

# COMMERCIAL FLORICULTURE

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Published by

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**COMMERCIAL FLORICULTURE**

A Treatise on Floriculture

by

**DR. E. Tajuddin**

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## FOREWORD

*The Kerala Agricultural University hitherto has published about 40 titles on crop husbandry. These were mainly meant for extension education workers. Earlier, the University had a proposal to bring out some titles for meeting the reading requirements of the farmers. Somehow, that project could not materialise. The Directorate of Extension filled this gap through a series of books on various homestead crops. I congratulate the Director of Extension for piloting this programme.*

*The Directorate of Extension in the course of its two and half decades of existence had kept no stones unturned to provide worthy reading materials. It is heartening to note that the titles brought out had been widely read by the farming community of Kerala. I hope, the present series of books being published by the Directorate will keep up this tradition.*

*The book entitled 'Commercial Floriculture' is one of the important publications in the above series. The author of the book, Dr. E. Tajuddin is an Agronomist and Extension Educationalist of national eminence. He is co-authored by Dr. R. Prakash, Associate Professor, Instructional Farm, College of Agriculture, Vellayani.*

*I hope that this valuable publication will be of great help to the farmers of Kerala.*

Vellanikkara  
29 - 7 - 1996

DR. A.M. MICHAEL  
Vice Chancellor

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## COMMERCIAL FLORICULTURE IN INDIA

"Floriculture is the art and knowledge of growing flowers to perfection". The cut flowers constitute 45 per cent of the total world trade in floricultural products. Cut flowers are used for home decorations, designing bouquets and floral arrangements. West Germany is the biggest consumer and importer of cut flower while the Netherlands is the biggest exporter.

The cut flower demand is increasing in developed countries. Many developing countries of the tropical region such as Colombia, Brazil, Kenya, Thailand, Singapore and Srilanka are important exporters of cut flowers to Europe in winter. Though India also grows various tropical and sub-tropical flowers, the cut flower export from India is negligible. The constraints to cut flower export from India are poor production in terms of quantity and quality, lack of planting material of export varieties, high air freight charges, inadequate incentives and financial assistance for export and unorganised marketing system. Basic inputs like standard containers, growing media and quality packing materials are also lacking. Since cut flowers are perishable, proven methods of prolonging the life of cut flowers is yet to be found out.

The potential of floriculture as an industry has not been exploited properly. Floriculture is an intensive type of agriculture and the income per unit area from floriculture is much higher than any other branch of agriculture.

Commercially, floriculture can open up great opportunities to our farmers. India is endowed with diverse climatic conditions which offer big scope for growing several kinds of flowers. The government has to organise flower growers societies and offer them help in selling their produce through a net work of retail stores in big cities, hotels and markets.

Commercial floriculture is a recent development in India. Though India grows all kinds of flowers in the open, they are not suitable for export due to their poor quality. There is market preference for specific varieties and high quality and standard specification.

### **Strategies for boosting production of cut flowers**

a) **Increasing domestic consumption** : Indian floricultural market is worth Rs.250 crores and is expected to grow at an actual rate of 20-30 per

cent. With proper reconciliation of marketing channels, the demand is expected to increase to a considerable extent.

b) **Export** : India has a good potential for entering global trade as certain flowers and plants grow in climates peculiar to India. Considering this the government has prioritised floriculture.

Roses, carnation, chrysanthemums, orchids, gladioli, etc., are potential export commodities. Intensive mobilisation of all the revenues would entirely increase the exports. The strategies are :

- \* Identification of product/region as intensive floriculture zone to achieve quantitative and specified targets. The major zones identified are Hyderabad (roses), Bangalore (chrysanthemums, carnations, roses), Kerala (Orchids and Anthurium) Pune (chrysanthemums, carnations and roses) and Gangok, Imphal and Northern States (cymbidiums and other orchids)
- \* Creation of appropriate infrastructure and suitable technology and equipment for precooling and storage facilities.
- \* Making available on a large scale, planting materials and production inputs such as fertilizers, pesticides, media and packaging materials.
- \* Adopting export specific market production floriculture trade shall be permitted to sell 50 per cent of their production in the local market. This will enable floral units to dispose their surplus in the domestic market.
- \* Strengthening the market intelligence network which will provide advise to producers regarding demand-supply position in the international market.
- \* Establishing advise centres cum auction houses in potential zones.
- \* Creation and formation of co-operative florist organisations to safeguard the producers/growers and enable them to control marketing of their produce.
- \* Government should supported the industry as a whole and export oriented floriculture in particular.

