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# Studies on the effect of different desiccants on flower quality of dried garden rose flowers

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**Abstract**
An investigation was conducted to study the effect of different desiccant on dehydration of garden rose flowers at the Horticulture laboratory, Department of Horticulture, School of Agriculture, Lovely Professional University, Phagwara, Punjab, India. Six different desiccants *viz*; boric acid, silica gel, boric acid + silica gel (ratio 1:1), sand, perlite and perlite + silica gel (ratio 1:1) along with one control treatment (drying without embedding media) was used in this experiment for drying of garden rose. The experiment was laid out in completely randomized design (CRD) with three replications. Among the different desiccants used for drying garden rose, silica gel was shown to be the most effective medium in terms of quantitative factors, including maximum reduction in flower weight (2.74g), minimum reduction in diameter (1.64 cm) and time taken for drying (100.30 hrs). For qualitative factors such as colour, texture and overall appearance outstanding result were shown in treatment where boric acid was used as desiccant.

**Keywords:** Drying, desiccants, embedding media and rose

## Introduction

Flowers are the beautiful creation of God that expresses several states of human emotions *i.e.* happiness, passion, love, sorrow, admiration, care, good luck, joy, warmth *etc.* The importance and scope of the flower industry are increasing day by day all over the world. Flowers enhances the beauty of the surroundings, gives an eco-friendly atmosphere for living. Fresh flowers are costly and also they are perishable in nature. Moreover, there is a non-availability of fresh flowers and foliage all around the year in all places (Datta, 2019) [2]. To increase the availability of flowers all around the year and also extend flower longevity, drying of flowers is one of the best ways for it. Dried flowers are long-lasting and retain their aesthetic value irrespective of the season (Koley, 2020) [13]. Earlier dried flowers were used in the practice in the form of herbarium made by botanists for the purpose of identification of various species. "OSHANA" - the "preserved flower art" started centuries ago by the Japanese to extend the beauty of living plants. This technology expands to all over the world and is used commercially to dry the flowers.

Rose is the "Queen of Flowers" which is one of the most beautiful creations of nature, belonging to the family Rosaceae and genus Rosa. Nearly 120 species of genus Rosa are available globally and nearly 30,000 cultivars are present in all over the world. Rose represents love, innocence and adoration and it also has special demand in the tradition, social culture and religious places in every country of the world. In export market, cut flower rose has great demand and it is increasing day by day with the increasing living standards, awareness of people and aesthetic sense. In the flower trade Rose stands for top ranking cut flower on the basis of average production and consumption. Across India roses are cultivated as cut flowers, in flower arrangement, pankhuri, rose water, vase decoration, and to prepare gulkand, for making garlands, hair adornment, bouquets, for worshipping the gods, to extract essential oils, and attars (Vijayalaxmi *et al.*, 2017) [20] etc. Dried Roses are used for preparation of pot-puri, preserves, rose vinegar, and rose petal wine in Europe. Rose hips have high ascorbic acid and vitamin C. Consumptive things like jams, jellies, and syrups can also prepared from rose. Industries like essential oils, cosmetics and soaps widely use rose flowers (Irshad *et al.*, 2020) [6]. In addition to these dried rose flowers are used commercially as dry rose flower bouquets, rose flower wreath, gift cover, corsage, button hole, greeting card and dry flower floral jewelry etc. Flowers are dried through different methods like air drying, embedding drying, freeze drying etc. Embedding the flower with desiccant for drying gives better result as compare to air drying in many flowers.

Further different desiccant used for drying of flower results in varying dry flowers in term of texture, appearance and other qualitative and quantitative characters. In the present research, an experiment was conducted in order to find out the effect of different desiccants on dehydration of garden rose.

