International Journal of Advanced Biochemistry Research

ISSN Print: 2617-4693
ISSN Online: 2617-4707
IJABR 2024; SP-8(2): 584-594
www.biochemjournal.com
Received: 19-11-2023
Accepted: 22-12-2023

Nisha Singh
M.Sc., Department of Floriculture & Landscape Architecture, Pt. K.L.S. College of Horticulture and Research Station in Rajnandgaon, MGUVV, Durg, Chhattisgarh, India

Dr. Jitendra Singh
Director of Instructions and Professor, Department of Vegetable Science, Pt. K.L.S. College of Horticulture and Research Station in Rajnandgaon, MGUVV, Durg, Chhattisgarh, India

Dr. Pooja Gupta
Assistant Professor, College of Agriculture, IGKV, Raipur, Chhattisgarh, India

Trilesh Sahu
M.Sc. Department of Floriculture & Landscape Architecture, College of Agriculture, IGKV, Raipur, Chhattisgarh, India

Kalp Das
Ph.D. Research Scholar, Department of Vegetable Science, College of Horticulture & Forestry, PAU, Ludhiana, Punjab, India

Corresponding Author:
Nisha Singh
M.Sc., Department of Floriculture & Landscape Architecture, Pt. K.L.S. College of Horticulture and Research Station in Rajnandgaon, MGUVV, Durg, Chhattisgarh, India

Evaluation of different drying methods on the shape, colour retention and overall acceptability of rose (*Rosa hybrida* L.)

Nisha Singh, Dr. Jitendra Singh, Dr. Pooja Gupta, Trilesh Sahu and Kalp Das

DOI: https://doi.org/10.33545/26174693.2024.v8.i2Sh.654

Abstract
Flowers, cherished for their fleeting beauty, have found a new lease on life through the art of preservation. This study delves into the intricate world of drying methods, specifically focusing on roses (*Rosa hybrida* L.), aiming to enhance their longevity, colour retention, and overall acceptability. Conducted at Pt. K.L.S. College of Horticulture and Research Station in Rajnandgaon, Chhattisgarh, from March to May 2023, the study compared six rose drying methods: air, sun (sand-embedded), press, water, microwave (sand-embedded), and silica gel embedding. Using a randomized design, each method dried five roses (observations on three). Color, texture, shape, appearance, and brittleness were rated (1-5), while weight, moisture loss, and drying time were measured. Silica gel embedding excelled in visual quality and moisture control, making it the optimal method for preserving roses. Results reveal the prowess of embedded drying with silica gel (T_6), achieving peak scores in visual quality parameters. The method not only maintains superior colour retention but also excels in texture, shape, overall appearance, and brittleness. Quantitative data portrays the delicate dance of moisture loss, where microwave drying (T_5) stands out for its rapidity, albeit with the highest loss percentage. Time taken for drying is a symphony orchestrated by microwave drying, showcasing efficiency in both days and hours. In conclusion, this study advocates for the Embedded Drying (Silica Gel) method as the optimal choice for drying roses. Beyond aesthetics, it sheds light on the delicate balance between moisture loss and drying time, while emphasizing the economic efficiency of this method.

Keywords: Flowers, dried flowers, preservation, drying methods, silica gel, roses, floriculture, colour retention

Introduction
Flowers have ingrained themselves in human culture as objects of admiration, but their beauty is often short-lived. Fresh flowers, while charming, can be costly and are confined to specific seasons. The practice of drying flowers serves as a preservation technique, allowing for long-lasting decoration by removing moisture from various botanical components. Dried flowers, encompassing petals, buds, stems, roots, fruits, and leaves, offer enduring qualities, environmental friendliness, and widespread accessibility. With approximately 80% of flower species effectively dried and preserved in natural settings, the dried flower industry holds significant promise, potentially generating employment opportunities, particularly benefiting housewives and women in rural areas.

The global market for dried flowers is expansive, with India's dried flower exports reaching 4.17 million USD between April and November 2020-2021. Key trading partners include the USA, UAE, Singapore, Germany, and Canada. Drying flowers not only adds value to raw materials but also contributes to increased income for farmers. The market potential for dried flowers is underscored by their unique attributes, durability, aesthetic appeal, and year-round availability. To capitalize on this potential, fortifying the market, providing financial support, offering entrepreneurship development training, and raising awareness through workshops are essential steps.

Various drying methods, including air drying, sun drying, oven and microwave drying, freeze drying, water drying, and embedded drying, are employed to create decorative floral craft items.

Among these, air drying is common, involving suspending plant materials to expedite the drying process in a well-ventilated area. Other methods include sun drying, press drying, water drying, hot air-drying, and microwave drying. Silica gel is recognized as an effective desiccant. The choice of drying method influences the quality of the dried flowers, and techniques like microwave drying are valued for their quick results while retaining colour and shape.

In the context of the importance of drying flowers, this study aims to investigate optimal drying methods for roses, focusing on shape, colour retention, and overall acceptability. With the objectives including standardizing drying techniques for Rose (*Rosa hybrida* L.), preparing quality dry flower products. The study aims to provide valuable insights into enhancing the longevity and aesthetic appeal of dried roses, ultimately improving consumer satisfaction and acceptance in the market.

Materials and Methods

The study was conducted at the floriculture laboratory of Pt. K.L.S. College of Horticulture and Research Station, Rajnandgaon, Chhattisgarh, from March 2023 to May 2023. The geographical location, agro-climatic conditions, and experimental details, including the varieties of drying methods, were carefully documented. The laboratory is situated at Pendri, about 11 km from Rajnandgaon, at a latitude of 21.10˚N and a longitude of 81.03˚E, with an elevation of 307 m above mean sea level. The agro-climatic conditions during the study period (March 2023 to May 2023) were tropical to sub-tropical, typical of the experimental area. The mean maximum temperature was 38.10 ℃, and the mean minimum temperature was 22.02 ℃. Monthly meteorological observations were graphically illustrated, providing insights into the climatic nuances during the experiment.

