower trade due to its diverse flower forms, attractive colours and good keeping quality (Zlesak, 2006) ^[17]. In India, floriculture has emerged as an important commercial horticultural enterprise. As per the National Horticulture Database, during 2024–25, the area under floriculture was 3.97 lakh hectares with a production of 42.65 lakh tonnes of flowers (Anon, 2025) ^[1].

The postharvest life of cut roses is affected by water imbalance, depletion of carbohydrate reserves, microbial proliferation, bent neck, petal wilting and senescence. Among these factors, maintenance of water balance and prevention of microbial blockage are particularly important for maintaining flower quality and extending vase life. Microbial contamination can cause vascular blockage, restrict water movement and adversely affect the water relations of cut rose stems (Halevy and Mayak, 1981; van Doorn and de Witte, 1991) ^[4, 14]. Sucrose is widely used in vase solutions as a source of respiratory substrate and has been reported to support flower opening and delay senescence (Ichimura, 1998; Pun and Ichimura, 2003) ^[6, 12].

In recent years, natural and organic materials such as honey, coconut water, lemon juice and botanical extracts have gained attention as potential alternatives to conventional floral preservatives. Honey provides readily available carbohydrates and bioactive constituents that may help maintain flower quality and delay senescence. (Hamid *et al.* 2024) ^[5] reported that honey-

based vase solutions improved vase solution uptake, reduced transpiration loss and maintained the ornamental quality of cut flowers. Botanical and herbal extracts have also shown potential as natural preservatives owing to their antimicrobial properties and their ability to improve water relations and delay senescence (Kantharaj *et al.*, 2018) [7]. Further reported beneficial effects of natural floral preservatives on the physical quality of cut gerbera flowers (Tiwari and Bisen 2025) [13].

Although several studies have evaluated sucrose, honey and botanical extracts individually, limited information is available on their simple organic combinations for maintaining the postharvest quality and vase life of Dutch rose cv. Top Secret. Therefore, the present investigation was undertaken to evaluate different organic vase solutions for improving the postharvest quality and vase life of cut Dutch rose (*Rosa hybrida* L.) cv. Top Secret and to identify a suitable organic vase solution for maintaining flower quality during the vase period.

Materials and Methods

The experiment was conducted in the laboratory of the Department of Floriculture and Landscaping, K. D. College of Horticulture and Research Station, Jagdalpur, Chhattisgarh, during 2025–26 using cut Dutch rose (*Rosa hybrida* L.) cv. Top Secret. The experiment was laid out in a Completely Randomized Design (CRD) with 10 treatments and 3 replications, with five flower stems per replication. Each flower stem was maintained in 200 ml of the respective vase solution. The treatments comprised distilled water (control), sucrose 2%, honey 2%, coconut water 10%, sucrose 2% + lemon juice 1%, sucrose 2% + neem leaf extract 2%, sucrose 2% + guava leaf extract 2%, sucrose 2% + Aloe vera gel extract 2%, coconut water 10% + lemon juice 1% and coconut water 10% + neem leaf extract 2%. The flower stems were recut to a uniform length of 40 cm with an oblique cut and placed individually in the respective vase solutions. Observations were recorded on physiological weight loss (%), water loss (%), flower diameter (cm), bent neck incidence (%), petal wilting (%), flower freshness (score 1–5), initial and final pH, microbial load (OD₆₀₀ nm) and vase life (days), following the parameters described by Kumar (2021) [9]. Microbial load was assessed by measuring optical density at 600 nm (OD₆₀₀) following the approach described by Peñuelas-Urquides *et al.* (2013) [11]. The data were statistically analysed using CRD, and treatment means were compared using the critical difference (CD) at the 5% level of significance.

Results and Discussion

Physiological weight loss (%)

The physiological weight loss of cut Dutch rose was significantly influenced by different organic vase solutions. The minimum physiological weight loss was recorded in T₂ - Honey 2% (19.09%), which was followed by T₄ - Sucrose 2% + Lemon juice 1% (27.47%), whereas the maximum physiological weight loss was recorded in T₃ - Coconut water 10% (40.00%). The lower physiological weight loss recorded in T₂ might be attributed to the readily available carbohydrates present in honey, which helped maintain cellular turgidity and reduce moisture loss during the vase period. Similar findings were reported by Hamid *et al.* (2024) [5].

Water loss (%)

The water loss of cut Dutch rose was significantly influenced by different organic vase solutions. The maximum water loss was recorded in T₂ - Honey 2% (39.17%), followed by T₀ - Distilled water (34.83%), whereas the minimum water loss was recorded in T₃ - Coconut water 10% (4.67%). The higher water loss under

T₂ indicated greater water uptake by the flower stems, which may have helped maintain water balance and postharvest quality of the cut flowers. Similar findings were reported by Hamid *et al.* (2024) [5].