**Material and Methods**

The present investigation was carried out at the Department of Horticulture, School of Agriculture, Lovely Professional University, Phagwara, Punjab, India. The flowers used for the present study were garden rose, which bear dark red-colored flowers. Evenly matured and uniform-sized garden rose flowers, which were free from infection and infestations, were brought from the Maa Bhagwati flower shop, Jalandhar which is 14km away from Lovely Professional University, Phagwara, Punjab, India. In this experiment fully opened, uniform, garden rose flowers were embedded with six different desiccants such as boric acid, silica gel, boric acid + silica gel (in the ratio 1:1), sand, perlite and perlite with silica gel (in the ratio 1:1) under room temperature. Flowers were also kept without desiccant under room temperature which was considered a control treatment. The average room temperature during the experiment period ranged from 24 $^{o}$C-26$^{o}$C with a relative humidity range of 25%- 35% RH. The sample size of eight flowers per replication was placed on a beaker and was kept under room temperature in a well-ventilated room for each treatment. First the desiccant was poured into the bottom of the plastic beaker and a single flower was gently placed into the medium. Desiccant was then gently and gradually poured all around and over the flower up to 4 to 5 cm above, so as to fill all the spaces in between the petals without disturbing the flower shape. Again another flower was kept and was again fully covered with the desiccant and this process continued until there were three flowers inside the beaker, all fully covered with the desiccant. After embedding the flowers with desiccants, the beakers were kept in room temperature. After dehydration, the beakers were tilted for removing the desiccants over and around the flowers. The dried flowers were picked up by hand, cleaned by inverting them and tapping the base of the flowers with fingers slowly and gently. The remaining desiccants attached to the flowers were finally removed with the help of a fine brush. At the end of drying, the petals of the flowers were gently pressed with the fingers to check the presence of moisture. If the moisture was still present, then the flowers were further exposed for drying for complete moisture elimination. The weight of all samples before placing to treatments was recorded using digital balance and expressed in grams. The following observations were recorded Fresh weight, Dry weight, Fresh flower diameter, Dry flower diameter, Time taken for drying (hrs) and Quality parameters like color, appearance and texture were assessed by means of sensory evaluation. The color and texture of the flower change due to loss of moisture after dehydration and the rating was given based on visual observation. For texture, the rating was given 1, 2, 3, 4 and 5 (1-Very poor, 2- Poor, 3- Good, 4- Very good, 5- Excellent). Whereas for color, visual observation was preferred and a flower color chart was used and noted accordingly. The whole dried flower appearance (such as fine-textured, coarse-textured or slightly rough textured) was observed and noted using the hand sensation method. The data recorded on various parameters were subjected to analysis of variance (ANOVA) using Completely Randomized Design for Experiment at a five percent level of significance. The data were analyzed using the software Goa WASP 2.0 using factor analysis (one-factor analysis for Experiment).

**Result and Discussion**

Data presented in Table 1 and Fig 1-4 revealed the significant effect of different desiccants on the dehydration of rose. Significant differences were observed for the reduction in flower weight after drying, the reduction in flower diameter after drying, and the time taken for drying. The colour, texture, and appearance of flowers after dehydration were also found to vary in different treatments.

**Effect of different desiccants on the reduction in flower weight (g) after drying of rose**

Perusal of data from Table 1 and Fig. 1 revealed the significant effect of different desiccant on the reduction in flower weight after drying. The data showed that after drying, the maximum reduction in flower weight was 2.74 g in treatment $T_3$ (silica gel as desiccant), followed by treatment $T_4$ (2.68g) *i.e.* boric acid + silica gel as desiccant. These two treatments were found to be statistically at par with each other. Treatment $T_2$ (boric acid as desiccant) and treatment $T_5$ (sand as desiccant) were also found to be statistically at par with each other. The reduction in flower weight in these two treatments was recorded as 2.48 g and 2.47 g, respectively. Significantly, minimum reduction in flower weight (1.87 g) after desiccant treatment at room temperature was recorded in treatment $T_6$ (Perlite as desiccant).