The experiment involved six different drying methods for roses, namely air drying, sun drying (embedding in sand), press drying, water drying, microwave drying (embedded in sand), and embedded drying (silica gel). The study followed a Completely Randomized Design (CRD), with three replications. Each treatment comprised five roses, and observations were made on three roses per replication.

The study collected both qualitative and quantitative data. Visual quality parameters included colour, texture, shape, overall appearance (acceptability), and brittleness, scored on a 5point scale. Quantitative parameters included fresh weight, dry weight, moisture loss percentage, and time taken for drying (in days and hours). Economic aspects were analysed through the costbenefit ratio, considering total costs, gross returns, and net returns treatment-wise. Two embedding media, sand and silica gel, were used in the experiments. Airtight plastic containers were employed for embedding the flowers, ensuring a controlled drying environment. The study meticulously detailed the preparation of the embedding media and containers.

Results and Discussion

Visual quality parameters (VQP)

Colour: The impact of various drying methods on the colour retention of dried flowers is evident in Table 1, 2) and Figure 1. Notably, embedded drying using silica gel (T_6) achieved the highest score of 4.66, comparable to microwave drying (T_5), indicating superior colour retention. These findings align with Datt *et al*. (2007) [10], who observed that silica gel's structural properties, characterized by interconnected microscopic pores, effectively preserved the colour pigments of dried flowers.

Texture

Table 3, 4), and Figure 2 present the influence of drying methods on the texture of dried flowers. Embedded drying with silica gel (T_6) scored the highest at 4.83, emphasizing its positive impact on texture. This result is consistent with previous studies (Nair *et al*., 2011; Sindhuja *et al*., 2015) [27, 41] endorsing silica gel embedding as a method for achieving optimal texture in various flower types.

Shape

The shape of dried flowers, as affected by different drying methods, is detailed in Table 5, 6), and Figure 3. Once again, embedded drying with silica gel (T_6) and microwave drying (T_5) stood out with the highest score of 4.66. The process of drying with silica gel maintained the original shape, aligning with observations by Kher and Bhutani (1979) [20].

Overall appearance (acceptability)

Table 7, 8), and Figure 4 underscore the impact of drying methods on the overall appearance of dried flowers. Embedded drying with silica gel (T_6) and microwave drying (T_5) achieved the highest score of 4.66. This aligns with Kher and Bhutani's (1979) [20] observation that embedded drying in silica gel contributes to the best appearance of dried flowers.

Brittleness

The brittleness of dried flowers, as influenced by different drying methods, is presented in Table 9, 10), and Figure 5. Once again, embedded drying with silica gel (T_6) and microwave drying (T_5) exhibited the least brittleness, reinforcing the idea that silica gel embedding prevents significant fluctuations in the microclimate, ensuring even drying.

Quantitative parameters

Fresh weight (g)

The initial fresh weight of flowers before any treatment is detailed in Table 11 and Figure 6. Careful selection ensured uniform weights, with an average of 9.59 g and a range of 8.70-10.63 g.

Dry weight (g)

Table 12 and Figure 7 present the dry weight of flowers after applying different treatments, resulting in an average weight range of 2.43-3.19 g.

Moisture loss (%)

The percentage of moisture loss, calculated from fresh and dry weights, is outlined in Table 13, 14 and Figure 8. Microwave drying (T_5) exhibited the highest moisture loss (77.17%), attributed to the rapid release of moisture due to heat application.

Time taken for drying (Days)

The significant effect of different drying methods on the time taken for drying is depicted in Table 15, 16 and Figure 9. Microwave drying (T_5) required the minimum time (0.003 days), emphasizing its efficiency in rapidly drying flowers.

Time taken for drying (hour)

Table 17, 18 and Figure 10 further elaborate on the time taken for drying, highlighting the rapid drying achieved by microwave drying (T_5), taking only 0.072 hours.

Summary

The study, "Studies of Different Drying Methods on the shape, colour retention and overall acceptability of Rose (*Rosa hybrida* L.)", aimed to standardize drying techniques, produce quality dry flower products, and assess the economic viability through Cost-Benefit Ratio. The experiment was conducted at Pt. K.L.S. College of Horticulture and Research Station, Rajnandgaon, during 2022 – 2023. The experiment focused on various drying methods, evaluating parameters like colour retention, texture, shape, overall appearance, brittleness, fresh weight, dry weight, moisture loss, and time taken for drying. Among the different methods, the embedded drying (silica gel) method (T_6) consistently outperformed others in visual quality parameters, obtaining the highest scores.

The mean weight of fresh flowers used was 9.59 g, and the mean weight of dry flowers obtained was 2.78 g. The maximum moisture loss (77.17%) occurred in microwave drying (embedded in sand), while the minimum loss (65.36%) was observed in air drying. Microwave drying (embedded in sand) demonstrated the minimum time for drying in both days (0.003 days or 4.32 min.) and hours (0.072 hours or 4.32 min.), albeit with the highest moisture loss. In contrast, air drying took the maximum time (358.89 hours) for drying

Table 1: Effect of different drying methods on colour retention in *Rosa hybrida* L.

Treatment	Colour
T_1 (Air Drying)	2.50
T_2 [Sun Drying (Embedding in sand)]	3.50
T_3 (Press Drying)	2.16
T_4 (Water Drying)	2.66
T_5 [Microwave Drying (Embedded in sand)]	4.16
T_6 [Embedded Drying (Silica Gel)]	4.66
C.D0.05 S.E m (±) SE(d) C.V.	0.67 0.21 0.30 11.37

Table 2: Effect of different drying methods on colour retention in *Rosa hybrida* L. by using Duncan multiple range test

Treatment	Treatment Mean
T_1 (Air Drying)	2.50^c
T_2 [Sun Drying (Embedding in sand)]	3.50^b
T_3 (Press Drying)	2.16^c
T_4 (Water Drying)	2.66^c
T_5 [Microwave Drying (Embedded in sand)]	4.16^a
T_6 [Embedded Drying (Silica Gel)]	4.66^a
C.D0.05 S.E m (±) SE(d) C.V.	0.67 0.21 0.30 11.37