### **Production of cut flowers**

Cut flowers are mainly used in India for hair decoration, garlands, worship, table decoration and various other uses during religious ceremonies and social functions. But commercial production for export has not yet progressed much. The most important commercial flowers cultivated on a large scale in India are : rose, jasmine, orchids, anthuriums, china aster, chrysanthemum, marigold carnation, gladiolus, tube rose, dahlia, and gerbera. These are dealt with in detail in this book.

# ROSE

*Family : Rosaceae*

## **Rosa spp.**

The rose is without doubt the most beloved and popular of all garden shrubs. No other shrub or plant can provide a continuous display of colour. Rose has been held in esteem and cultivated since the early days of gardening. The genus *Rosa*, is derived from the Greek word "rhodon", meaning excellent fragrance.

The roses in cultivation originated from wild roses. 'Old roses' were the results of first attempts to produce proper rose for the garden. From the 'old roses' 'Hybrid Tea' roses were produced. Tea roses get their name from the fact that when they were first introduced the scent was like that of freshly opened Tea chest. These tea roses are still the best choice for perfume and quality flowers. Floribunda roses were produced by crossing hybrid tea roses with dwarf polyantha. In floribundas, a cluster of flowers are produced on each stem.

Standard roses have erect, bare stem on top of which a particular rose variety has been budded, mainly a hybrid tea or floribunda. Miniature roses are the popular 'baby roses' with small leaves and flowers. They are hardy and are multiplied by cuttings as well as propagated on rootstock. Those raised from cuttings are ideal for growing on pots.

Ramblers are old climbers with large clusters of small, single or double flowers and mainly belong to two groups i.e., Multiflora Ramblers (*Rosa multiflora*) and Wichuriaha Ramblers (*Rosa wichuriaha*). The Wichuriaha ramblers are more common now-a-days.

## **VARIETIES**

Every year many new varieties are added and marketed all over the world. At present, there are about 25,000 cultivars of roses, differing widely in form, shape, size, colour, fragrance and flowering habits.

Some of the major varieties of roses both exotic and Indian, under various categories are listed below :

## EXOTIC VARIETIES

### Hybrid Teas

Sl. No.	Name	Breeder	Year	Attraction	Growth habit
1	Ace of Hearts	Kordes	1981	Golden yellow flowers	Medium sized
2	Alec's Red	Cocker	1970	Deep crimson superb fragrance	strong bushy growth
3	Anvil sparks	Meyer	1961	Golden yellow fragrant	Medium sized
4	Avon	Morey	1961	Bright red flowers	Tall bushy
5	Autumn Gold	Weeks	1980	Buttery cream and pale yellow flowers	Vigorous
6	Bel Ange	Lens	1962	Pink fragrant	Vigorous
7	Blue Moon	Tantau	1964	Lilac coloured	Vigorous
8	Blue Perfume	"	1979	Large blooms of blue shade	Free blooms
9	Century Two	Armstrong	1971	Deep pink fragrant	Vigorous
10	Colour Magic	Warriner	1978	Ivory pink shade	Vigorous upright
11	Fascination	Warriner	1982	Apricot and ivory colour	-
12	Flaming Beauty	Winchel	1980	Yellow bloom with orange red border	-
13	Lady Marine	Delashmutt	1981	Dark orange red colour	Medium growth
14	Lord Louis	Gregory	1982	Light crimson	Vigorous
15	Pace Maker	Harkness	1981	Reddish pink	Long stems



