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Effect Of Various Drying Techniques And Desiccants On The Qualitative Traits Of *Gerbera jamesonii* L. *Rosa indica* L. & *Zinnia elegans* L.

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Abstract

Experiments were conducted to study the effects of various drying techniques and desiccants on the qualitative traits of gerbera *(Gerbera jamesonii), rose (Rosa indica)*, and zinnia *(Zinnia elegans)*. The selected plant material was processed through different drying techniques and desiccants viz., air drying, sand drying, borax drying, sand and borax drying, silica gel drying, sand and silica gel drying, microwave oven drying, hot air oven drying, and the results were recorded. For gerbera and zinnia, sand drying produced good quality dry flowers with the maximum color retention, form, and the least amount of mechanical deterioration. Additionally, a treatment approach combining sand with silica gel resulted in highly acceptable quality, maintaining the color, form, texture, and intactness of the petals of gerbera and zinnia flowers. Conversely, rose flowers dried in hot air oven exhibited adequate color, form, texture, and intactness of the petals.

Keywords: Drying methods, Desiccants, Dry flowers, Value addition, Gerbera, Rose, Zinnia

Introduction

Fresh cut flowers are beautiful and attractive, but maintaining their charm and vibrant appearance for an extended period of time is difficult. To address this issue, the same flowers can be dried and processed into dried flowers that last indefinitely (Saima et al., 2020). Dry flowers are natural flowers processed and preserved in a manner to retain their natural qualities for prolonged periods. They offer an exceptional opportunity to Indian entrepreneurs as the country is endowed with a wide variety of floral materials, inexpensive labour, and a good climate. Dried flowers are long-lasting and have several desirable qualities, such as being decorative, long-lasting, and readily available all year round (Joyce 1998). The availability of abundant plant material is one of the driving force to nurture the hobby of preparing, crafting, and developing dried plant material. If stored properly, dried flowers and foliage have considerable potential as fresh flower substitutes since they stay longer, preserve their beauty, and have a higher market value (Saima et al., 2019)[a].

Simple drying techniques can be used to create dry flowers that retain as much of their color and shape as possible while also reducing their water content, thus maintaining their attractiveness and, consequently, their value (Saima et al., 2023). The dried flowers obtained can be used to make a variety of value-added products, including greeting cards, photo frames, tablemats, coasters, wall hangings, landscapes and different types of flower arrangements (Saima 2022). The floriculture industry is rapidly expanding in the worldwide trade and is primarily composed of dried flowers. This industry has grown significantly, accounting for more than 60% of the profits belonging to the floriculture business (Ranjan et al., 2002). India is rich in floral diversity, which makes it a potential source of raw materials for the sector. A large amount of the raw materials are exported from India to industrialised nations like the UK, Japan, and America (Puri 1995). The USA is a biggest consumer of dried and artificial flowers assessed at (US $2.4 million) yearly followed by Germany and UK (Bhattacharjee ++et al., 2003) In the years 2020 to 2021 (April-November), the total volume of exports was roughly 32,84,910. In the year 2018, the total volume of dried flowers exported around the world was 347,469. The results demonstrate that Indian exporters of dried flowers have great potential to grow their market share and boost their numbers (Vidya et al., 2021).

Gerberas are popular in the world of ornamental gardening and as cut flowers due to their vibrant colors and variety. Their diverse range of hues, including white, yellow, orange, red, and pink, as well as the potential for multicolored petals, make them a versatile choice for decorative purposes. The striking appearance of gerberas, often featuring contrasting black centers, adds to their appeal in floral arrangements and gardens. Roses, often considered the epitome of beauty and elegance, remain the most sought-after cut flowers globally, with their array of colors such as red, yellow, orange, pink, and white, are highly valued in the cut flower market both locally and internationally. Their elegance and symbolic meanings contribute to their persistent popularity across various sectors. Zinnias are indeed prized for their vibrant and varied flowers, as well as their rapid growth and ease of cultivation. Their adaptability and wide range of colors make them a favorite in the cut flower industry. Due to their low maintenance and versatility, zinnias hold a prestigious position among cut flowers, appreciated by both gardeners and florists for their beauty and practicality. (Danish et al., 2012). These flowers are better suited for dry flower production due to their commercial value and excellence in producing various hues of blossoms. However, the process of drying has a significant impact on the quality of dried flowers in addition to flower structure and time of harvest. A study was therefore conducted to ascertain the effect of various drying methods and desiccants on the quality characteristics, including color, form, texture, and intactness, of the petals of *Gerbera jamesonii, Rosa indica,* and *Zinnia elegans*.