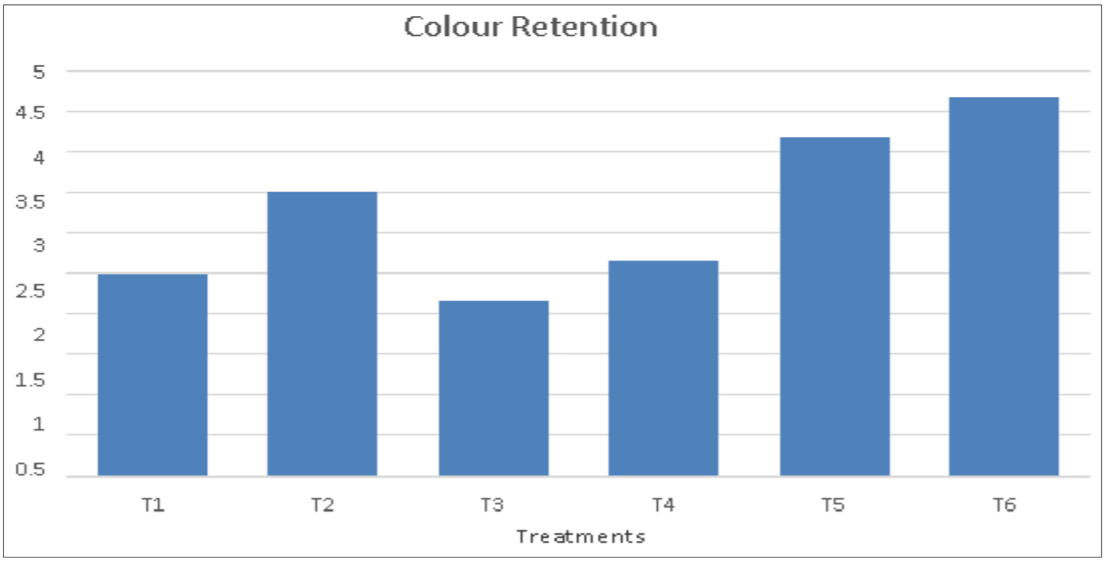

Fig 1: Effect of different drying methods on colour retention in *Rosa hybrida* L.

Table 3: Effect of different drying methods on texture in *Rosa hybrida* L.

Treatment	Texture
T_1 (Air Drying)	2.16
T_2 [Sun Drying (Embedding in sand)]	3.50
T_3 (Press Drying)	2.83
T_4 (Water Drying)	3.16
T_5 [Microwave Drying (Embedded in sand)]	4.16
T_6 [Embedded Drying (Silica Gel)]	4.83
C.D0.05 S.E m (±) SE(d) C.V.	0.47 0.15 0.21 7.65

Table 4: Effect of different drying methods on texture in *Rosa hybrida* L. by using Duncan multiple range test

Treatment	Treatment Mean
T_1 (Air Drying)	2.16^e
T_2 [Sun Drying (Embedding in sand)]	3.50^c
T_3 (Press Drying)	2.83^d
T_4 (Water Drying)	3.16^{cd}
T_5 [Microwave Drying (Embedded in sand)]	4.16^b
T_6 [Embedded Drying (Silica Gel)]	4.83^a
C.D0.05 S.E m (±) SE(d) C.V.	0.47 0.15 0.21 7.65

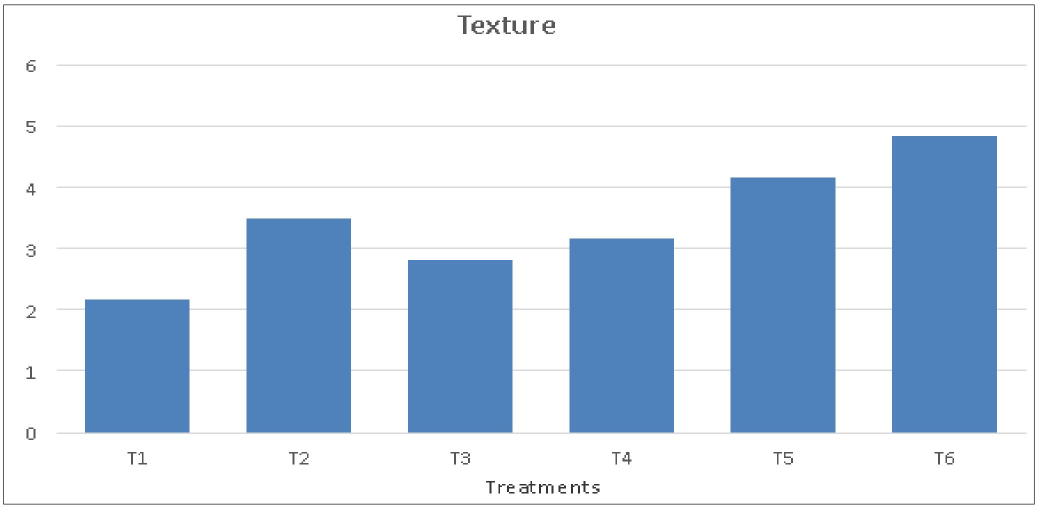

Fig 2: Effect of different drying methods on texture in *Rosa hybrida* L.

Table 5: Effect of different drying methods on shape in *Rosa hybrida* L.

Treatment	Shape
T_1 (Air Drying)	3.16
T_2 [Sun Drying (Embedding in sand)]	3.66
T_3 (Press Drying)	0.83
T_4 (Water Drying)	3.00
T_5 [Microwave Drying (Embedded in sand)]	4.50
T_6 [Embedded Drying (Silica Gel)]	4.66
C.D0.05 S.E m (±) SE(d) C.V.	0.67 0.21 0.30 11.27

Table 6: Effect of different drying methods on shape in *Rosa hybrida* L. by using Duncan multiple range test

Treatment	Treatment Mean
T_1 (Air Drying)	3.16^b
T_2 [Sun Drying (Embedding in sand)]	3.66^b
T_3 (Press Drying)	0.83^c
T_4 (Water Drying)	3.00^b
T_5 [Microwave Drying (Embedded in sand)]	4.50^a
T_6 [Embedded Drying (Silica Gel)]	4.66^a
C.D0.05 SE(m) SE(d) C.V.	0.67 0.21 0.30 11.27