## Floribundas

Sl. No.	Name	Breeder	Year	Attraction	Growth habit
1	Africa Star	West	1965	Rosy mauve, produced in clusters	strong spreading bush
2	All Gold	LeGrice	1956	Yellow flowers	Vigorous
3	Australian Gold	Kordes	1980	Apricot peach colour	Bushy
4	Bridal Pink	Boerner	1967	Organdy pink flowers	Bushy
5	Charisma	Jelly	1978	Flame red and golden yellow	Strong bush
6	First Edition	Delbard	1971	Shadings of yellow orange pink and red	Vigorous
7	Golden Times	Kordes	1976	Brownish yellow rose	Clusters
8	Independence	Kordes	1950	Scarlet Flowers	Clusters
9	Shocking Blue	Kordes	1974	Lilac mauve blooms	Clusters
10	Simplicity	Warriner	1979	Pink	Vigorous

## Polyantha

Sl. No.	Name	Breeder	Year	Attraction	Growth habit
1	Baby Faurax	Lille	1924	Purple flowers	Clusters
2	Chatillon Rose	Nonin	1923	Glowing pink with pale base	Tall and vigorous
3	Ideal	Spek	1921	Dark Velvety crimson	-
4	Katharina Zeimet	Lambert	1901	small white flowers	Bushy plant
5	Vatertag	Tantau	1959	Blooms globular salmon orange	Produced freely

## Miniatures

Sl. No.	Name	Breeder	Year	Attraction	Growth habit
1	Amy's Delight	Williams	1980	Pink blooms	Bushy
2	Antique Rose	Moore	1980	Rose pink flowers	Vigorous upright
3	Blue Mist	Moore	1970	Pink lavender flowers	upright bushy
4	Deep Velvet	Jelly	1981	Dark velvet bloom	Bushy
5	Twinkle Twinkle Bennet		1981	White with apricot - brushed on edges	Bushy

## Climbing Miniatures

Sl. No.	Name	Breeder	Year	Attraction	Growth habit
1	Climbing Candy Cane	Moore	1958	Pink light red flowers	Free blossoming
2	Clg Cinderella	Moore	1975	Sating - white tinged pale pink borne in cluster	Vigorous upright
3	Clg Cameo	Moore	1954	Rose pink blooms	Moderate height
4	Clg Pixie	Ruston	1964	Bluish pink to white flowers	Free blooming
5	Happy Time	Moore	1974	Double yellow overlaid red blooms	Clusters

## Climbers and Ramblers

Sl. No.	Name	Breeder	Year	Attraction	Growth habit
1	America	Warriner	1976	Porcelain rose colour	-

2	Clg Blue Moon	Murgia	1981-92	Silver - like colour	Vigorous good blooming
3	Lavender Mist	Delashmutt	1988	Dark orange red bloom	Prolific bloomer
4	Pinata	Warriner	1977	Yellow blooms with orange red on edges	-
5	Royal Gold	Morey	1957	Golden yellow flowers	Vigorous

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## INDIAN VARIETIES

### Hybrid Teas

Akashsundari	(Pal, 1982) Lilac pink with deeper reverse, displaying an attractive silvery lilac and at later stages with red flushes on the outer petals.
Anupama	(Kasthuri Rangan, 1971) Elegant buds open into large fully double, crimson red flowers of perfect form and shape.
Anuraag	(IARI, 1980) Shapely blooms of high centre and Ayrian rose colour. Highly fragrant. Medium sized balanced bush with upright growth
Apsara	(Palm, 1982) Flesh pink flowers with lovely salmon plant vigorous and floriferous
Arjun	(IARI, 1980) Porcelain rose colour, large, beautifully shaped bloom borne on very long shoots.
DR.B.P. Pal	(IARI, 1980) Exquisitely formed bloom purple in colour and large with high centre.
Indian Princess	(Pal, 1980) Well shaped blooms with many petals of vibrant carmine vermilion colour, the outer petals are light red. Well scented.
Raktima	(IARI, 1994) Highly centered double flowers of shining red colour. Stem is strong and straight, growing into a bush type. A recurrent bloomer.
Preyasi	(IARI, 1994) Highly fragrant flowers of fuchsan pink colour. The large sized flowers have more than 30 petals vigorously growing bush.