Materials and Methods

The study, "Effect of various drying techniques and desiccants on the qualitative traits of *Gerbera jamesonii, Rosa indica* & *Zinnia elegans*", was conducted at the research laboratory of the Department of Botany, Prof Ramkrishna More Arts, Commerce & Science College, Akurdi, Pune, Maharashtra during the years 2023-2024. The following treatments were applied to brightly colored flowers that were carefully selected and collected during the peak of the flowering season. (1) Air drying: flowers were tied to a rope or wire and hung in a well-ventilated area to dry. (2) Sand Drying: Desiccant was layered 2-3 cm on top and below with flowers embedded in it. (3) Borax drying: Flowers were carefully positioned in the container containing desiccant and covered with desiccant again. (4). Sand and borax drying. A mixture of sand and borax (1:1) was prepared, and the flowers were embedded in the desiccant without disturbing the shape of the flowers. (5)

Silica gel drying: Flowers were placed in a container with a tight-fitting lid that had been filled with silica gel (60-120 mesh) and covered to embed in excess silica gel. (6) Sand and silica gel: A mixture of sand and silica gel (1:1) was prepared and the flowers were embedded in the desiccant. (7) Microwave oven drying: Flowers were microwaved for 5-6 minutes at (40oC) and then left at room temperature for 4-5 hours to set. (8) Hot air oven drying: Flowers were kept in a hot air oven at a controlled temperature of 45-50oC, with time and temperature combinations chosen based on flower thickness and compactness. Five flower replicas per treatment were used, and the treatments were graded according to qualitative factors such as color preservation, form retention, brittleness, and intactness of petals on a scale from 1 to 5. The approximate time to dry and overall acceptability with each method were recorded as shown in Table 1-3.

Table-1 Effect of various drying techniques and desiccants on the qualitative traits of *Gerbera jamesonii*

Treatment	Qualitative traits				Approx. drying time(days)
	Color	Form	Texture	Crispness	
Air drying	1	2	1	1	9-10
Sand drying	5	5	5	2	10-12
Borax drying	3	3	3	2	9-10
Sand & borax drying	2	3	2	2	10-11
Silica gel drying	5	5	4	3	5-6
Sand & silica gel drying	5	5	5	3	6-7
Microwave oven drying	4	3	3	2	1-2
Hot air oven drying	4	4	3	2	1-2

Table-2 Effect of various drying techniques and desiccants on the qualitative traits of *Rosa indica*

Treatment	Qualitative traits				Approx. drying time(days)
	Color	Form	Texture	Crispness	
Air drying	2	2	1	1	7-8
Sand drying	3	4	2	2	10-12
Borax drying	2	2	2	2	9-10
Sand & borax drying	2	3	3	2	9-10
Silica gel drying	4	5	4	3	5-6
Sand & silica gel drying	4	4	5	3	5-6
Microwave oven drying	4	5	4	3	1-2
Hot air oven drying	5	5	5	3	1-2

Table-3 Effect of various drying techniques and desiccants on the qualitative traits of *Zinnia elegans*

Treatment	Qualitative traits				Approx. drying time(days)
	Color	Form	Texture	Crispness	
Air drying	1	2	1	1	9-10
Sand drying	5	5	5	2	10-12
Borax drying	3	3	3	2	9-10
Sand & borax drying	2	3	2	2	10-11
Silica gel drying	5	4	4	3	5-6
Sand & silica gel drying	5	5	5	3	5-6
Microwave oven drying	4	3	3	2	1-2
Hot air oven drying	4	4	3	2	1-2

Flower color and form were evaluated on a 5-point scale.
Outstanding (5 points), Very Good (4 points), Good (3 points), Poor (2 points), and Very Poor (1 point)
According to this investigation, the five of texture are described as very smooth (5 points), smooth (4 points), medium (3 points), rough (2 points), very rough (1 point).
The petals were assigned a point value of 1-3 depending on how intact they were, for intact petals (3 points), slightly crisp (2 points), crisp (1 point), respectively.

Results and Discussion

Table 1-3 lists the findings of the effects of various drying techniques and desiccants on the color, form, texture, and crispness of *Gerbera jamesonii, Rosa indica,* and *Zinnia elegans*. It is seen from Table-1-3 that flowers dried by the air drying method were faded in color, deformed in shape, rough in texture, and with crisped petals. The time required by the tested flowers to dry by this method was found to be in the range of 9-10 days. These findings of dark and deformed flower yield are in accordance with earlier reports of Saima et al., (2021)[a] in *Ipomoea quamoclit, Jaquemontia pentantha, Eranthemum roseum, and Matricaria chamomilla.* As reviewed by Verma et al., (2012), when air dried, the petals may shrink and sometimes droop, resulting in the loss of decorative value of the product. Some flowers are well dried by the air drying method, but some lose their colour and become black and stiff as a result of this process. (Saima et al., 2019)[b]. Sand as a desiccant was found to produce dry flower products of good quality in terms of color, form, and texture of gerbera and zinnia flowers. Rose flowers dried using this technique were found to have a satisfactory form and a medium texture. However, slight roughness in the petals was observed, which was acceptable. The drying period was completed in 10-12 days. According to Singh et al., (2004), drying zinnia flowers in sand produced high-quality products with the

retention of the most colour and a smooth petal texture. Our findings are consistent with their findings. This method of drying requires more time for the drying of plant material. Yet it is cost-effective and is convenient to use.

