

**REVIEW ARTICLE**

# Dry Flowers – A Boon to Floriculture Industry

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Received: 21.05.2018

Accepted: 12.07.2018

**ABSTRACT**

Dry flowers in floriculture have been gaining impetus with the rapidly growing floriculture industry in India. Value addition in form of floral or plant part drying increases the economic value and consumer appeal of floricultural commodities. Dried flowers are exported as assortments of value added items. In this review the scattered information and data on Indian market of Dried flowers, plants and plant materials suitable for drying and different drying methods of flowers and other ornamental plant parts, packing and transportation are being compiled which would be useful for further studies. This can eventually be helpful in drawing the attention of the researchers and scientists to work on it.

**Keywords:** Dry flowers, postharvest, value addition, floriculture, drying methods**Citation:** Sharvani, Ch.S.R. and Sree, G.D. 2018. Dry flowers- A boon to floriculture industry. *Journal of Postharvest Technology*, 6(3): 97-108.**INTRODUCTION**

Dry flowers are naturals, dried and preserved with an everlasting value that can be cherished for longer period (Sheela, 2008). Dry flower industry has been identified as a potential area for export and it constitutes 15% of global floral business. Netherlands ranks first in export of dried flowers to USA followed by Mexico, India, Colombia and Israel. In India, export items include more than 70% of dry flower products and these are exported to USA, Europe, Japan, Australia and Far East. Export of dried flowers and plants from India is about Rs 100 crore per year. The dry flower industry is about five decade old and was brought to India by Britishers. In India, dry flower industries are mostly concentrated in Tamil Nadu, West Bengal, Andhra Pradesh and Karnataka. Exporting companies at Kolkata in West Bengal, Tuticorn in Tamilnadu, Mumbai in Maharastra and Hyderabad in Andhra Pradesh are earning 10-15 times higher returns than domestic markets (Verma et al., 2012). Dry flower production is labour intensive, provides self employment and job oppurtunities for a large number of workers and aids in development of subsidiary industries. Fresh flowers though quite attractive, are very expensive and short lived as well as available only during a particular season. Dried flower products on the other hand are long lasting and retain their aesthetic value irrespective of the season (Malcolm, 1994).dried flowers are exported as assortments of value added items. A part from obvious uses in boquets and flower arrangements, dried flowers can be used in topiaries, swags, collages, wreaths, flower-pictures, greeting cards, pomanders, festive decorations and as pot pourii.

**DRIED FLOWERS AND PLANT PARTS IN BULK**

This is a high volume, well established end of the business, which has the market outlet in retail florists and supermarkets. The varieties of plants used include globe amaranth, celosia marigold etc.

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## **Potpourri**

It is a mixture of dehydrated flowers, berries and leaves, exported either as raw or scented. It is usually packed in small muslin bags and placed in wardrobes and drawers as clothes fresheners. This is also used as a natural scent and as a decorative feature.

## **Arrangements with dried plant materials**

This is used in wreaths, topiaries and swags where artistic input is the determining factor. The common products used in India are cotton pods, large pine cones, dried capsicums, ornamental gourds, seed pods and heads, exotic grasses and leaf material, unfurling fern fronds, bark and twigs.

## **Floral handicrafts**

This includes collages, flower pictures, cards and covers. Innovative items like candle stands, table lamps, picture frames, floral jewellery, mirror decorative, arrangements in glass containers are also made.

## **TECHNIQUES OF FLOWER DRYING**

Various techniques involved for the production of dried ornamental plant material includes air drying, press drying, embedded drying, oven drying and freeze drying etc. The NBRI, Lucknow is a pioneer institute in India which works on the dehydration of flowers, foliage and floral crafts. Various dehydration techniques have been developed by which flowers, twigs, branches, foliage etc retain their fresh look for several months or years (Mishra et al 2003).