Shreyasi (IARI, 1994) Flowers are attractively bicoloured plum red with silver grey on the lower side, double with about 40 petals. Flowers have long lasting fragrance

### **Floribunda**

- Akash Narthaki (Pal, 1983) Double flowers of silvery lilac colour, comes in small clusters of three to four
- Arunima (IARI, 1976) A seedling of Frolic. Deep pink flowers of long lasting quality produced in small bunches.
- Chandrama (IARI, 1980) Large moon light white double flowers born in clusters of 4-6 on sturdy shoots
- Delhi Princess (Pal, 1963) Suitable for bedding and half standards. Cerise red buds, opening into large sparkling pink flowers in clusters in amazing abundance. Very vigorous
- Madhura (Pal, 1979) Light yellow and pink flowers produced freely in single and small clusters on a vigorous plant.
- Suryakiran (Pal, 1979) Produces large well shaped blooms of brilliant orange, ageing to salmon orange. Flowers come in large clusters on upright stems. Very vigorous.
- Lahar (IARI, 1994) A highly floriferous floribunda type. The flowers are mimosa yellow in colour with a tinge of spinel pink. A recurrent bloomer, the upright growing bushes are full of big bunches.
- Manasi (IARI, 1994) Small, double flowers of light pink colour slightly deeper at margins. The flowers are produced in small and large clusters on strong stems with a mild fragrance. Medium in height and vigorous growing.
- Sadabahar (IARI, 1994) Produces pink flowers on its branches Highly floriferous.

### **Polyantha**

- Anjani (Kasturi Rangan, 1970) Rose-red flowers with a white eye, produced in large sprays.
- Narthaki (Kasturi Rangan, 1974) Deep blue-lavender flowers with yellow stamens
- Priti (Kasthuri Rangan, 1971) Lovely, ball like soft pink flow-

- ers, borne on large clusters. Prolific bearer.
- Rashmi (Kasthuri Rangan, 1977) Globular flowers of deep blackish crimson with a velvety sheen.
- Swati (IARI 1968) Well shaped, deep carmine-pink buds open to semi-double, small white flowers having deep pink on edge of the petals. Very floriferous.

### **Miniatures**

- Chandrika (Kasthuri Rangan, 1978) Greenish white to white flowers, produced in clusters.
- Dark Beauty (Airum, 1980) Double flowers of deep red colour
- Dazzler (Kasthuri Rangan, 1982) Clusters of pink flowers with a predominant white centre. Very attractive.
- Delhi Starlet (Pal, 1963) Small yellow deep buds opening into light yellow flowers
- Pushkala (1973) Small, pure white flowers produced in clusters. Free flowering.

### **Climbers**

- Delhi Pink Pearl (Pal, 1962) Clusters of pink flowers are produced. Vigorous growth, good foliage and thornless.
- Kanayakumari (Vira raghavan, 1978) This climbing rose produces salmon pink shaded orange flowers freely, singly or in cluster
- Lalkila (Bhattacharjee, 1959) Glorious climbing form with small glossy green leaves and enormous clusters of white flowers.

## **PROPAGATION**

Rose can be grown by seeds, cuttings, layers, budding and grafting.

### **Seeds**

To produce new hybrids, through breeding, seeds are formed and grown for obtaining hybrid seedlings.

### **Cuttings**

Some of the climbers, ramblers, polyanthas etc. are raised by this method. Miniatures are more widely propagated by cuttings rather than by

budding. Rootstock are also raised by cuttings. Using root hormones like seradix can induce rooting easily.

### **Layering**

For multiplication of climbers and ramblers, this method is useful.

### **Budding**

Budding is the most popular and successful method for multiplying rose. Shield or 'T' budding is the most commonly used method. On the selected rootstock, the buds are inserted into a 'T' shaped incision and then tied with a polythene tape. When the new shoot from the grafted bud is about 10 c.m. long, the top portion of the stock above the union is cut off. It takes 3-4 weeks for the bud to unite.

## **SOIL AND CLIMATE**

Though grown in all types of soils, medium loamy soils having sufficient organic matter with proper drainage is ideal for rose cultivation. The optimum pH range is between 6.0 to 7.5. In heavy soils, gravel and sand may be mixed into the bed to allow drainage.

Regarding climate, roses love sunshine and free air. Sunshine for 6 hours is ideal for better growth and flowering.

## **CULTIVATION**

The beds or individual pits may be dug before the rains, so that the soil may settle down during rains. The soil is dug up to a depth of 60 c.m. - 75 c.m. Grasses along with their roots should be weeded out by deep digging. Half of the dug out soil, heaped on the ground should be returned to the trench.

