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Popular Article

The Art and Science of Dry Flower Production

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Introduction

The natural, dried and preserved flowers offering lasting value that can be cherished over an extended period (Sheela, 2008). The dry flower industry has emerged as a significant sector for export, accounting for 15% of the global floral market. The Netherlands leads in exporting dried flowers to the USA, followed by Mexico, India, Colombia and Israel. Major dry flower exported from India are rose petals, marigold flowers, chrysanthemum, carnation, jasmine buds, lavender flowers and babys breath used in otpurries, wreaths, floral arrangements and crafts that are exported to USA, UK, Germany, Japan and Australia. The country has exported 19677.89 MT of floriculture products to the world for the worth of Rs. 717.83 Crores in 2023-24. In India, the dry flower industry is predominantly concentrated in Tamil Nadu, West Bengal, Andhra Pradesh and Karnataka. Exporting companies based in Kolkata (West Bengal), Tuticorin (Tamil Nadu), Mumbai (Maharashtra) and Hyderabad (Andhra Pradesh) are generating returns that are 10 to 15 times higher than those from domestic markets (Verma *et al.*, 2012). Dry flower production is labor-intensive providing significant self-employment and job opportunities for a large workforce and fostering the growth of subsidiary industries. While fresh flowers are expensive, short-lived and seasonally available dried flower products are long-lasting and maintain their aesthetic appeal year-round. These dried flowers are often exported as assortments of value-added products. In the Indian floriculture trade the dry flower industry is particularly promising accounting for approximately 70% of the total floriculture market with demand increasing annually by 8-10%.

Globally the need for dried flowers and other plant parts is increasing for the decoration of living and working spaces. Floral craft items such as cards, floral segments, wall hangings, landscapes,

calendars and potpourris can be created using the dried flowers and foliages. Various drying methods allow for the preservation of numerous flowers, foliages, hard shoots, seeds, barks, grasses and more, enabling the creation of diverse commercially valuable artifacts.

Scope and opportunities of dry flower industry

Dried flowers and plant parts are long-lasting, biodegradable and easily accessible making them highly valuable in the global dry flower industry particularly in the hilly regions of India. Approximately 80% of flower species can be successfully dried and preserved while the widespread availability of various wild plant materials further supports the industry's growth. This sector has immense potential to create employment opportunities for thousands especially housewives and rural women by enabling the creation of numerous aesthetic and decorative products using dry flower technology. To maximize this potential, it is crucial to enhance market value, provide financial assistance from the government and offer training for entrepreneurship development. Support from GOI through schemes like the Merchandise Exports from India Scheme (MEIS) and Export Promotion on Council for Handicrafts (EPCH). Raising awareness about the benefits of dry flower technology through workshops, exhibitions and seminars is also essential.

Advantages of dry flowers

Dried flowers and their products can be preserved and cherished for many years with minimal care. The raw materials are available year-round and dried plant materials offer unique indoor decoration. Unlike fresh flowers, dried flowers are not dependent on weather or season and once arranged they require no further alteration. They are more affordable than fresh flowers, eco-friendly, biodegradable and long-lasting requiring minimal maintenance. Dried flowers can be used to create a variety of products such as bouquets, floral arrangements, collages, floral balls, greeting cards, festive decorations and potpourris. These dried arrangements are also time-saving and well-suited for modern lifestyles.

Stages of harvesting

The quality of dry flowers is primarily influenced by the harvest stage which should be carefully considered before applying any drying technique.

Flower	Optimum harvesting stage
Strawflower, Globe, Amaranth, Salvia and Chrysanthemum.	Bud stage or partially open stage as these flowers continue to open while drying.
Rose	Flowers harvested at half bloom stage gives superior quality of dry roses and require minimum time for drying with better colour retention due to colour stability at this stage
Helichrysum	Fully opened stage of flowers took lesser time for drying



	than those harvested at tight bud and half open stage.
Foliage	Harvesting foliage in their active phase is preferable because at this stage the leaves will be at peak maturity

Methods of drying

1. Air drying

Air drying also known as the "Upside Down" or "Hang and Dry" method is the simplest and most cost-effective way to dry flowers. In this method, flowers are hung upside down or laid flat on blotting sheets or newspapers either in the dark or in sunlight. The drying process takes 1-2 weeks depending on moisture, temperature and humidity. Although this method is easy and inexpensive it takes longer and some flowers may lose color becoming dark and stiff while their stems typically remain straight after drying.