The result (Table 1 and Fig. 1) showed that the maximum reduction in the flower weight of roses after drying was recorded in silica gel as a desiccant at room temperature. The reason for this result could be that silica gel absorbs about 40% of moisture and is suitable for flowers with tight petals, such as roses (Chakrabarty & Datta 2020) [1]. Similar results have been reported by Joshi & Jadhav (2020) [9] in Dutch rose and Jeevitha & Jadhav (2021) [10] in *Rosa damascena*. The least amount of flower weight loss after drying in rose was observed in perlite as a desiccant at room temperature. Perlite absorbs less moisture and cannot retain moisture for an extended period of time compared to other desiccant used in the experiment. (Sengul *et al*., 2011) [14].

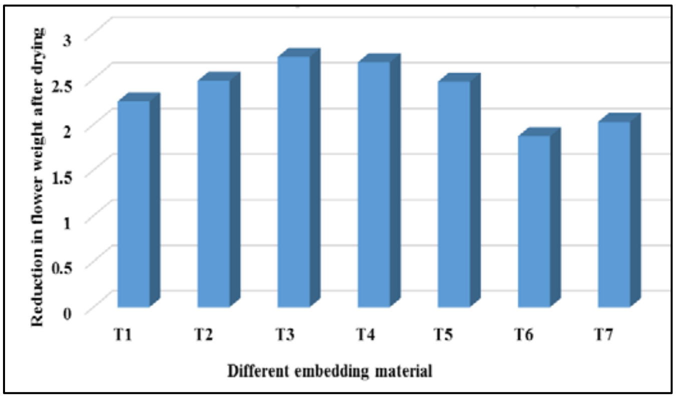


**Fig 1:** Effect of different desiccants on the reduction in flower weight (g) after drying of rose.

*Here: $T_1$ - Room drying, $T_2$ - Boric acid, $T_3$ – Silica gel, $T_4$ – Boric acid + Silica gel, $T_5$ – Sand, $T_6$ – Perlite, $T_7$ – Perlite + Silica gel.

**Effect of different desiccants on the reduction in flower diameter (cm) after drying of rose**

Data presented in Table 1 and fig. 2 revealed the effect of different desiccants on the reduction in flower diameter after drying. The treatment $T_3$ *i.e.* silica gel as desiccant, recorded the minimum reduction in flower diameter (1.64 cm), which was found to be statistically at par with the treatment $T_6$ *i.e.* perlite as desiccant and treatment $T_5$ *i.e.* sand as desiccant. The reduction in flower diameter in these two treatments was recorded as 1.93cm and 2.00cm respectively. Maximum flower diameter reduction (2.66cm) after drying was recorded in treatment $T_1$ control (room drying without desiccant) and was found to be statistically at par with treatment $T_2$ (2.50cm) *i.e.* boric acid as desiccant.

The maximum reduction in flower diameters after drying in rose was recorded in the control (room drying without desiccant) condition. The flowers wither and shrink in room conditions after drying, which is why the flower diameter indicates maximum reduction after drying. The same result was obtained by Katoch *et al.*, (2010) [11] in acroclinum flowers, Singh and Dhaduk (2005) [17] in some flowers and Sherpa (2016) [15] in African marigold.

The result showed that the minimum reduction in flower diameter was reported in treatment where silica gel was used as a desiccant. Silica gel is a fine powder which only absorbs moisture but the condition of the flower remains good. So, the shrinkage in diameter is not much. Silica gel is used to avoid petal shrinkage and preserve the better flower petal colour and shape (Koley 2020) [13].