At the time of planting each pit should receive about 4-8 kg. of well rotten FYM and a handful of bonemeal. A small hole is dug proportionate to the size of the root system of the plant at the centre of the site and the plant with earth ball or bare-rooted is lowered in the pit. The point of bud union should be kept above the ground level. The soil round the stem should be made firm. The planting distance varies from 60-70 c.m. from plant to plant and row to row depending upon the cultivar.

Avoid planting during heavy rains. Planting is advised in open weather

at any time from October to April.

Immediately after planting, plants are watered properly. Newly planted roses need watering frequently to keep the soil moist.

Disbudding or removal of axillary buds is practiced to obtain exhibition type blooms, especially in the large flowered types. Only one or two buds are allowed to flower in each stem. The faded flowers and hips (fruits) are removed to obtain better quality blooms in subsequent flushes.

### **Growing Roses in Pots**

Roses can be grown in pots as well. The size of pots should be larger for Hybrid Teas, and Floribundas (30-35 c.m.) and smaller for polyanthas and miniatures. The potting mixture consists of 3 parts of garden soil, 1 part of well rotten cow-dung manure, 1 part of leaf mould and 1 part of wood ash. The top 7.5-10 c.m. layer of the compost is to be removed every year and replaced with fresh mixture.

Potted roses are to be watered on alternate days in the summer or even every day. Drainage should be ensured in pots. Otherwise the leaves may turn yellow. The 'Hybrid Teas' suitable for growing in pots are Flaming sunset, Fragrant cloud, Mc Gredy's sunset etc. The Floribundas suited for pot culture include All Gold, Delhi Princess, Flamenco, Rumba and Zambra.

### **MANURING**

Roses should be manured adequately to ensure good growth and flowering. A well rotten cow-dung manuring is to be applied at the time of manuring. The general dose is 4-8 kg. per bush.

Nitrogenous fertilisers are very important for rose. Phosphates help in the production of more and quality blooms. Potash fertilizers are also important.

Complete rose fertilizers such as 'Rose mix' are now available in the market. Dr. B.P. Pal, the Indian Rose expert, has recommended the following mixture for roses.

Ground nut cake	5 k.g
Bone meal	5 k.g
Amophos (11:48)	2 k.g.
Super phosphate	2 k.g.

Potassium Sulphate 1 k.g.

A quantity of 100 g. per bush is to be added.

### **Foliar Feeding**

For foliar feeding, 14 g. of the following mixture is to be dissolved in 10 l of water and sprayed at fortnightly intervals.

Urea 2 parts

Dehydrogenase ammonium phosphate 1 part

Potassium nitrate 1 part

potassium phosphate 1 part

About 14 g. of liquid soap may be added to the mixture as a spreader. The concentration should be strictly adhered to.

To supply trace element the following mixture may be used as foliar spray

Magnesium sulphate 7 g.

Ferrous sulphate 7 g.

Borax 3.5 g

Seven grams of the above mixture may be dissolved in five litres of water and along with liquid soap once a month. This spray will help to obtain bright coloured flowers.

### **IRRIGATION**

Though roses do not withstand water logging, plenty of water is required for their optimum growth and development. Frequency of water depends on weather and nature of soil. Sandy soils need frequent watering than clayey soil.

### **PRUNING**

The general principle of pruning is that all dead, diseased or insect-infected wood and the weaker branches are to be removed. It keeps the rose in proper shape and size. It also allow light and air to reach the centre of the plant. Pruning time will depend on the climatic condition of the region. The most ideal times for pruning rose in India is October-November after the rains are over. By sequential pruning, cut flowers are produced through out the year.

A sharp cut at an angle of 45 degrees, about 5 mm above a healthy bud,



is given.

## **HARVESTING AND POST HARVEST HANDLING**

The flowers should be cut in the tight bud stage when the buds show full colour but the petals have not yet started unfolding. At this stage they last longer in vases, during transportation, retain colour and freshness. Flowers should be cut in the early morning before sunrise or late in the afternoon. Immediately after cutting the stem should be dipped in clear water upto the neck or base of the flower buds.