Plant material suitable for air drying with approximate drying time

Crop	Drying duration (days)
Rose and Gerbera	10-12
Gladiolus and Carnation	9-10
Marigold, <i>Acroclinum</i> and <i>Hydrangea</i>	8-9
Orchids, Liliun, <i>Helianthus</i> , Salvia, <i>Limonium</i> and Cosmos	7-8

2. Embedded drying

In this method flowers retain their color and shape well. After harvesting and preparing the flowers are placed in desiccants such as sand, silica gel, boric acid, borax, sawdust, alum powder, aluminum sulfate or corn granules. The drying process can be accelerated using methods like sun drying, solar dryers, hot air ovens or microwave ovens. Desiccants should quickly remove moisture from the plant parts without reacting with the water vapor released during drying. They should have an ideal particle size of 0.02-0.2mm (20-200 mesh), be heavy enough to maintain the original shape of the plant parts, not stick to them and be cost-effective.

Embedded drying procedure

i. Sun drying

In this method, plant material is embedded in a desiccant-filled container and exposed to sunlight daily for rapid dehydration. Flowers like small zinnias, marigolds, pansies and pompon chrysanthemums can be placed upside down in embedding media and dried in 3-4 days.

ii. Hot air oven drying

A Hot air oven at 40-50°C is used to dry flowers in an embedded condition. Temperature is key as higher heat speeds up dehydration but can degrade pigments like chlorophylls and anthocyanins.



Plant material suitable for hot air oven drying with optimum temperature and approximate drying time

Crop	Drying Temperature (°C)	Drying duration (hours)
Antirrhinum and Gerbera	50	12
Lilium and Helianthus	45	12
Anthurium, <i>Dendrobium</i> , Zinnia and Gomphrena	45	10
Ixora, Chrysanthemum and China aster	50	9
Rose	45	13-14

iii. Microwave oven drying

Microwaves quickly remove moisture from organic materials by agitating water molecules preserving color and shape. Flowers should be embedded in a desiccant and placed in an open microwave-safe container. A cup of water in the oven prevents excessive drying. After drying a standing time of 10 minutes to a few hours should be given. The dried petals are then protected from air moisture by spraying them with hair spray or transparent lacquer.

Plant material suitable for microwave oven drying with approximate drying time

Crop	Drying temperature (°C)	Drying duration (minutes)
Chrysanthemum, Calendula, Zinnia, Gulmohar and Asters	45	4-5
Dahlia and Gladiolus	45	5-6
<i>Dendrobium</i> orchids	50	2-3
Ixora and China aster	45	3-4

3. Press drying

For press drying place flowers or leaves are placed between two sheets of blotting paper inside an herbarium press with a layer of corrugated paper over each. After staking 3-4 layers the press bolts are fastened. The flowers and blotting paper must be turned every day to prevent fungal growth. Hot air oven at 45-50 °C is used to speed up drying. This drying technique is suitable for flowers where shape retention is not needed.

4. Water drying

Water drying is ideal for flowers prone to petal shattering after drying. In this method the flower stems should be placed in a few inches of water to keep the petals intact. The container is stored in a dry, warm, and dark place for 7-10 days to allow natural drying. This technique works well for



flowers like hydrangeas, yarrow, Bells-of-Ireland and celosia.

5. Glycerin drying (Glycerinization)

Glycerin is highly effective as an osmotic reagent for drying plants preserving flexibility, form and texture. This makes the plant material less brittle and less prone to shattering or mechanical damage compared to traditional drying methods. To use glycerin for drying one part glycerin has to be mixed with two parts warm water. The lower leaves are stripped from the stems and they should be submerged in the glycerin solution to a depth of 5 cm. The drying process takes 6-7 days depending on the weather. This method is suitable for plants like eucalyptus, magnolia, maple leaves, hydrangea, gypsophila and cornflowers.

6. Freeze drying

Freeze drying or lyophilization uses lyophilizers to dry flowers by lowering their temperature and removing moisture through a vacuum. This sublimation process preserves the flower's color, fragrance, texture and structure without liquid water resulting in flowers that closely resemble fresh ones. The process which can take up to 4 weeks, is effective but costly. It's ideal for flowers like carnations, snapdragons, roses and gypsophila. Approximate cost of a lyophilizer is around 1-1.5 lakhs with a capacity to dry 20 kg to 3000 kg flowers.