Flower diameter (cm)

The flower diameter of cut Dutch rose was significantly influenced by different organic vase solutions. The maximum flower diameter was recorded in T₂ - Honey 2% (8.60 cm), followed by T₄ - Sucrose 2% + Lemon juice 1% (7.90 cm) and T₇ - Sucrose 2% + Aloe vera gel extract 2% (7.90 cm), whereas the minimum flower diameter was recorded in T₃ - Coconut water 10% (5.80 cm). The increased flower diameter under T₂ may be attributed to better maintenance of cellular turgidity and adequate carbohydrate availability, which promoted proper petal expansion. Similar findings were reported by Kshirsagar *et al.* (2021) [5].

Bent neck incidence (%)

The bent neck incidence of cut Dutch rose varied significantly among the different organic vase solutions on the 2nd, 6th and 10th day of vase life. On the 2nd day, the minimum bent neck incidence (0.00%) was recorded in T₀ - Distilled water, T₁ - Sucrose 2%, T₂ - Honey 2%, T₄ - Sucrose 2% + Lemon juice 1%, T₇ - Sucrose 2% + Aloe vera gel extract 2% and T₉ - Coconut water 10% + Neem leaf extract 2%, which were statistically at par with each other. The maximum bent neck incidence (86.67%) was recorded in T₈ - Coconut water 10% + Lemon juice 1%. On the 6th day, the minimum bent neck incidence (13.33%) was recorded in T₂ - Honey 2% and T₄ - Sucrose 2% + Lemon juice 1%, which were statistically at par with each other. The maximum bent neck incidence (100.00%) was observed in T₈ - Coconut water 10% + Lemon juice 1%. On the 10th day, the minimum bent neck incidence (14.00%) was recorded in T₂ - Honey 2%, whereas the maximum bent neck incidence (100.00%) was observed in T₅ - Sucrose 2% + Neem leaf extract 2%, T₆ - Sucrose 2% + Guava leaf extract 2% and T₈ - Coconut water 10% + Lemon juice 1%. The lower bent neck incidence under T₂ might be attributed to better maintenance of stem water balance and cellular turgidity, which helped preserve stem rigidity and delayed the development of bent neck symptoms during the vase period (Burdett, 1970) [3].

Petal wilting (%)

The petal wilting of cut Dutch rose was significantly influenced by different organic vase solutions on the 2nd, 6th and 10th day. On the 2nd day, the minimum petal wilting (0.00%) was recorded in T₂ - Honey 2%, which was at par with T₀ - Distilled water, T₄ - Sucrose 2% + Lemon juice 1%, T₆ - Sucrose 2% + Guava leaf extract 2% and T₉ - Coconut water 10% + Neem leaf extract 2%. The maximum petal wilting (65.00%) was recorded in T₃ - Coconut water 10%. On the 6th day, the minimum petal wilting (6.67%) was observed in T₂ - Honey 2%, followed by T₁ - Sucrose 2% (13.33%), whereas the maximum petal wilting (100.00%) was recorded in T₃ - Coconut water 10% and T₈ - Coconut water 10% + Lemon juice 1%. On the 10th day, the minimum petal wilting (10.00%) was recorded in T₂ - Honey 2%, followed by T₁ - Sucrose 2% (40.00%) and T₄ - Sucrose 2% + Lemon juice 1% (58.33%). The maximum petal wilting (100.00%) was observed in T₃ - Coconut water 10%, T₅ - Sucrose 2% + Neem leaf extract 2%, T₈ - Coconut water 10% + Lemon juice 1% and T₉ - Coconut water 10% + Neem leaf extract 2%. The lower petal wilting observed under T₂ - Honey 2% might be attributed to the continuous supply of readily available carbohydrates and improved water balance, which helped maintain petal cell turgidity and delayed the onset of flower senescence (Hamid *et al.*

al., 2024) [5].

Flower freshness (score 1–5)

The flower freshness of cut Dutch rose was significantly influenced by different organic vase solutions on the 2nd, 6th and 10th day. On the 2nd day, the minimum flower freshness score (1.00) was recorded in T₂ - Honey 2%, which was at par with T₀ - Distilled water, T₄ - Sucrose 2% + Lemon juice 1% and T₆ - Sucrose 2% + Guava leaf extract 2%. The maximum score (4.07) was recorded in T₃ - Coconut water 10%. On the 6th day, the minimum flower freshness score (1.06) was observed in T₂ - Honey 2%, followed by T₁ - Sucrose 2% (1.80), whereas the maximum score (5.00) was recorded in T₃ - Coconut water 10% and T₈ - Coconut water 10% + Lemon juice 1%. On the 10th day, the minimum flower freshness score (1.60) was recorded in T₂ - Honey 2%, followed by T₁ - Sucrose 2% (2.60) and T₄ - Sucrose 2% + Lemon juice 1% (3.40). The maximum flower freshness score (5.00) was observed in T₃ - Coconut water 10% and T₈ - Coconut water 10% + Lemon juice 1%. The lower flower freshness score under T₂ - Honey 2% indicated better flower freshness and might be attributed to the continuous supply of readily available carbohydrates and improved water relations, which helped maintain petal turgidity, colour and overall ornamental quality, thereby delaying flower senescence during the vase period (Kshirsagar *et al.*, 2021) [8].