### **Air drying**

The air drying is a very common method of drying where plant materials are attached to rope/wire and are kept in hanging position either in dark or in the sun for quick drying. Air drying requires a warm clean dark and well ventilated area with low humidity (Raghupathy et al 2000). Flowers may also be spread over blotting sheets/ news papers and kept in dark or in the sun (Datta 1997). Bryan (1992) reported air drying as the earliest method to dry rose, larkspur, statice and straw flower. For air drying flowers of good quality, a slightly immature stage should be selected and thereafter stripped off the foliage and hung upside down in a warm dark area. The weak flowers, if any, are to be wired before drying (Perry 1996). Crisp textured flowers of helichrysum and statice can be easily dried either by hanging them in an inverted position or by keeping them in a container positioned erect till they get desiccated (Bhutani 1995). Flower heads of hydrangea and gypsophilla can be dried by putting their stems in a little water (Westland 1995). Water drying, which usually seems like a contradiction in terms, gives fairly good results with flowers, eg hydrangeas, cornflower, gypsophilla and a few others (Desh Raj 2006). Blue and yellow flowers retain their colour when air dried but pink flowers fade. According to White et al (2002) more fleshy flowers and foliage took more time for drying.

### **Press drying**

In press drying, the flowers and foliage are placed between the folds of news paper sheets or blotting papers giving some space among flowers. These sheets are kept one above the other and corrugated boards of the same size are placed in between the folded sheets so as to allow the water vapour to escape (Bhutani 1990). The drying time can be reduced if the

sheets are kept in oven at an appropriate temperature (Datta 1997). The microbial attack is a common feature because the moisture and cellulose of the paper serve as the potential substrate for the sporulation and growth of these organisms. Though the flowers and foliages become flat after press drying, yet this material can be used for composing floral craft items like greeting cards, floral designs and other art creations which may be framed for wall pin-ups (Bhutani 1990). Gill et al (2002) reported the time required for press drying of different flower crops and they concluded that rose, carnation and helichrysum required 120, 132 and 72 hours, respectively, for press drying. Kher and Bhutani (1979) found that press drying in oven at 35-39°C for 48 hours was optimum for pansy, whereas, 24 hours for the leaves of silver oak, thuja, adiantum, nephrolepis and flowers of hibiscus, haemotoxylon, calliandra, marigold and *Cassia biflora*. A temperature of 40-44°C for 24 hours was optimum for *Euphorbia leucocephala*, *Galphimia nitida*, *Lantana camara*, *Lantana depressa* and *Lantana montevidensis* while it was 45-49°C for flowers of *Ixora* sp and *Mussaenda* sp. Lourdasamy et al., 2001 described press drying as the earliest method of preserving flowers and suggested that flowers like candytuft, chrysanthemum, lantana, rose, verbena, euphorbia and leaves like thuja, ferns, silver-oaks, etc are suitable for press drying.

### Embedded drying

Sand, borax, silica gel, sawdust, perlite and combination of these are used as media for embedding. Among these, sand and borax are cheaper but they take more time for drying. For delicate flowers like roses, dahlia, carnation etc, silica gel is the ideal drying agent. Among the desiccants like sand, cornmeal, borax and silica gel used, silica gel has been found to be the best. Desh Raj (2006) found that it is difficult to avoid shrinkage and changes in morphology of the dehydrated ornamental plant material during hang-drying mainly due to loss of moisture from the cells. The flowers and foliage are to be embedded very carefully in various desiccants such as sand or silica gel in a suitable container during air drying to avoid shrinkage and other morphological changes (Datta 1997). Singh et al (2004) found that drying of zinnia flowers in sand resulted in good quality of dried flowers with attractive flower colour and smooth petal texture. Silica gel is composed of a vast network of interconnecting microscopic pores, which attract and hold moisture by a phenomenon known as physical adsorption and capillary condensation. Through by this phenomenon, it acted as a dehydrating agent (Safeena et al 2006b). Trinklein (2000) reported that since silica gel dried flowers quickly, so more flowers could be moved in and out of the mixture during a single season. Silica gel can be reused, the crystals were blue when dry and turned pink after absorbing moisture. If silica gel was to be reused again, it should be warmed up in an oven till the crystals turned blue. Sujatha et al (2001) reported that borax crystals and sand in the ratio of 1:1 volume by volume basis was the best combination as it helped to regain brightness and colour. Among the various desiccants used to dry Indian blue water lily flowers, fine sand was the best (Geetha et al 2002). Fine sand has been found to be the best material for embedding because it is easy to handle, heavy and doesn't react with water vapour (Datta 2001).

