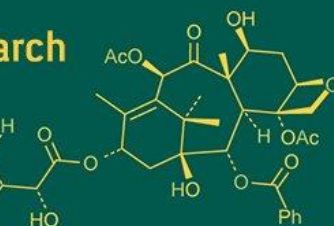
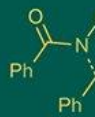


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Evaluating quality parameters in lisianthus flowers under different drying methods and desiccant treatments

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Abstract

Lisianthus (*Eustoma grandiflorum*), belonging to the Gentianaceae family, is popularly known as prairie gentian, Texas bluebell, tulip gentian and blue bells. It is an annual or short-lived perennial herb that can grow up to 80 cm tall. The plant has simple, opposite, sessile leaves, and its striking flowers are borne singly on long pedicels at the terminal ends. Recognized as an emerging cut flower, *Eustoma grandiflorum* (also referred to as *E. russellianum* or Texas bluebell) is native to regions such as Colorado, Kansas, Nebraska and Texas, where it naturally occurs as an annual or biennial species. A study conducted during 2024-25 at the College of Horticulture, Bagalkot, assessed various drying techniques for *Lisianthus*. The research revealed that drying methods and desiccants significantly influenced moisture retention and flower size. Flowers embedded in sand and dried in a hot air oven showed the lowest final moisture content (15.34%). Meanwhile, flowers treated with silica gel and dried under shade exhibited the least reduction in flower diameter (5.36%).

Key words: Moisture retention, Flower diameter, Shelf Life, Silica gel and Flower Preservation

Introduction

Lisianthus (*Eustoma grandiflorum*) is a prized ornamental species admired for its rose-like blossoms and striking colour palette. The plant produces elegant, bell-shaped flowers with a satin texture, often pale purple with darker centers, appearing singly or in clusters during summer. Over the past two decades, extensive hybridization has led to the development of numerous series and cultivars, offering a wide spectrum of colours such as pink, purple, red, white, yellow and various patterned combinations, available in both single and double forms with seasonal adaptability. Renowned for its use in floral arrangements and decorative displays, *Lisianthus* holds significant aesthetic and symbolic value in both domestic and commercial floriculture. However, its high perishability as a cut flower restricts shelf life and marketability. To address this limitation, flower drying has emerged as a sustainable approach to preserve its visual appeal and extend usability. Establishing standardized drying techniques including shade drying, desiccant drying, and hot air oven drying is crucial for ensuring consistent quality, colour retention, and structural stability of dried *Lisianthus* blooms.

Material and methods

The present study was conducted to evaluate the impact of different drying techniques and desiccants on cut flowers for value addition. The work was carried out in the Departmental Laboratory of Postharvest Management, College of Horticulture. *Lisianthus* varieties *Rosita clear pink* and *Rosita bright blue* were collected during December-January, which is considered the peak season for harvesting these flowers. Two drying methods hot air oven and shade drying were tested in combination with three desiccants: sand, silica gel and vermiculite. The experiment followed a factorial completely randomized design (CRD) with three replications, resulting in a total of 12 treatment combinations.

The treatments included

1. T₁: Rosita clear pink + sand + hot air oven
2. T₂: Rosita clear pink + sand + shade drying
3. T₃: Rosita clear pink + silica gel + hot air oven
4. T₄: Rosita clear pink + silica gel + shade drying
5. T₅: Rosita clear pink + vermiculite + hot air oven
6. T₆: Rosita clear pink + vermiculite + shade drying
7. T₇: Rosita bright blue + sand + hot air oven
8. T₈: Rosita bright blue + sand + shade drying
9. T₉: Rosita bright blue + silica gel + hot air oven
10. T₁₀: Rosita bright blue + silica gel + shade drying
11. T₁₁: Rosita bright blue + vermiculite + hot air oven
12. T₁₂: Rosita bright blue + vermiculite + shade drying

Data analysis was performed using the statistical methods outlined by Fisher and Yates. Flower quality was assessed using a 9-point hedonic scale to evaluate consumer acceptability.