Initial and final pH of vase solution

The initial and final pH of the vase solutions varied significantly among the different organic vase solutions. The minimum initial pH was recorded in T₄ - Sucrose 2% + Lemon juice 1% (3.75), followed by T₈ - Coconut water 10% + Lemon juice 1% (3.90), whereas the maximum initial pH was recorded in T₀ - Distilled water (6.84). At the end of the vase life, the minimum final pH

was recorded in T₄ - Sucrose 2% + Lemon juice 1% (3.37), followed by T₂ - Honey 2% (3.96), whereas the maximum final pH was recorded in T₀ - Distilled water (6.33). The decrease in pH observed in most vase solutions during the vase period was attributed to changes in the vase solution associated with flower metabolism and microbial activity.

Microbial load (OD_{600 nm})

The microbial load of the vase solution varied significantly among the different organic vase solutions. The minimum microbial load was recorded in T₇ - Sucrose 2% + *Aloe vera* gel extract 2% (0.006), followed by T₀ - Distilled water (0.010), whereas the maximum microbial load was recorded in T₈ - Coconut water 10% + Lemon juice 1% (0.529). The lower microbial load observed in T₇ might be attributed to the antimicrobial constituents present in *Aloe vera* gel, which restricted microbial proliferation in the vase solution. Reduced microbial contamination may help keep the xylem vessels free from blockage, thereby facilitating better water uptake and delaying flower senescence (van Doorn and de Witte, 1991) [14].

Vase life (days)

The vase life of cut Dutch rose was significantly influenced by different organic vase solutions. The maximum vase life was recorded in T₂ - Honey 2% (11.20 days), followed by T₄ - Sucrose 2% + Lemon juice 1% (7.87 days), whereas the minimum vase life was recorded in T₈ - Coconut water 10% + Lemon juice 1% (1.26 days). The extended vase life under T₂ might be attributed to the availability of readily metabolizable carbohydrates and naturally occurring bioactive compounds in honey, which helped maintain water balance, cellular turgidity and delayed senescence of the cut flowers. Similar observations were reported by Hamid *et al.* (2024) [5].

Table 1: Effect of organic vase solutions on physiological weight loss, water loss and flower diameter of cut Dutch rose (*Rosa hybrida* L.) cv. Top Secret

Treatment combinations		Physiological weight loss (%)	Water loss (%)	Flower Diameter (cm)
T ₀	Distilled water	30.03	34.83	6.9
T ₁	Sucrose 2%	29.78	33.33	7.3
T ₂	Honey 2%	19.10	39.17	8.6
T ₃	Coconut water 10%	40.04	4.67	5.8
T ₄	Sucrose 2% + Lemon juice 1%	27.49	34.67	7.9
T ₅	Sucrose 2% + Neem leaf extract 2%	34.23	23.83	6.5
T ₆	Sucrose 2% + Guava leaf extract 2%	34.09	21.33	7.3
T ₇	Sucrose 2% + <i>Aloe vera</i> gel extract 2%	31.50	26.33	7.9
T ₈	Coconut water 10% + Lemon juice 1%	39.42	7.83	5.9
T ₉	Coconut water 10% + Neem leaf extract 2%	35.85	16.67	6.9
S.Em ±		0.58	0.5	0.23
CD at 5%		1.72	1.48	0.68
CV		3.14	3.59	5.63

Table 2: Effect of organic vase solutions on bent neck incidence (%) of cut Dutch rose (*Rosa hybrida* L.) cv. Top Secret

Treatment combinations		Bent neck incidence (%)		
		2 nd Day	6 th Day	10 th Day
T ₀	Distilled water	0.00	46.00	92.00
T ₁	Sucrose 2%	0.00	36.00	56.67
T ₂	Honey 2%	0.00	13.33	14.00
T ₃	Coconut water 10%	80.00	93.33	93.33
T ₄	Sucrose 2% + Lemon juice 1%	0.00	13.33	42.00
T ₅	Sucrose 2% + Neem leaf extract 2%	13.33	66.67	100
T ₆	Sucrose 2% + Guava leaf extract 2%	6.67	56.67	100
T ₇	Sucrose 2% + <i>Aloe vera</i> gel extract 2%	0.00	52.00	67.00
T ₈	Coconut water 10% + Lemon juice 1%	86.67	100	100
T ₉	Coconut water 10% + Neem leaf extract 2%	0.00	80.00	87.00
S.Em ±		0.61	0.77	0.84
CD at 5%		1.79	2.38	2.47
CV		5.62	2.38	1.93