### Oven drying

In this method, plant material is kept at controlled temperature for a specified time typical of the plant species. Temperature plays an important role in the drying of flowers and other ornamental plant parts by influencing both qualitative and quantitative parameters. Singh et al (2004) studied the effects of different temperature treatments on drying of zinnia (*Zinnia elegans*) and reported that higher the temperature, more faster would be the dehydration process owing to the fact that drying of flowers at higher temperature would accelerate degradation of all pigments viz chlorophylls, carotenes, xanthophylls and anthocyanins. Oven drying of china aster flowers using white sand as the medium was the best for retention of original colour, shape and texture of dried flowers (Raju and Jayanthi, 2002). Dahiya (2003) reported that the best quality dried flowers of chrysanthemum could be obtained by embedding them in silica gel and keeping them at 50°C for 48 hours in the hot air oven.

**Table 1. Oven drying of flowers subjected to different temperatures**

Flowers	Temperature	Drying Time	References
French marigold	45-49°C	72 hours	Ranjan and Misra 2002
African marigold	45-49°C	96 hours	Ranjan and Misra 2002
Bougainvillea	35-39°C	48 hours	Kher and Bhutani (1979)
Pompon, dahlias and narcissi	35-39°C	72 hours	Sheela (2008)
Helipterum, Helichrysum, Candy tuft, Gerbera, Gompherena, Limonium	45-49°C	48 hours	Sheela (2008)
China aster, Euphorbia, Larkspur, Rose bud, Zinnia	40-44°C	48 hours	Sheela (2008)

### Microwave oven drying

Plant materials embedded in Silica gel is kept in oven for a specific time. Drying is very fast. The drying time is standardized for some plant species (Sheela, 2008). After the particular drying time, containers are taken out of the oven and kept at room temperature for a specific period so that moisture gets evaporated and plant materials get fully dried. This process is called setting time. Rothenberger (2000) advocated a cup of water in the oven before starting helps to prevent excessive drying. Microwave oven dried flower petals should be sprayed with hair spray or lacquer to prevent absorption of air moisture. White et al (2002) reported that microwave oven dried flowers looked fresh and more colourful than obtained by other methods.

### Glycerine drying

Glycerine drying has been used by several workers especially to preserve foliage. It was comparatively less expensive and has a high water attracting capacity. Many types of foliage have been successfully preserved by either immersing leaves or placing crushed stems in a 33 per cent glycerol solution. In glycerine drying, the quality of the product was good as moisture in flower was replaced by a mixture of water and glycerine (Paul and Shylla 2002). The use of glycerine in drying is reported to be successful with most foliage. Glycerine serves as a good source for micro-organisms, so a pinch of antibiotic is necessary to prevent microbial growth in the dried specimens.

**Table 2. Time duration of microwave drying for different flowers**

Flowers	Time
Snap dragon, China aster, Dahlia, Chrysanthemum, Bougainvillea, Gerbera, Gladiolus, Pride of India, Narcissus	3 minutes
Delphinium, Straw flower, Phlox, Statice	2.5 minutes
Gulmohar, Helipterum, Ixora	2 minutes
Combretum comosum, Petrea volublis	1 minute
Water lily	4 minutes
Rose	2.5 minutes

### Freeze drying

The most effective method of flower preservation is freeze drying. Freeze drying relies on the principle of sublimation, whereby

ice held under conditions of partial vacuum (less than 4.58 torr) and low temperature (less than 0°C) will evaporate on heating without going through a liquid phase. The absence of liquid water during the dehydration process means that undesirable chemical reactions will not occur. Hence, colour and even fragrance are retained in the dried article (Dubois and Joyce 1989). In this process, the flowers are placed into a refrigerated chamber and the temperature of the chamber is lowered below freezing. A vacuum is then created in the chamber, causing the moisture in the flowers to sublime, or change from solid to gaseous form. The water vapor is then collected in a separate chamber and the dried flowers are allowed to slowly warm to room temperature. This process takes several days (Trinklein 2006). Bridal bouquets could be preserved without any damage by the technique of flower drying (Ruth 2000). Chen et al (2000) evaluated the effect of different freezing time (2 and 4 hours), freezing temperature (-35°C) and vacuum drying temperature (27°C, 37°C, 47°C) on colour, moisture content, stem and petal.