Results and discussion

Flower diameter

In Table 1, flower diameter was observed to decline gradually across all treatments under ambient storage conditions. Among the two varieties, *Rosita bright blue* (V2) exhibited comparatively lower reduction (5.65, 5.63, 5.60 cm) than *Rosita clear pink* (V1), which recorded values of 5.75, 5.74, and 5.72 cm. With respect to desiccants, silica gel (D2) proved most effective, showing the least diameter loss (5.62, 5.59, 5.58 cm), followed by vermiculite (D3) (5.69, 5.67, 5.64 cm). Sand (D1), however, resulted in the highest reduction (5.81, 5.80, 5.78 cm). Similarly, shade drying (M2) maintained flower diameter better (5.65, 5.63, 5.62 cm) compared to hot-air oven drying (M1), which recorded 5.77, 5.74, and 5.73 cm. Significant interaction effects were noted, with the least reduction observed in treatment V2D2M1 (5.35, 5.33, 5.32 cm), while the maximum reduction occurred in V1D2M1 (5.94, 5.93, 5.91 cm). These findings emphasize the combined influence of variety, desiccant, and drying method on flower diameter. The study further revealed that desiccants had a significant role in minimizing diameter reduction of dried *Lisianthus* flowers. Flowers embedded in silica gel and subjected to shade drying showed the lowest shrinkage (5.35, 5.33, and 5.32%). Conversely, the largest flower diameter was recorded in treatment V2D1M2 (5.94, 5.92, 5.90 cm at 30, 60, and 90 DAS). The results confirmed silica gel as the

most effective drying medium for *Lisianthus* and *Chrysanthemum*, as it preserved floral shape and appearance more efficiently than sand (Patel et al., 2017) [1]. Its fine particles facilitate uniform moisture absorption, thereby reducing shrinkage (Rathod et al., 2021; Dalal & Mishra, 2025) [3, 4]. Overall, the study highlights silica gel's superiority in maintaining the structural integrity and visual quality of dried flowers.

Moisture retention

Drying methods and desiccants had a marked effect on moisture retention in *Lisianthus* flowers, with values increasing progressively over time. As shown in Table 1, *Rosita bright blue* (V2) recorded the lowest retention levels (17.26%, 17.28%, 17.30% at 30, 60, and 90 days), whereas *Rosita clear pink* (V1) exhibited the highest (17.32%, 17.35%, 17.38%). Among the desiccants, silica gel (D2) proved most effective, yielding the minimum retention (15.96%, 15.99%, 16.01%), followed by vermiculite (D3) (17.58%, 17.61%, 17.63%). Sand (D1) resulted in the greatest retention (18.32%, 18.35%, 18.39%). With respect to drying methods, shade drying (M2) maintained lower retention (17.25%, 17.29%, 17.30%) compared to hot-air oven drying (M1), which showed slightly higher values (17.32%, 17.35%, 17.38%). The lowest retention overall was observed in treatment V2D2M2 (15.37%, 15.40%, 15.42%), while the highest was recorded in V1D1M1 (18.76%, 18.79%, 18.82%).

The study confirmed that desiccants significantly influenced final moisture retention in dried *Lisianthus* flowers. Flowers embedded in silica gel consistently showed the lowest moisture content (15.34%), outperforming other treatments. This outcome aligns with the findings of Moona (2004), who attributed the effectiveness of silica gel to its strong hygroscopic properties, enabling rapid moisture removal from floral tissues. In contrast, flowers embedded in vermiculite (V1D3M1) retained comparatively higher moisture. These results reinforce silica gel's role as a superior drying medium, ensuring better preservation of *Lisianthus* flowers by minimizing shrinkage and maintaining quality. Maximum final moisture (18.76, 18.79 and 18.82%) during 30,60 and 90 DAS, respectively. This may be due to the reason that sand absorb less moisture. Consequently, the moisture is reabsorbed by flowers (Sindhuja et al., 2015) [5].