The flowers which are uniform in colour, stem length and development should be grouped together at the time of cutting and kept in separate containers.

The cut blooms are graded and then packed in corrugated cardboard boxes. The blooms are generally packed in bundles of 20 each and tied with string or rubber bands. The lower half of the bundle should be wrapped in tissue paper.

## **PLANT PROTECTION**

Aphids feed on the tender shoots buds and flowers. The flowers are malformed. By spraying malathion 0.1%, this can be controlled. The red scales infest roses and when the attack is severe the branches dry. These scales can be removed by rubbing with a tooth brush dipped in methylated spirit. Spraying the affected plants with malathion or rogor will control the pest.

Black spot, dieback and powdery mildew are the major diseases affecting rose. By spraying Dithane M. 45 (2 ml/1 litre of water) black spot and die back can be controlled. By dusting sulphur at about 10 days intervals the powdery mildew can be brought under control. Since plants show sulphur injury, bavistin can be applied at 10-14 days intervals to control the disease .

# DAHLIA

*Dahlia spp.*

Family : *Compositae*

Dahlia occupies a place of pride in any garden. Wide range of colours, variation in size, attractive shapes and forms, free flowering and easy cultivation have made dahlias highly popular.

Dahlias can be easily grown in pot or ground and used for garden display and home decoration. The height of dahlia plants varies from 30 to 180 cm depending upon the cultivator.

## VARIETIES

Classification : The National Dahlia Society of England has classified the modern dahlias into the following main types.

1. **Single flowered** : Flowers in this group consist a single row of ray florets round the central discs. The blooms hardly exceeds 10 cm in diameter. e.g. Bambino, yellow hammer.
2. **Star dahlias** : The blooms are small consisting of 2 or 3 rows of some what jointed ray florets which are slightly incurved forming a cup around the central disc. e.g. White star.
3. **Anemone flowered dahlias** : In this group, the flowers have a dense dome-shaped central disc tubular florets surrounded by an outer ring of ray florets. e.g. Comet, Scarlet comet and Guinea
4. **Collerette** : Flowers with one row of normal petals and one or more rows of small petals (the collar). Disc apparent. Very good for flower arrangement. e.g. choh, sincerity, Thais.
5. **Paeony flowered dahlias** : This consists of semi-double blooms of a few rows of ray florets surrounding the central disc. e.g. Bishop of Llandaff and Fascination.
6. **Decorative** : The blooms in this class are fully double and the central disc is not visible until the blooms are aped. The ray florets are flat and broad with a fluent point. The petals are generally not much twisted.
7. **Cactus dahlias** : These also have fully double blooms without any central disc showing atleast until the bloom is too old. The ray florets

in this group are narrower and more pointed than in decorative dahlias and part of the petal tend to curve backwards, or incurving or straight.

Both the classes, decorative and cactus are subdivided according to size into Giant flowered (over 25 cm diameter), large flowered (above 20 c.m. diameter), medium flowered (over 15 c.m. but less than 20 c.m.) small flowered (over 10 c.m. but below 15 c.m.) and miniature flowered (less than 10 c.m.)

8. **Double show and fancy dahlias** : The blooms in this group are also fully double, almost globular, and the central florets are comparatively smaller than the outer. The margins of the petal are incurved tabular and fluent at the mouths. The flowers are over 10 c.m. in diameter.
9. **Pompon dahlias** : These resemble the double show and fancy dahlias but smaller in size. The class is subdivided according to the size of the bloom into large (over 7.5 c.m. but below 10 c.m.), medium (over 5 c.m. but below 7.5) and small (less than 5 c.m.)
10. **Miscellaneous dahlias** : A small group of dahlias which are not covered by any of the above classes. The orchid flowered dahlias resembling somewhat the cactus types except that the petals are involute (i.e. covered forward across the width forming a tube and showing the reverse side. The chrysanthemum type flowered types are also included under this.
11. **Dwarf bedding dahlias** : The height of the plants in this group is between 30 and 60 c.m. but the formation of the flower may belong to any of the above groups.

Varieties : A large number of dahlia varieties exist (around 20,000 cultivars). Some of the outstanding cultivars grown through out the world in given below.