### Bleaching, Dying and painting

Bleaching and dyeing are the two important processes related to commercial dry flower production. Bleaching is important in processing of plant material that is to be marketed. Various bleaching agents including oxidative bleaches like sodium chloride, hypochlorite, peroxidise and reductive bleaches like sulphites are used widely to remove colour from plant tissues. Sodium chlorite (10%) is an effective bleaching agent for Gomphrena followed by hydrogen peroxide (30%) (Lourdusamy, 1998). Dyeing of dried plants is a creative fun and they are highly adaptable for home decoration. The lasting quality is one of the greatest assets. Both natural and artificial dyes are popularly used. Natural dyes are obtained from onion skin, marigold petals, rasp berries, blue berries, mulberries, strong tea, sun flower hulls, Iris flowers. Artificial dyes like Basic Methylene Blue, Basic Auromine yellow and basic Rhodamine were suitable dyes for Gomphrena (Lourdusamy, 1998). Dye could be added to water used in air-drying process. Eg. Hydrangea and Gypsophila. Painting of dried plant materials can be done using enamel, posterpaint, interior paint and tube paint

### STORAGE AND CARE OF DRIED PLANT PRODUCTS

The dried flowers and dry floral crafts have to be stored in dry cardboard boxes along with silica gel pouches to avoid dampness. The floral crafts made with dry flowers need polyethylene lining to protect from insect pest and outside humidity on display. Dried materials have to be made dust free by cleaning with soft brush or dry cloth. Cones, seed pods, berries and large foliage can be given a protective coating with varnish or shellac. This improves their appearance. In some cases, a dried part may get detached. In that case, it can be fixed by applying transparent glue. It is better to apply glue before drying the material (Sheela, 2008).

**Table 3. Guidelines for suitable flowers and plant species used for drying and arrangements (Verma et al., 2012)**

Plant	Specific guide lines for remarks
Acacia	The dried flower cluster is required to be steamed over a kettle for preserving the natural appearance of the flowers.
Acroclinum	Flowers immediately after picking are dried either by embedding or hang and dry method.
African violet	Embedding of flowers for two weeks in face up position in sand.
Ageratum	Method –Borax (4days) (commercial preparation), sand (2 weeks) Remarks –Embedding of flowers in face down position
Althaea	Plant part - seed pods (pick when green) Method – hang to dry

Plant	Specific guide lines for remarks
Apple	Plant part – foliage Method: glycerin (4-7 days)
Anemone Method	Sand is suitable drying material.
Method Remarks	Careful handling is required due to fragile nature
Asters	Drying material: Borax Single varieties – 5 days time, Double varieties – 10 days.
Astilbe	Drying material: Borax Method : Hang to dry(4 days)
Baby's Breath	Method : hang to dry (1-2 weeks) Plant part : foliage Drying method : glycerin (6 days);
Baptisia	Plant part : flowers Method :hang to dry ; Plant part : pods Method : shellac Harvesting time : cut when lower bells begin to turn Drying material : borax (4days)
Bells of Ireland	Method : hang to dry (1 week ) Method: glycerin (2-3 days) remarks : remove immature tips as they may shrivel; green cake coloring added to glycerin will keep greenness. Plant part – foliage Method – glycerin (3-10 days)
Beech	Remarks : length of treatment will depend on color preferred – they change from green to brown ; treat after leaves start to turn for lighter shade; cut green and remove from glycerin in 24 to 36 hours and foliage will remain green Plant part - berries Method - shellac
Bitter sweet	Remarks : should be dried in water to prevent excessive shrinkage and to keep longer. Shellac improves their appearance Plant part – fruit
Bleeding heart	Method – shellac and hang to dry Plant part – flowers Method – borax and sand Plant part – fruit
Blackberry lily	Method – shellac and hang to dry Plant part – flowers Method – borax and sand
Boxwood	Plant part – flowers Method : glycerin (4days ) upright in water Plant part – seed pods
Butterfly weed	Drying material : sand Remarks : difficult to dry
Calendula	Embedding of flowers for two weeks in face up position in sand. This may need diluted glue from top when dry.
candytuft	Flowers are dehydrated in vertical position in deep containers or in horizontal position in shallow containers