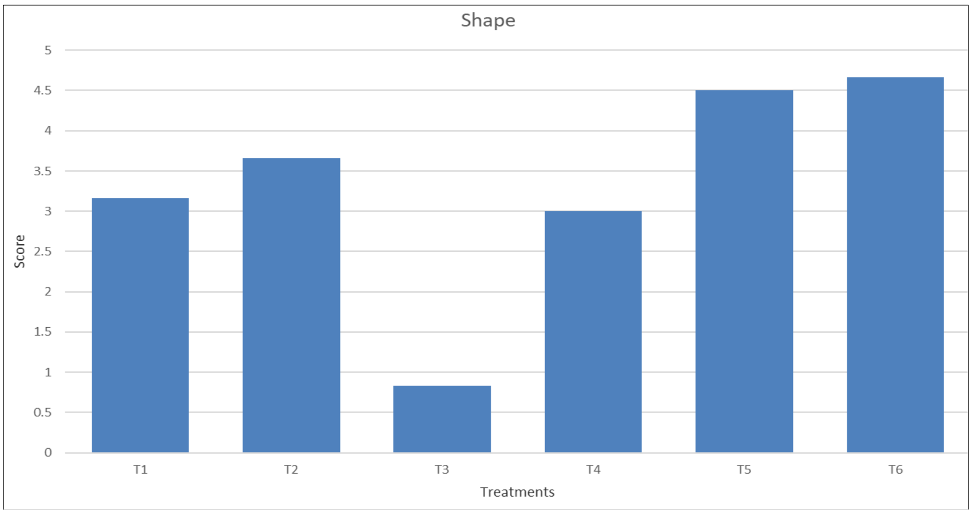

Fig 3: Effect of different drying methods on shape in *Rosa hybrida* L.

Table 7: Methods on overall appearance in *Rosa hybrida* L.

Treatment	Overall Appearance
T_1 (Air Drying)	3.00
T_2 [Sun Drying (Embedding in sand)]	3.66
T_3 (Press Drying)	3.16
T_4 (Water Drying)	2.83
T_5 [Microwave Drying (Embedded in sand)]	4.33
T_6 [Embedded Drying (Silica Gel)]	4.66
C.D0.05 S.E m (±) SE(d) C.V.	0.60 0.19 0.27 9.23

Table 8: Effect of different drying methods on overall appearance in *Rosa hybrida* L. by using Duncan multiple range test

Treatment	Treatment Mean
T_1 (Air Drying)	3.00^{c}
T_2 [Sun Drying (Embedding in sand)]	3.66^{b}
T_3 (Press Drying)	3.16^{bc}
T_4 (Water Drying)	2.83^{c}
T_5 [Microwave Drying (Embedded in sand)]	4.33^{a}
T_6 [Embedded Drying (Silica Gel)]	4.66^{a}
C.D0.05 S.E m (±) SE(d) C.V.	0.60 0.19 0.27 9.23

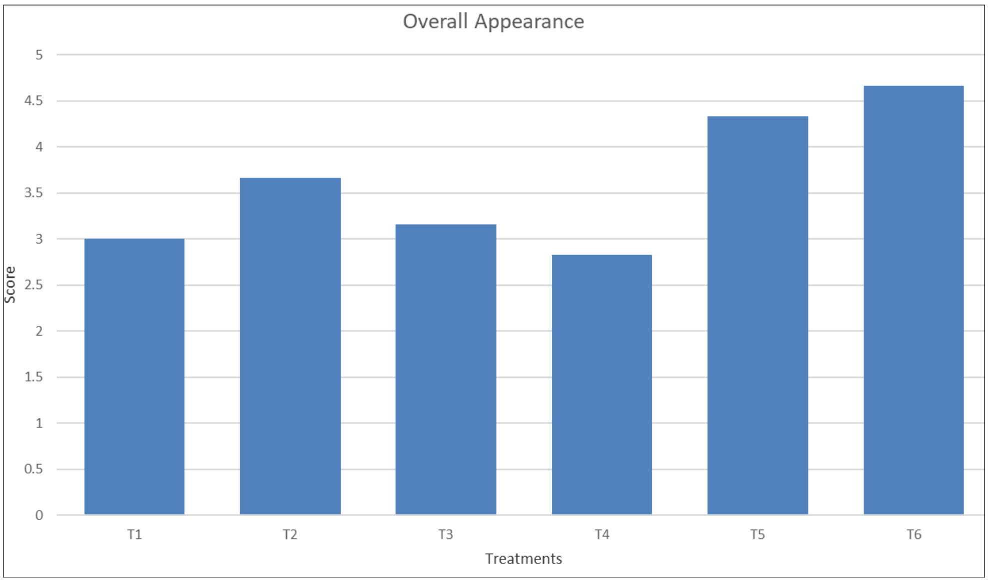

Fig 4: Effect of different drying methods on overall appearance in *Rosa hybrida* L.

Table 9: Methods on brittleness in *Rosa hybrida* L.

Treatment	Brittleness
T_1 (Air Drying)	1.66
T_2 [Sun Drying (Embedding in sand)]	3.50
T_3 (Press Drying)	2.00
T_4 (Water Drying)	2.16
T_5 [Microwave Drying (Embedded in sand)]	4.33
T_6 [Embedded Drying (Silica Gel)]	4.66
C.D0.05 S.E m (±) SE(d) C.V.	0.67 0.21 0.30 12.19

Table 10: Effect of different drying methods on brittleness in *Rosa hybrida* L. by using Duncan multiple range test

Treatment	Treatment Mean
T_1 (Air Drying)	1.66^{c}
T_2 [Sun Drying (Embedding in sand)]	3.50^{b}
T_3 (Press Drying)	2.00^{c}
T_4 (Water Drying)	2.16^{c}
T_5 [Microwave Drying (Embedded in sand)]	4.33^{a}
T_6 [Embedded Drying (Silica Gel)]	4.66^{a}
C.D0.05 S.E m (±) SE(d C.V.	0.67 0.21 0.30 12.19