Flowers including gerbera and zinnia dried by using borax as desiccant were found satisfactory in terms of color, form, and texture with a slight crisp nature of petals, and rose flowers dried by this method were found unacceptable in terms of the parameters taken into consideration. The time required to complete the process of drying through this method was found to be in the range of 9-10 days. Our results are in accordance with those of Saima et al., (2020) in *Tagetes erecta, Dianthus caryophyllus,* and *Dendranthema grandiflora.* Saima et al., (2021)[a] reported that borax drying is suitable for maintaining the shape and colour of some flowers. Flowers dried in a combination treatment of sand and borax were found in good form but unacceptable in terms of color, texture, and intactness of petals, as evident from Table 1-3, and the drying process was completed in 10-11 days. These findings are in accordance with Norman (1990). Datta (1997) reported that due to the hygroscopic nature of borax, it could cause bleaching, brittleness, and sometimes burn the flower petals if embedded for a long time. Flowers embedded in silica gel were found acceptable with the maximum retention of color, form, texture, and the intactness of petals. The flowers dry completely in 5-6 days. Our results are in accordance with Saima et al. (2021)[b] in *Crysanthemum morifolium, Cosmos bipinnatus, Callistphus chinensis, Dahlia pinnatus, Dianthus caryophyllus, Geranium belladonna, Helianthus annuus,* and *Tagetes patula.* Silica gel is the best desiccant for getting excellent quality dry flower products that retain color and shape (Verma et al., 2012). The use of silica gel has significantly extended the varieties of flowers to be dried (Cristy Pat 1999). Flowers not suitable for air drying can be well dried using this technique since silica gel is lightweight, streams well, and makes it simple to include all the portions of the flowers for speedy drying.

The treatment combination of sand and silica gel as desiccant was found to be the best method of drying gerbera and zinnia flowers. The flowers were found with a smooth texture, intact petals, and the maximum retention of color and form. Rose flowers dried with this method were found to have less mechanical damage. The flowers took 5-6 days to dry completely. Our findings are in accordance with Chandana et al., (2022) in annual chrysanthemum and gerbera. Rose flowers dried in a microwave oven were found acceptable in terms of color, form, texture, and intactness of petals, whereas gerbera and zinnia flowers were found satisfactory in color, form, and texture. Our findings are in accordance with Reema et al., (2021) in *Gerbera jamesonii* and *Rosa indica.*

Excellent and superior quality dry flower products with respect to color, form, texture, and intactness of petals of rose flowers were obtained in a shorter time when dried by hot air oven drying. However, gerbera and zinnia were found satisfactory in terms of color, form, and texture. Similar reports of the rapid drying of flowers in oven drying were documented by Chen (2000). Hot air oven drying is the best method of drying rose flowers to get the superior quality products and is comparatively faster when compared with the other methods of drying (Saima et al., 2020). The quality of roses comes up as the finest with hot air oven drying. Hot air oven drying is one method where the roses retain their maximum shape, color, and texture (Saima et al., 2021)[c] The best quality of roses with hot air oven drying was also acquired by Saima et al., (2020). Verma (2012) reported that hot oven drying was the best method to obtain superior quality dry flower products.

Conclusion

From the results of the study, it can be concluded that gerbera and zinnia flowers embedded in the treatment combination of sand and silica gel is the best technique for maintaining the qualitative parameters such as color, form, texture, and intactness of the petals to a greater extent compared to other methods of drying used in the study. When dried in a hot air oven, superior and highly acceptable quality rose flowers were obtained. The rose flowers exhibited the best results in terms of all the qualitative parameters considered. The dried flowers obtained following a suitable method of drying can be used in the preparation of diverse commercial artifacts such as dry flower arrangements, artistic greeting cards, wall hangings, landscapes, potpourris, and more. Dry flower technology is a potential avenue for self-employment and can empower people by providing business opportunities. With adequate awareness, motivation, and funding, this industry can encourage physically challenged individuals, housewives, and rural women to start small-scale ventures, enhancing their economic independence and livelihoods. The technology, skills, and investment required for these ventures are relatively modest, making them a significant opportunity to boost creativity and income levels in rural communities. Raising awareness through workshops, exhibitions, and innovative training programs can help individuals achieve sustainable livelihoods and increased income by transforming agro-items into value-added products. This approach not only fosters entrepreneurial spirit but also contributes to economic development in rural areas.

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