Plant	Specific guide lines for remarks
Castor beans	Plant part – stalks and seed pod. Method – hand to dry Remarks – a light coat of shellac will aid in securing the pods to the stems. foliage may be sheared to give an oriental appearance.
Cattails	Method – hand to dry Remarks – spray with shellac or hair lacquer; let dry on stems and cut later
Chinese lantern	Method – hand to dry(1-3 weeks) Remarks – if picked green, they will remain green
chrysanthemum	Plant part – flowers Method – sand and borax (7 to 10 days ) Method – silica gel method (5days) Remarks – yellow flowered varieties retain their colour, while red and mauve coloured flowers turn dull and dark. Not all chrysanthemums are satisfactory for drying
Christmas rose	Method – borax(5 days) Remarks- wire stems before drying Plant parts – flowers Method – borax(5 days)
Clematis	Plant parts – seed pods Method – glycerin (24 hours) Remarks-Large flowers are difficult to treat , glue petals to stem before drying. seed pods are most interesting to dry.
Clover (red)	Plant part – flower Method –hang to dry
Cockscomb	Plant part – flowers with stem (cut when green) Method –hang to dry (1-3 weeks)
Coral bells	Plant part – flowers Method – borax or press drying remarks – wild varieties are most desirable
Cornflower	Plant art – flowers Method – borax (5 days)or hang in air to dry Remarks- pick when mature and pull back husks
daffodils	Plant part – flowers Method – borax (3days) Remarks - remove stems, treat and store in de-moist crystals
Daisies	Plant part – flower Method – upside down in borax field daisy (3 days),Shasta (6 days ),gloriosa (5 days) Remarks – corn – like center of flower may be used after drying Plant parts – small flowers (5 days),large flowers (10 days) Method – borax
Dahlia	Remarks – small flowered types are more suited for drying. Red colour becomes darker, white yellow and orange flowers retain their colour after drying. Place shredded waxed paper between some of the petals
Delphinium	Plant part – spikes (5 day) , florets(3 days ) Method – sand and borax Plant part – bracts
Dogwood	Method – borax (4 days ) plant part – foliage method – glycerin(7-10 days)

Plant	Specific guide lines for remarks
Dock	Method – hang to dry or pick dry Remarks – changes colour in different stages of growth
Dusty miller	Method – hang to dry Plant part – foliage
Euonymus	Method – glycerin(5 days ) Plant part – berries Method- shellac
False dragon head	Plant part – foliage Method – borax (3-5 days); hang to dry
Ferns	Plant part -foliage Method – press drying
fennel	Method – hang to dry Bright green and feathery
Feverfew	Method – borax (3days ) Dry upside - down
firethorn	Plant part – berries Method – shellac Remarks- remove foliage when treating ; dry in water
forsythia	Plant part – foliage Method – glycerin Plant part – flowers Method - borax Remarks- turn light to dark brown or purple red
Gardenia	Plant part – foliage Method - glycerin
Gerbera	To be kept in face up position while embedding in sand. petals are to be reinforced when dry.yellow, orange and pink flowers retain their colour after drying. Sand: commercial preparation
Gladiolus	Individual flowers are cut and processed. flowers are to be kept face up while embedding in sand.
Globe thistle	Method – hang to dry Remarks – cut before bracts have fully opened; allow some foliage to remain on the stem Plant part – flower
goldenrod	Method- hand to dry (1-3 weeks) Remarks- pick before upper florets open
Grains – ( wheat , oat, rye etc)	Method – hang to dry (1-3 weeks ) Plant part – fruit
Hedge apple	Method – oven dry and air dry Remarks- pick when green ,it will turn brown when dried in an oven, if hung in a war location it will remain green Plant part – flower
helichrysum	Method – hand and dry method.Remarks - these flowers can be easily air dried or oven dried. if embedded in sand , the flowers ,along with stems, may be kept in shallow containers horizontally or in deep containers in vertical position
Hibiscus	To be kept in face up position while embedding in sand for three weeks. Only medium sized flowers are to be selected