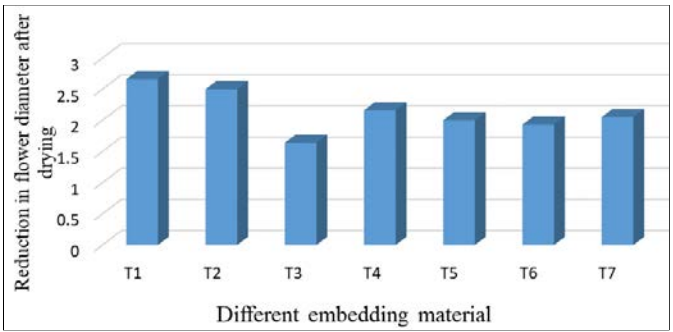


**Fig 2:** Effect of different desiccants on the reduction in flower diameter (cm) after drying of rose.

*Here: $T_1$ - Room drying, $T_2$ - Boric acid, $T_3$ – Silica gel, $T_4$ – Boric acid + Silica gel, $T_5$ – Sand, $T_6$ – Perlite, $T_7$ – Perlite + Silica gel.

**Effect of different desiccants on the time taken for drying (Hrs.) of rose**

Significant differences were observed in time taken for drying of rose flowers with the application of different desiccant treatments (Table 1 and Fig. 3). Maximum time for effective drying of rose flower (268.25hrs) was recorded in treatment $T_1$ *i.e.* control (room drying without desiccant). Among different desiccants used, the minimum time for effective drying was recorded in treatment $T_3$ (100.30hrs) *i.e.* silica gel as desiccant, which was followed by the treatment $T_4$ (122.45 hrs) *i.e.* boric acid + silica gel as desiccant.

Rose flowers took the longest to dry in control (room drying without desiccant) conditions, according to Table 1 and Fig. 3. Humidity is present in the room. As a result, the flowers take longer to dry than the embedding material. Similar findings are observed in roses by Koksall *et al.*, (2015) [12] and in some flowers by Dilta *et al.*, (2011) [5].

Silica gel desiccant took shortest amount of time for rose flowers dehydration. The reason for this is that silica gel has a massive microscopic pore network that is interconnected. These microscopic pores retain the most moisture. This is referred to as capillary condensation. Sindhuja*et al.*, (2015) found these results in carnation, Jagadeeswari*et al.*, (2021) in gerbera, and Chandana, (2021) in chrysanthemum and gerbera.

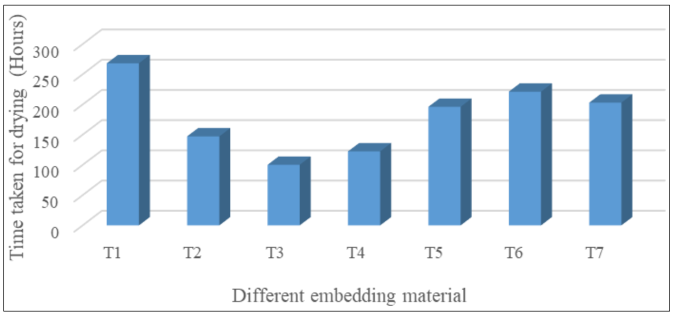


**Fig 3:** Effect of different desiccants on the time taken for drying (Hrs.) of rose.

*Here: $T_1$ - Room drying, $T_2$ - Boric acid, $T_3$ – Silica gel, $T_4$ – Boric acid + Silica gel, $T_5$ – Sand, $T_6$ – Perlite, $T_7$ – Perlite + Silica gel.

**Effect of different desiccants on texture and appearance of rose flower after drying**

Rose dried with boric acid as desiccant in treatment $T_2$ at room temperature was found to be excellent with a fine textural appearance and after drying the colour of rose changed to magenta red. Treatment $T_5$ (sand as desiccant) and treatment $T_6$ (perlite as desiccant) showed a poor result in terms of texture of dry flower with bronze red and madalim brown colour appearance respectively. (Table 1 and Fig. 4)

After drying of rose, the quality parameters of texture, colour, and overall appearance in boric acid revealed excellent results. Boric acid is used to prevent flower shrinkage and morphological changes. Plant materials such as bougainvillaea, candytuft, chrysanthemum, dahlia (pompon), gerbera, marigold, and roses can be embedded in boric acid without changing their shape, colour, texture, or form (Kant, 2018) [10]. Singh *et al.*, (2004) [18] discovered that drying zinnia flowers in boric acid resulted in high-quality dried flowers with desirable colour and petal texture.