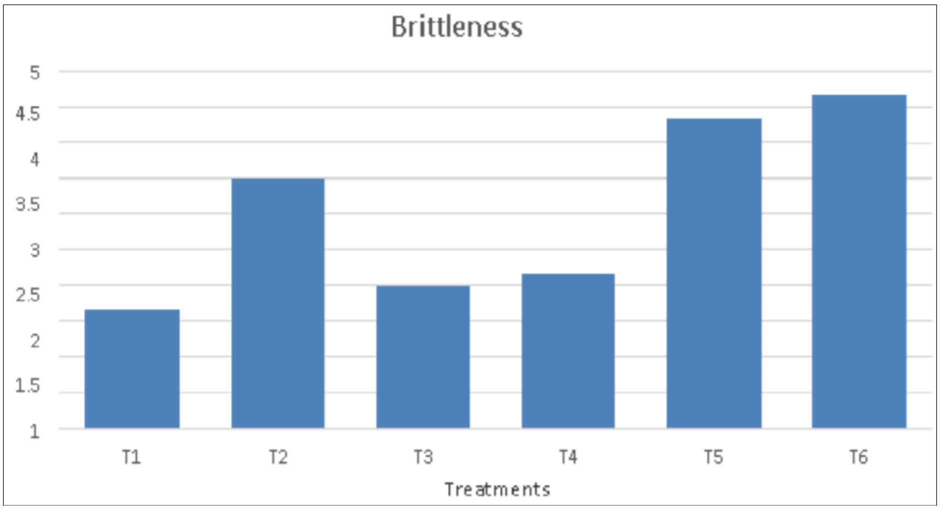

Fig 5: Effect of different drying methods on brittleness in *Rosa hybrida* L.

Table 11: Fresh weight of the flowers

Treatment	Fresh weight (g)
T_1 (Air Drying)	9.20
T_2 [Sun Drying (Embedding in sand)]	10.25
T_3 (Press Drying)	9.18
T_4 (Water Drying)	8.70
T_5 [Microwave Drying (Embedded in sand)]	10.63
T_6 [Embedded Drying (Silica Gel)]	9.59
Mean S.E m (±)	9.59 0.16

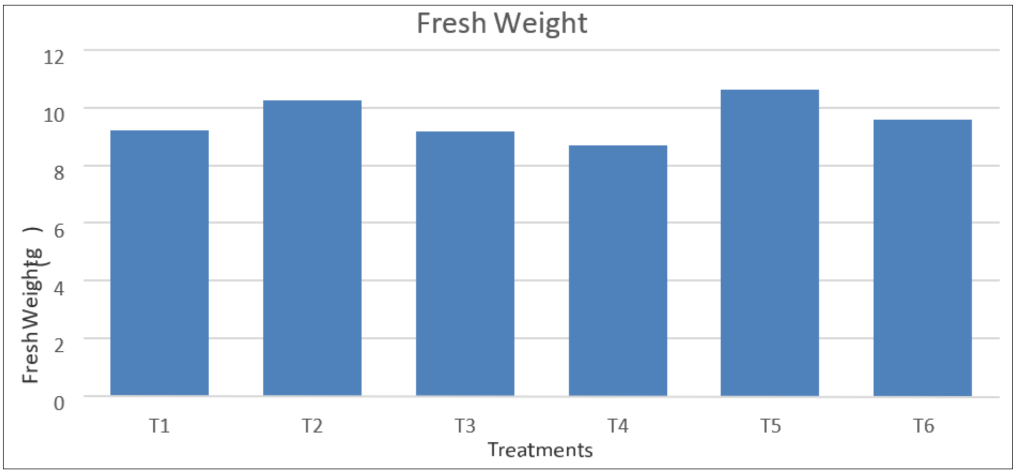

Fig 6: Fresh weight of the flowers

Table 12: Dry weight of the flowers

Treatment	Dry weight (g)
T_1 (Air Drying)	3.19
T_2 [Sun Drying (Embedding in sand)]	2.95
T_3 (Press Drying)	2.79
T_4 (Water Drying)	2.82
T_5 [Microwave Drying (Embedded in sand)]	2.43
T_6 [Embedded Drying (Silica Gel)]	2.55
Mean S.E m (±)	2.78 0.13

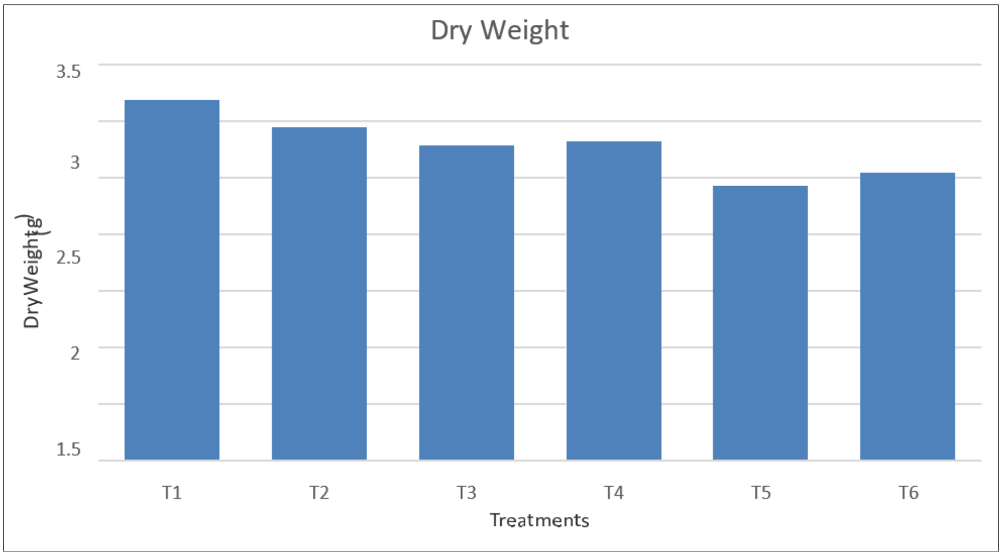

Fig 7: Dry weight of the flowers

Table 13: Effect of different drying methods on moisture loss percentage in *Rosa hybrida* L.