Packaging, handling and storage

Dry flowers and foliage are delicate and brittle requiring careful handling and storage. Packaging should protect them from moisture and rough handling with moisture-proof containers and silica gel is recommended. To preserve color dried flowers should be stored away from direct sunlight. Air-dried flowers can remain hanging while silica gel-preserved flowers should be stored in airtight containers. Newspaper or tissue wrapping is suitable for air-dried or borax-dried materials when stored in cardboard boxes. It should be ensured that plant material is fully dry before storage to prevent rotting. Properly stored dried flowers can last several months but should be discarded when they fade.

Research on dry flower production at ICAR-IIHR

ICAR-IIHR research has been undertaken to standardize simple drying methods that can be adopted by farm women and others without having to invest heavily on the equipment. Orchid flowers (*Dendrobium* cv. Emma White) has been used to standardize the drying methods and desiccants. Flowers were dried in hot air oven at 50 °C and in microwave oven. Different types of desiccants were tried alone and in combinations *viz.*, silica gel, borax powder, sand alone and a combination of silica gel: borax powder: sand (1:1:1 v/v). Flowers embedded in silica gel and microwave dried was found best for physical parameters *viz.*, weight loss, moisture loss, moisture retention. This is because of high temperature and hygroscopic nature of silica gel that helped in rapid removal of moisture from flowers while hot air oven dried flowers with silica gel as desiccant was found best for quality parameters *viz.*, colour retention, shape retention, less mechanical damage and good overall acceptance. This was due



to the fact that in hot air oven moisture was steadily removed without compromising the structural integrity with silica gel as the desiccant. The uniform temperature in the oven ensured rapid and consistent moisture removal while preserving the quality of the flowers. The dried flowers were resin encapsulated and paper weights and key chains were made.



Selection of uniform sized flowers



Embedding flowers with desiccants (sand, borax and silica gel)



Drying of flowers in microwave oven for 6 minutes or hot air oven at 50 °C for 48 hours



Dendrobium flowers after drying



Flowers of *Dendrobium* orchid florets harvested at the half-open and three-fourth open stage, dried in silica gel at 42°C for 48 hours retained their original greenish-white color at the base of the outer sepals and maintained higher flexibility (47°). In contrast, the fully open florets' sepals turned straw-colored and **Paper weight and keychain prepared from dried flowers** showed reduced flexibility (15°).

Three *Dendrobium* varieties were evaluated for dried flower qualities. Flowers of *Dendrobium* var. Sonia 17 had well preserved color, shape, size and texture with 3% moisture and a shelf life of



over 4 months, when embedded in silica gel and dried in hot air oven at 42°C for 48 hours. In contrast, *Dendrobium* var. Emma White turned from bright white to straw color and var. Madam Pompadour exhibited a charred effect after drying.

Carnation variety Dona retained its original dark pink color and texture when dried in silica gel. Flowers harvested at the paintbrush stage were best for preserving color, texture, shape and size.

Celosia spicata and *Celosia plumose* inflorescences harvested at full color stage produced glossy smooth-textured dried flowers through shade air drying with a shelf life of seven months in open storage at room temperature. Air drying under shade was found to be effective for obtaining superior quality dried inflorescences in cockscomb var. Magenta while it led to discoloration in var. White.

Hot air oven drying with silica gel at 40°C for 24 hours produced improved quality dried cosmos petals with a bright orange color and green foliage with a smooth texture.

Showy bracts from seven bougainvillea varieties harvested at their peak size, shape and color after dew drying were evaluated and var. Partha (dark purple) produced smooth bright-colored bracts when press dried making them suitable for greeting cards, wall frames, tea coasters and glass art.

Conclusion

Dried flowers present a year-round income opportunity for farmers regardless of weather conditions. Simple drying methods can preserve the color and shape of flowers, making them valuable for various craft items like greeting cards, calendars and interior decorations. Flowers dried using silica gel or oven drying are particularly well-suited for floral arrangements while skeleton leaves enhance any arrangement. This business offers immense potential especially for unemployed youth, housewives and rural women who can start small-scale home-based ventures. It's an underexplored market in India with significant international potential. The technology and investment needed are minimal making it accessible to socio-economically weaker sections and physically handicapped individuals. Proper training, motivation and funding can empower these groups to create profitable craft items and sustainable livelihoods. Workshops, exhibitions and training programs can raise awareness and help individuals turn agro-products into value-added goods.

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