Rose was discovered to be of poor quality after drying in both sand and perlite. The texture of the flower changes and becomes rough after drying in sand and perlite; the red colour fades to brown, and it does not look any better visually. Because sand and perlite have larger particle sizes, they may not retain as much moisture as silica gel and borax. It could affect the colour and texture of flowers. Vidhya *et al.*, (2021) [19] and De *et al.*, (2017) achieved the same result in dehydration of fresh flowers, foliage and orchids respectively.

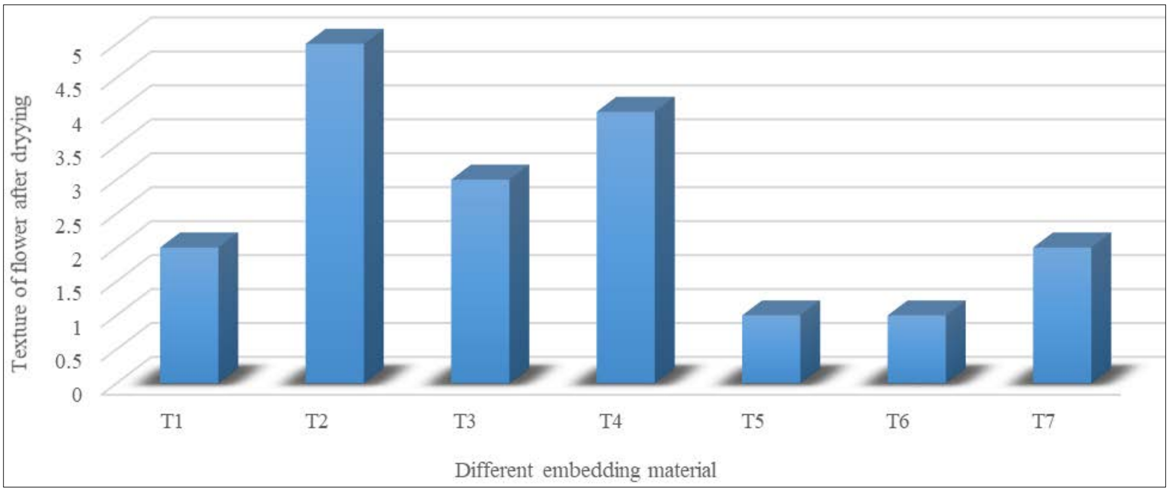


**Fig 4:** Effect of different desiccants on texture and appearance of rose flower after drying.

*Here: $T_1$ - Room drying, $T_2$ - Boric acid, $T_3$ – Silica gel, $T_4$ – Boric acid + Silica gel, $T_5$ – Sand, $T_6$ – Perlite, $T_7$ – Perlite + Silica gel.

**Table 1:** Effect of different desiccants on reduction in flower weight, reduction in flower diameter, time taken for drying, texture of flower and appearance of flower after drying of rose.