Table 1: Flower diameter and Moisture retention of dried *Lisianthus* flowers during storage as influenced by various desiccants and drying methods

Treatments	Flower diameter (cm)				Moisture retention (%)			
	DAS							
Variety	Initial	30	60	90	Initial	30	60	90
V ₁	5.78	5.75	5.74	5.72	17.30	17.32	17.35	17.38
V ₂	5.66	5.65	5.63	5.60	17.22	17.26	17.28	17.30
S.Em ±	0.02	0.02	0.02	0.03	0.01	0.01	0.01	0.01
C.D. at 1 %	0.10	0.06	0.09	0.11	0.05	0.03	0.03	0.02
Desiccant								
D ₁	5.83	5.81	5.80	5.78	18.30	18.32	18.35	18.39
D ₂	5.63	5.62	5.59	5.58	15.93	15.96	15.99	16.01
D ₃	5.70	5.69	5.67	5.64	17.56	17.58	17.61	17.63
S.Em ±	0.03	0.02	0.03	0.03	0.02	0.01	0.01	0.01
C.D. at 1 %	0.12	0.08	0.11	0.13	0.07	0.03	0.04	0.03
Method								
M ₁	5.78	5.77	5.74	5.73	17.30	17.32	17.35	17.38
M ₂	5.66	5.65	5.63	5.62	17.22	17.25	17.29	17.30

S.Em ±	0.02	0.02	0.02	0.03	0.01	0.01	0.01	0.01
C.D. at 1 %	0.10	0.06	0.09	0.11	0.07	0.03	0.03	0.02
Interactions								
V ₁ D ₁ M ₁	5.95	5.94	5.93	5.91	18.74	18.76	18.79	18.82
V ₁ D ₁ M ₂	5.68	5.66	5.63	5.62	18.53	18.55	18.58	18.60
V ₁ D ₂ M ₁	5.46	5.45	5.43	5.41	15.39	15.42	15.45	15.47
V ₁ D ₂ M ₂	5.95	5.93	5.91	5.90	16.73	16.75	16.78	16.80
V ₁ D ₃ M ₁	5.75	5.73	5.71	5.70	18.07	18.09	18.12	18.13
V ₁ D ₃ M ₂	5.87	5.85	5.84	5.82	16.35	16.39	16.41	16.44
V ₂ D ₁ M ₁	5.43	5.41	5.38	5.36	17.29	17.31	17.34	17.36
V ₂ D ₁ M ₂	5.96	5.94	5.92	5.90	18.65	18.68	18.70	18.72
V ₂ D ₂ M ₁	5.54	5.52	5.50	5.49	16.26	16.29	16.31	16.34
V ₂ D ₂ M ₂	5.36	5.35	5.33	5.32	15.34	15.37	15.40	15.42
V ₂ D ₃ M ₁	5.75	5.73	5.71	5.70	18.57	18.60	18.61	18.64
V ₂ D ₃ M ₂	5.95	5.93	5.92	5.89	17.24	17.28	17.31	17.32
Mean	5.72	5.70	5.68	5.67	17.26	17.28	17.31	17.33
S.Em ±	0.06	0.04	0.06	0.07	0.03	0.02	0.02	0.01
C.D. at 1 %	0.24	0.15	0.22	0.26	0.13	0.07	0.08	0.06

DAS: Days after storage

- V₁= Rosita clear pink
- D₁= Sand
- M₁= Hot air oven drying
- V₂= Rosita bright blue
- D₂= Silica gel
- M₂=Shadem drying
- D₃= Vermiculite

Conclusion

The study demonstrated that the use of different desiccants and drying methods played a crucial role in maintaining the quality of dried *Lisianthus* cultivars *Rosita clear pink* and *Rosita bright blue*. The key outcomes are summarized below:

- Desiccant efficiency: Silica gel emerged as the most effective desiccant, ensuring superior preservation of dried cut flowers, particularly in maintaining their structural and visual quality.
- Optimal drying method: Embedding flowers in silica gel followed by drying in a hot air oven at 50°C produced the best results, with improved colour retention, structural stability, and overall aesthetic appeal.
- Varietal performance: Between the two tested cultivars, *Rosita bright blue* showed better preservation of sensory attributes such as colour vibrancy, petal texture, and shape compared to *Rosita clear pink*.

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