Plant	Specific guide lines for remarks
Hollyhocks	Method – borax(6 days ) Remarks – becomes transparent on drying
Huckleberry	Plant part - foliage Method – glycerin (7-10 days) Plant part - flower
Hydrangea	Method – hang to dry (1-3 weeks):borax (4 days) Remarks- peegee (flower )picked in September , pink and blue florets type (august ) or when blooms are cured on bush
Iris	Plant part – seed pods Method - shellac
Ixora	Plant part – flowers Method – press drying is better for these flowers
Juniper	Method – glycerin (7-10 days)
Lantana	Method – box (3-5 days ) Remarks – colours may change
Larkspur	Method – hang to dry ; borax (4 days )
Laurel	Method – glycerin (10 days )
Leucothoe	Method – glycerin (10 days )
Ligustrum	Method – glycerin (7 - 10 days )
Lilac	Method – hang to dry ; borax (3 weeks)
Lily	Plant part – seed pods Method – shellac Plant part – flower Method – borax (3 days )
Lily of the valley	Plant part – foliage Method – oven dry Remarks – clean the foliage and bake in an oven at 250 <sup>0</sup> c for 15 minutes
Magnolia	Plant partlant part – leaves Method – glycerin (10 days -3 weeks) Plant part – flower Method – borax in upside down position Plant part – seed pods Method - shellac
Mountain ash	Plant part – fruit Method – hang to dry Plant Part - flower
Marigold	Method – borax (7-10 days) and hang to dry Remarks – to be kept in face up position while embedding for two weeks in sand. The petals may require gluing from underneath at the base of the petals
Milkweed	Method – hang y to dry Remarks – cut when pale green
Mussandra	Mellow colours method – press drying Remarks – yellow colour is retained well
Narcissus	To be kept in face up position while embedding for two weeks in sand in shallow containers.
Nymphaea	To be kept in face up position while embedding for two weeks in sand.both inside and outside

Plant	Specific guide lines for remarks
	surfaces of all petals should be completely dry.
Okra	Method – hang to dry Plant part – flower
	Method – press (10 days), sand and borax (4 days )
Pansy	Remarks – to be kept in face up position while embedding for three weeks in sand for short stemmed type.to be kept in horizontal position if long stemmed. This is also a good material for press drying
Passion flower	Plant part – seed pods and flower Method – borax (8 days ) Plant part – flower
Peony	Method – borax (5 days) Plant part – foliage Method – glycerin ( 7 days ) Plant part – foliage
Pine	Method – glycerin (10 days ) Remarks – cut from tree when green
Polygonum	Method – hang to dry Remarks – cut before maturing ; remove foliage
Poppies	Plant part – seed pods Method – hang to dry plant part- foliage
Poplar (white)	Method - press drying Remarks – stand in a jar to dry
Queen anne's lace	Method – borax (5 days) Plant part – flower Method – hang to dry ;borax (5 days ) sand (commercial preparation ),silica gel drying (4 days )
Roses	Remarks – if embedded in sand ,to be kept in face up position for two weeks.best when buds are half – open ;lay buds horizontally. Plant part – fruit (hips ) Method – shellac
Russian olive	Method – Glycerin (6 weeks)
Salvia	Method – borax (4 days );hang to dry (1-2 weeks ) Remarks – blue (deeper in colour); red (turns pink or orange )
Santolina	Method – hang to dry
Smoke tree	Plant part – flowers Method – hang to dry Plant part – florets
Snapdragons	Method – borax (4 days ) Remarks – dry each separately , wire florets before drying ,difficult to dry Plant part – flower
Statice	Method – hang to dry ,embedded in sand or are press dried
Stock	Method – borax (4 days )
Straw flower	Method – hang to dry Remarks – cut when flowers are half open
Sugar Cane	plant part – pods

Plant	Specific guide lines for remarks
	Method - hang to dry
Sumac	Plant part – seed pods
	Method – hang to dry
Sweet gum	Method – hang to dry
	Method – embedding
Sweet pea	Remarks – to be kept in face up position while embedding for two weeks in sand.
	Plant part – foliage
Sycamore	Method – glycerin (8-10 days )
Thistle	Dry upright in jars
	Plant part – pod
Tulip	Method – borax (6 days )
	Remarks – cut before fully open; use elmer’s glue to secure petals before drying
Verbena	To be kept in face down position ,while embedding for three weeks in sand
	Plant part– foliage
	Method – glycerin (3-5 days )
Viburnums	Plant part – berries
	Method - shellac
Water lily	Method – borax (10 days )
	Method – borax (5 days) , hang to dry
Yarrow	Remarks – these may be liquid dyed .to prevent shuttering , spraying with clear plastic spray is suggested
	Plant part – flowers
	Method – borax (6 days ); dry upside down in mixture
Zinnias	Remarks – to be kept in face up position while embedding in sand for two weeks. Petals are to be brushed before or after drying with coloured powdered chalk to restore velvety smoothness

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