Treatment	Moisture loss (%)
T_1 (Air Drying)	65.36
T_2 [Sun Drying (Embedding in sand)]	71.22
T_3 (Press Drying)	69.64
T_4 (Water Drying)	67.65
T_5 [Microwave Drying (Embedded in sand)]	77.17
T6 [Embedded Drying (Silica Gel)]	73.41
C.D0.05 S.E m (±) SE(d) C.V.	2.96 0.95 1.34 2.32

Table 14: Effect of different drying methods on moisture loss percentage in *Rosa hybrida* L. by using Duncan multiple range test

Treatment	Mean
T_1 (Air Drying)	65.36^{e}
T_2 [Sun Drying (Embedding in sand)]	71.22^{bc}
T_3 (Press Drying)	69.64^{cd}
T_4 (Water Drying)	67.65^{de}
T_5 [Microwave Drying (Embedded in sand)]	77.17^{a}
T_6 [Embedded Drying (Silica Gel)]	73.41^{b}
C.D0.05 S.E m (±) SE(d) C.V.	2.96 0.95 1.34 2.32

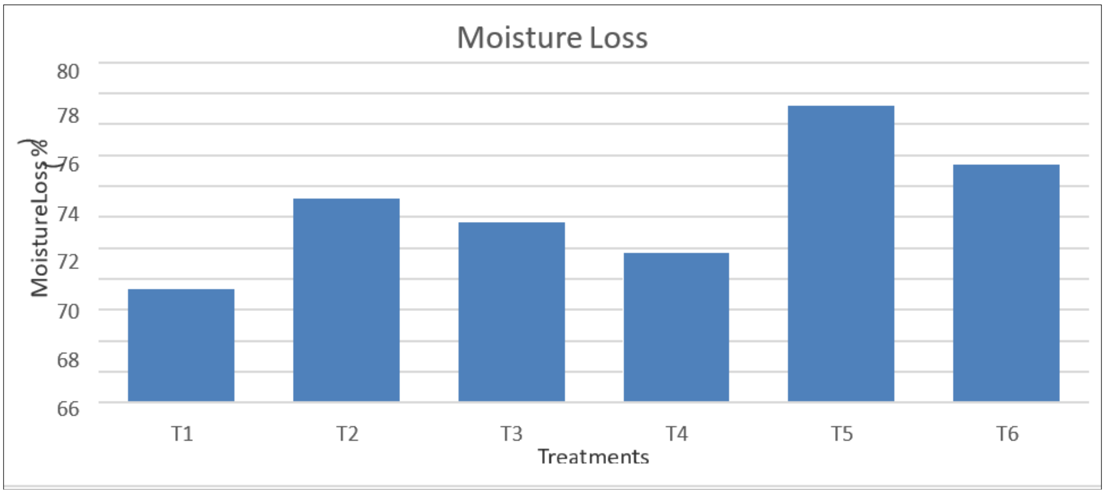

Fig 8: Effect of different drying methods on moisture loss percentage in *Rosa hybrida* L.

Table 15: Effect of different drying methods on time taken for drying (days) in *Rosa hybrida* L.

Treatment	Time taken for drying (days)
T_1 (Air Drying)	14.95
T_2 [Sun Drying (Embedding in sand)]	9.83
T_3 (Press Drying)	10.00
T_4 (Water Drying)	9.17
T_5 [Microwave Drying (Embedded in sand)]	0.003
T_6 [Embedded Drying (Silica Gel)]	8.96
C.D0.05 S.E m (±) SE(d) C.V.	0.28 0.09 0.13 1.79

Table 16: Effect of different drying methods on time taken for drying (days) in *Rosa hybrida* L. by using Duncan multiple range test

Treatment	Treatment Mean
T_1 (Air Drying)	14.95^{a}
T_2 [Sun Drying (Embedding in sand)]	9.83^{b}
T_3 (Press Drying)	10.00^{b}
T_4 (Water Drying)	9.17^{c}
T_5 [Microwave Drying (Embedded in sand)]	0.003^{d}
T_6 [Embedded Drying (Silica Gel)]	8.96^{c}
C.D0.05 S.E m (±) SE(d) C.V.	0.28 0.09 0.13 1.79

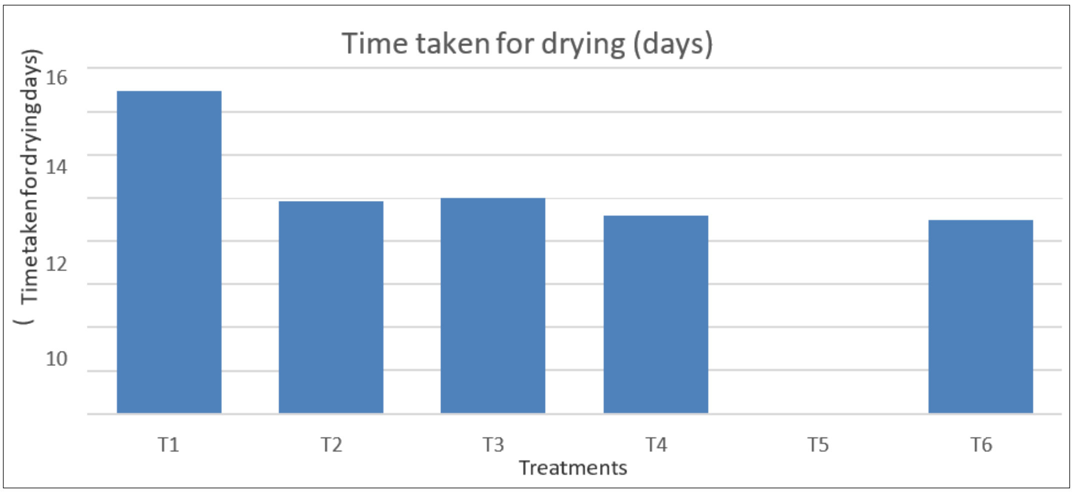

Fig 9: Effect of different drying methods on time taken for drying (days) in Rosa

Table 17: Effect of different drying methods on time taken for drying (hours) in *Rosa hybrida* L.