Table 3: Effect of organic vase solutions on petal wilting (%) of cut Dutch rose (*Rosa hybrida* L.) cv. Top Secret

Treatment combinations		Petal wilting (%)		
		2 nd Day	6 th Day	10 th Day
T ₀	Distilled water	0.00	20.00	81.67
T ₁	Sucrose 2%	1.67	13.33	40.00
T ₂	Honey 2%	0.00	6.67	10.00
T ₃	Coconut water 10%	65.00	100	100
T ₄	Sucrose 2% + Lemon juice 1%	0.00	30.00	58.33
T ₅	Sucrose 2% + Neem leaf extract 2%	1.67	81.67	100
T ₆	Sucrose 2% + Guava leaf extract 2%	0.00	65.00	98.33
T ₇	Sucrose 2% + Aloe vera gel extract 2%	5.00	58.33	76.66
T ₈	Coconut water 10% + Lemon juice 1%	45.00	100	100
T ₉	Coconut water 10% + Neem leaf extract 2%	0.00	50.00	100
S.Em ±		0.36	0.99	0.86
CD at 5%		1.07	2.92	2.55
CV		5.3	3.26	1.95

Table 4: Effect of organic vase solutions on flower freshness score of cut Dutch rose (*Rosa hybrida* L.) cv. Top Secret

Treatment combinations		Flower freshness Score (1–5)		
		2 nd Day	6 th Day	10 th Day
T ₀	Distilled water	1	2	4.2
T ₁	Sucrose 2%	1.2	1.8	2.6
T ₂	Honey 2%	1	1.06	1.6
T ₃	Coconut water 10%	4.07	5	5
T ₄	Sucrose 2% + Lemon juice 1%	1	2	3.4
T ₅	Sucrose 2% + Neem leaf extract 2%	1.2	4.4	4.93
T ₆	Sucrose 2% + Guava leaf extract 2%	1	4	4.93
T ₇	Sucrose 2% + Aloe vera gel extract 2%	1.3	3.2	4
T ₈	Coconut water 10% + Lemon juice 1%	3.73	5	5
T ₉	Coconut water 10% + Neem leaf extract 2%	1.06	3.6	4.8
S.Em ±		0.05	0.09	0.09
CD at 5%		0.15	0.27	0.28
CV		5.4	4.96	4.04

Table 5: Effect of organic vase solutions on pH of vase solution, microbial load and vase life of cut Dutch rose (*Rosa hybrida* L.) cv. Top Secret

Treatment combinations		pH of vase solution		Microbial load (OD ₆₀₀ nm)	Vase life (Days)
		Initial	Final		
T ₀	Distilled water	6.84	6.33	0.01	5.4
T ₁	Sucrose 2%	6.37	4.6	0.02	5.93
T ₂	Honey 2%	4.02	3.96	0.04	11.2
T ₃	Coconut water 10%	5.17	4.73	0.26	1.27
T ₄	Sucrose 2% + Lemon juice 1%	3.75	3.37	0.06	7.87
T ₅	Sucrose 2% + Neem leaf extract 2%	5.8	4.1	0.06	6.53
T ₆	Sucrose 2% + Guava leaf extract 2%	5.21	4.23	0.05	6.13
T ₇	Sucrose 2% + Aloe vera gel extract 2%	5.08	4.09	0.006	6.1
T ₈	Coconut water 10% + Lemon juice 1%	3.9	4.34	0.529	1.26
T ₉	Coconut water 10% + Neem leaf extract 2%	5.81	5.26	0.189	4.06
S.Em ±		0.11	0.15	0.002	0.17
CD at 5%		0.32	0.45	0.007	0.51
CV		3.58	5.89	3.5	5.42

Conclusion

The present investigation demonstrated that different organic vase solutions significantly influenced the postharvest quality and vase life of cut Dutch rose. Among the treatments, T₂ - Honey 2% proved to be the most effective treatment, recording the maximum vase life (11.20 days) and better performance for most of the postharvest quality parameters. The lower physiological weight loss, petal wilting and bent neck incidence under T₂ indicated better maintenance of flower quality during the vase period. T₄ - Sucrose 2% + Lemon juice 1% also showed comparatively better performance and recorded the second-highest vase life (7.87 days). Coconut water-based treatments, T₃ - Coconut water 10% and T₈ - Coconut water 10% + Lemon juice 1%, exhibited comparatively poor performance for most of the postharvest

parameters and recorded the shortest vase life (1.27 and 1.26 days, respectively). Overall, Honey 2% was found to be the most promising organic vase solution for extending the vase life and maintaining the postharvest quality of cut Dutch rose cv. Top Secret.

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