| Treatment (embedding material) | Reduction in flower weight after drying (g) | Reduction in flower diameter after drying (cm) | Time taken for drying (hours) | Texture of flower after drying | Appearance of flower after drying |
|---|---|---|---|---|---|
| $T_1$ (Room drying without embedding material) | $2.25^{c}$ | $2.66^{a}$ | $268.25^{a}$ | 2 | Colour - Rasin red<br>Texture- slightly rough. |
| $T_2$ (Boric acid) | $2.48^{b}$ | $2.50^{ab}$ | $147.35^{e}$ | 5 | Colour - magenta red<br>Texture - fine texture. |
| $T_3$ (Silica Gel) | $2.74^{a}$ | $1.64^{d}$ | $100.30^{g}$ | 3 | Colour - wine red<br>Texture - medium texture |
| $T_4$ (Boric Acid + Silica Gel) | $2.68^{a}$ | $2.16^{bc}$ | $122.45^{f}$ | 4 | Colour - dark red<br>Texture - slightly Coarse |
| $T_5$ (Sand) | $2.47^{b}$ | $2.00^{cd}$ | $196.20^{d}$ | 1 | Colour – bronze red<br>Texture – Coarse texture |
| $T_6$ (Perlite) | $1.87^{e}$ | $1.93^{cd}$ | $221.25^{b}$ | 1 | Colour – medalim brown<br>Texture – rough texture |
| $T_7$ (Perlite + Silica Gel) | $2.03^{d}$ | $2.05^{c}$ | $203.20^{c}$ | 2 | Colour – rosewood red<br>Texture – slightly rough |
| CD (5%) | 0.078 | 0.389 | 1.812 | | |

*The texture of flowers after drying were given rating 1, 2, 3, 4 and 5 (1-Very poor, 2-Poor, 3-Good, 4-Very good, 5-Excellent).


**Plate 1:** Measuring initial weight of fresh garden rose flowers

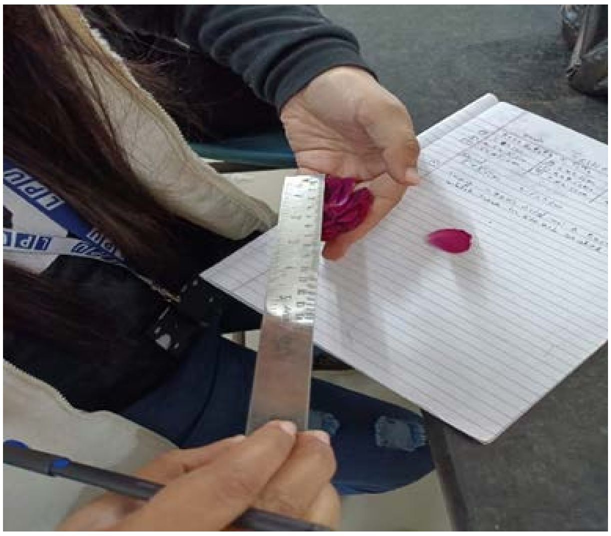

**Plate 2:** Measuring initial diameter of fresh garden rose flowers

**Plate 3:** Embedded dried rose flower at room temperature

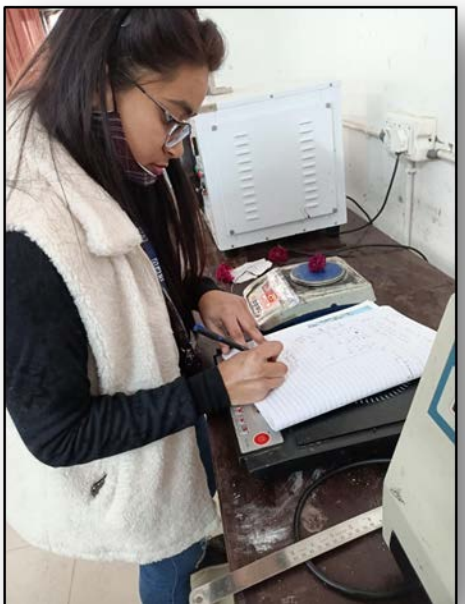

**Plate 4:** Measuring weight of flowers after drying

**Plate 5:** Measuring diameter of flowers after drying

## Conclusion

Silica gel as a desiccant was found to be an ideal method for maximum reduction in flower weight after drying, avoid shrinkage and get a minimum reduction in diameter after drying and the quickest method of drying for garden rose flowers. The boric acid was reported as an excellent drying media for retaining colour, texture and overall appearance of garden rose flowers after drying.

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