Treatment	Time taken for drying (hour)
T_1 (Air Drying)	358.89
T_2 [Sun Drying (Embedding in sand)]	236.13
T_3 (Press Drying)	240.20
T_4 (Water Drying)	220.16
T_5 [Microwave Drying (Embedded in sand)]	0.072
T_6 [Embedded Drying (Silica Gel)]	215.22
C.D0.05 S.E m (±) SE(d) C.V.	6.85 2.20 3.11 1.79

Table 18: Effect of different drying methods on time taken for drying (hours) in *Rosa hybrida* L. by using Duncan multiple range test

Treatment	Treatment Mean
T_1 (Air Drying)	358.89[a]
T_2 [Sun Drying (Embedding in sand)]	236.13[b]
T_3 (Press Drying)	240.20[b]
T_4 (Water Drying)	220.16[c]
T_5 [Microwave Drying (Embedded in sand)]	0.072[d]
T_6 [Embedded Drying (Silica Gel)]	215.22[c]
C.D0.05 S.E m (±) SE(d) C.V.	6.85 2.20 3.11 1.79

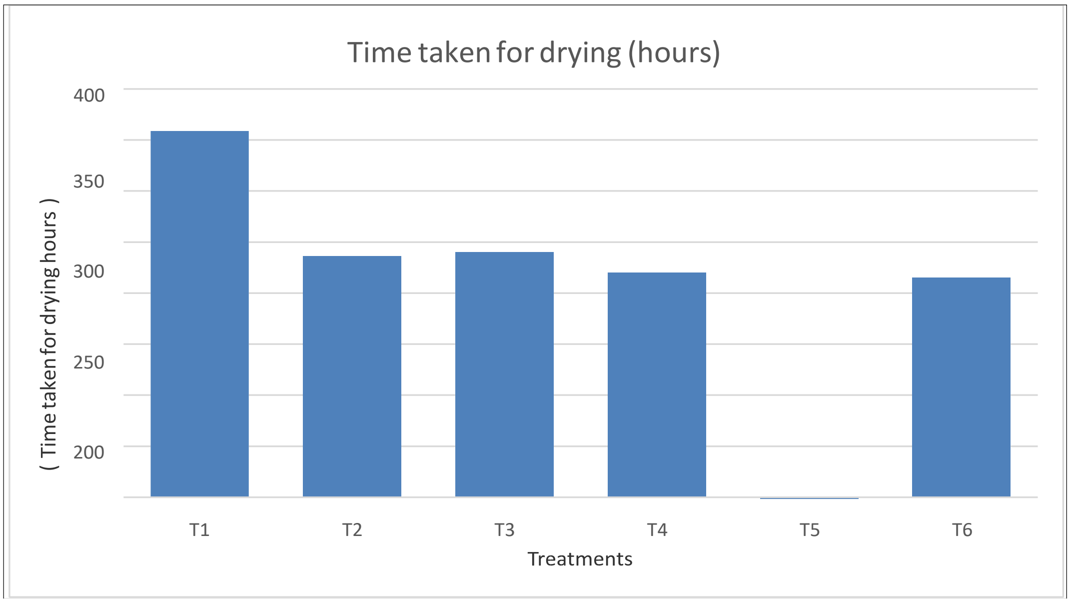

Fig 10: Effect of different drying methods on time taken for drying (hours) in *Rosahybrida* L.

Conclusion
Based on the study's findings, it can be concluded that the Embedded Drying (Silica Gel) method excelled in visual quality parameters, making it an optimal choice for drying roses. The experiment also revealed the mean weights of fresh and dry flowers, highlighted the trade-off between moisture loss and drying time, and identified the economic efficiency of the Embedded Drying (Silica Gel) method with the highest cost-benefit ratio. These conclusions provide valuable insights for enhancing the drying processes and economic considerations in rose floriculture.

References

1. Arvinda K, Jayanthi R. Standardization of drying techniques for chrysanthemum flowers (*Dendranthema grandiflora Tzvelev*). National Symposium on Recent Trends and Future Strategies in Ornamental Horticulture. Indian Society of Ornamental Horticulture. 2004;123.
2. Batra A. To study the behavior of color, change in some dehydrated ornamental flowers. Int J Latest Res Sci Technol. 2015;4(4):141-144.
3. Batra A. Dissemination of dry flower technology for societal good. Int J Curr Res Biosci Plant Biol. 2016;3(5):97-101.
4. Bhalla R, Moona DSR, Thakur KS. Standardization of drying techniques of Chrysanthemum (Dendranthem agrandiflorum Tzvelev). J Ornamental Hort. 2006;9:159-163.
5. Bhattacharjee SK, De LC. Dried flowers and plant parts. In: Advanced Commercial Floriculture. Avishkar Publishers, Jaipur. 2003. pp. 162-173.
6. Boyar S, Bayhan AK, Dikmen E. Investigation on drying behavior of Isparta rose flowers (Rosa damascena mill.) Under natural shade conditions. Bulg J Agric Sci. 2013;19(2):361-374.
7. Chandrasekhar R, Nirmala A, Padma M, Rajkumar M. Standardization of drying techniques of carnation (Dianthus caryophyllus L.). J Ornamental Hort. 2008;11(3):168-172.
8. Chen W, Gast KLB, Smithey S. The effects of different freeze-drying processes on the moisture content, color and physical strength of roses and carnations. Scientia Horticulturae. 2000;84(3/4):321-332.
9. Chungfang, Qin YH, Chen X, Zhou L. Experiments on microwave vacuum drying of rose. Chin Soc Agric Eng. 2011;27(4):389-392.
10. Datta SK. Dehydration of flowers: A new diversified product for floriculture industry. In: Emerging Trends in Ornamental Horticulture. Indian Society of Ornamental Horticulture. 2004. pp. 157-161.
11. Geetha CK, Rajeevan PK, Valsalakumari. In: Dry flowers. Kerela Agri. University, Trissur, Kerela. 2004. p. 80.
12. Gill SS, Rupa B, Sadhna A. Standardization of drying methods for certain cut flowers. In Floriculture research trend in India. Proceedings of the national symposium on Indian floriculture in the new millennium, Lal-Bagh, Bangalore. Indian Society of Ornamental Horticulture. 2002. pp. 357-358.
13. Gurjar A. Studies on Value Addition in Marigold (*Tagetes erecta* L.) and Chrysanthemum (Chrysanthemum morifolium Ramat.). M.Sc. Thesis, Sher-e-Kashmir University of Agricultural Sciences and Technology, Chatha, Jammu and Kashmir. 2022.
14. Hemant U, Singh A, Ahlawat T. Standardization of Dehydration Technique for Greenhouse Cut Rose var. Shakira. Indian J Hort. 2016;73:99-103.
15. Jain R, Jankiraman T, Kumawat GL. Drying techniques in ornamental plants. Commercial Horticulture. 2016;3(1):501-502.
16. Jean L, Lesley G. The Complete guide to drying and preserving flowers. Webb and Bower Ltd, England. 1982.
17. Jeevitha KM, Veena SJ. Standardization of Silica gel drying Technique of Rosa Damascena. Pharma Innovation J. 2021;10(6):1045-1048.
18. Joyce DC. Dried and preserved ornamental plant material not new, but often overlooked and underrated. Acta Hort. 1998;454:133-145.
19. Katoch A, Kishtwaria J, Raj D, Rana A, Dadwal M. Study on different methods of dehydration of Acroclinum flower. J Ornamental Hort. 2010;13:223-227.
20. Kher MA, Bhutani JC. Dehydration of flowers and foliage. Extension Bulletin No. 2, NBRI, Lucknow. 1979;20.
21. Kumari DLC, Peiris SE. Preliminary investigation of preservation methods to produce dried flowers of rose and statice. Trop Agric Res. 2000;12:416-422.
22. Mahapati SN, Hemlanaik H, Chougala S, Pujeri US, Kumar S. Standardization of drying temperature and time in hot air oven of gerbera var. impireal. Ecoscan. 2015;9(3&4):695-697.
23. Mayak S, Halevy AH. Flower senescence. CRC Press, Boca Raton US. 1980;132.
24. Meman MA, Barad AV, Varu DK. Technology for dry flower production of calendula (*Calendula officinalis*) flowers. Asian J Hort. 2008;3(1):1-4.
25. Mishra S, Dwivedi AK, Kulshreshtha K. To study the effect of texture of flower petal and moisture content during floral dehydration. Int J Latest Res Sci Technol. 2014;3(2):144-146.
26. Misra P, Banerji BK, Dwivedi AK. Dehydration of Zinnia in an oven for value addition through embedding technique. J Ornamental Hort. 2009;12(3):222-224.
27. Nair B, Singh KP. Aesthetic quality of chrysanthemum (*Dendranthema grandiflora* T.) flowers as affected by the desiccants. J Agro Crop Sci. 2011;2(2):11-14.
28. Nazki T, Imtiyaz N, Lone H, Qadri Z, Nelofer A, Rather ZA. Evaluation of dehydration techniques for product diversification in floral craft in some genera of Kashmir valley. J Ornamental Hort. 2012;15(3&4):259-265.
29. Nazki TI, Lone AR, Gazanfergani. Post dehydration quality and anthocyanins content of dried rose buds cv. first red as influenced by microwave duration, setting time and storage conditions. Agri Update. 2017;1677-1681.
30. Peryam D, Pilgrim F. Hedonic scale method of measuring food preferences. Food Technol. 1957;11(S1):9-14.
31. Pinder R, Namita N. Influence of dehydration techniques on color retention and related traits of Gerbera (*Gerbera hybrida*) flowers. Indian J Agric Sci. 2018;88(5):733-736.

32. Radha R, Mahalakshmi VR. Dehydration techniques for flowers. Int J Appl Res. 2015;1(10):306-311.
33. Raghupathy R, Amuthan G, Kailappan R. Dried flower: Significance Kisan World. 2000;28:39.
34. Renuka SKJ, Arya CK. Effect of drying techniques and embedding media on dried flower quality of rose (Rosa chinensisjacq.) and water lily (*Nymphaea alba* L.) HortFlora Res Spectrum. 2016;5(4):289-294.
35. Rogers BR. Drying of flowers, The Encyclopaedia of Everlastings. Michael Friedman Publishing Group, New York. 1988;199.
36. Rogers J. Flower arranging. Paul Hamlyn, London. 1967;152-157.
37. Sabale SN, Gupta P. Studies on microwave oven drying technique for dehydrating ornamental flowers and foliage. Pharma Innovation J. 2021;10(11):1875-1881.
38. Sanjana NJ, Veen SJ. A study on dehydration of Dutch rose and value-added products. J Pharmacognosy Phytochem. 2020;9(3):1217-1220.
39. Sankari and Anand. Process of making-waste into wealth-dry flower technology. Asian J Hort. 2014;9(2):466-483.
40. Sharma G, Chaudhary SVS, Gupta YC, Dhiman SR, Dogra RK, Gupta RK. Effect of Microwave Oven Drying on Production Quality of Dry flowers of roses. Int J Curr Microbiol Appl Sci. 2019;8:300-308.
41. Sindhuja S, Padmalata T, Padmavathamma AS. Effect of embedding media on production of quality dry flowers in carnation. Plant Archives. 2015;15(1):27-33.
42. Sindhuja S, Padmalatha T, Padmavathamma AS, Prasad ALN. Studies on Different Methods of Drying in Carnation. Int J Curr Microbiol Appl Sci. 2017;6:870-882.
43. Singh A, Dhaduk KB. Effects of dehydration techniques in some selected flowers. J Ornamental Hort. 2005;8:155-156.
44. Singh A, Dhaduk BK, Shah RR. Effect of Different Temperatures and Embedding Media on Flower Dehydration of Zinnia (Zinnia linearis Benth). Indian J Hort Physiol. 2004;9:383-387.
45. Wilson D, Attri BL, Sharma SK. Evaluation of Different Methods for Drying of Chrysanthemum Flowers. Progressive Horticulture. 2015;47:167-169.
46. Wilson D, Sumanthapa, Singh DR. Drying technologies of commercial flowers- An overview. Int J Res Appl Nat Soc Sci. 2016;4(3):111-120.