#### DAHLIA VARIETIES

Sl.No	Type	Variety	Flower
1	Giant decorative	African Queen Barbara Marshall	Purple to crimson glowing red

Sl.No	Type	Variety	Flower
		Bhikkus Vivek	vermillion
		Lena Lila	Lavender
		NearestBlue.	Bluish violet
2	Large decorative	Alden Galaxy	Red
		Arthur Hambly	Rosy lavender
		Islander	Deep pink
		Sunburst	Yellow
		Silver city	White
3	Medium decorative	April Dawn	Pink and white blend
		Evelyn Foster	White
		Rustig	Yellow
		Sandhya	Bright vermillion
4	Small decorative	Camano choice	Yellow and pink blends
		Corton linda	White
		Disneyland	Blend of yellow, red and bronze
		Lady Linda	Yellow tipped with levender
		Nina chester	White
5	Minature decorative	Christine Hammett	Apricot
		Eastwin	Purplish red
		Elizabeth Hamett	Lavender
		Mistil delight	White with lavender
		Robert Walker	Purple and White blends
6	Semicactus dehlia	Carol chanming	bronze yellow
		Davenport sunlight	yellow
		Dateway	white
		Pink Jupiter	Deep pink
		Vantage	Yellow

Sl.No	Type	Variety	Flower
7	Cactus dahlia	Banker	Flame red
		Doris Day	Scarlet
		Light music	lilac blends
		Sunset	Yellow and red bicolour
8	Fimbriated dahlia	Wee willy	pink
		Cabaret	Bicolour, carmine and white
		Phenomenon	bicolour, white and purple
		Frilly Dilly	Pink
		Lace maker	White
		Sultan	Pink
		9	Water lily dahlia
		Erin Ann	Pink
		Island dawn	Pink and Yellow blend
		Porcelain	White and lilac blend
10	Ball dahlia	Snow hill rose	Pink
		Camano candy	Pink
		Crusader	Red
		Senior Ball	Lavender blends
		Snow fall	White
		Risca miner	Purple
11	Pumpon dahlia	Diana gregory	lavender and white
		Hallmark	Pink
		Iris	Purple
		Moor Place	Purple
		Noren	Pink and purple
12	Anemone-flowered	Guinea	Yellow
		Scarlet comet	Bright scarlet
13	Collerette	Christneas star	Red and white

Sl.No	Type	Variety	Flower
14	Miscellaneous dahlia	Komeet	Red and buff
		Mars	Red
		Golden star	Yellow
		Jescot Julie	Orange
		Pink Giraffe	Pink

## PROPAGATION

Dahlia is a perennial plant and can be propagated by seeds, division, cuttings, grafting and micropropagation.

Dahlias are commercially propagated from cuttings. The cuttings are taken from the young green shoots, produced from the crown of the tubes when these are about 7.5 c.m. to 10 c.m. in length. The shoots should be cut as close as to be crown as possible with a sharp razor blade just below the first node above the tuber. This will encourage more growth from the secondary eyes which are as good as cuttings. The lower leaves in the cutting may be removed by clipping and the cut end should be treated with rooting hormone seradix B before planting. The cuttings are planted 5 c.m. apart in shallow boxes or pans containing porous mixture of coarse sand and leaf mould after rooting the cuttings are planted singly in 7.5 c.m. pots containing one part each of sand and leaf mold.

## SOIL AND CLIMATE

Dahlia can be grown in any type of soil but a medium textured soil of neutral pH or little acidic (pH 6.5) in reaction is preferred. The site selected should be in the open receiving ample sunlight.

## CULTIVATION

The land should be dry and prepared one month before planting. A general digging upto 4.5 c.m. will be quite sufficient for light and medium soils.

The planting distance recommended is 75 c.m. in the case tall, large flowered types.

## **MANURING**

Apart from FYM, chemical fertilizers @ 100 N, 150 P<sub>2</sub>O<sub>5</sub> and 100 K<sub>2</sub>O (kg/ha) is to be applied for getting optimum yield. Potash is an important element for dahlia culture as it promotes healthy plant and tuber quality and quality of flowers.

## **WATERING**

Dahlias require abundant water throughout the growth period. Plants in beds must be watered thoroughly only when they need it. The amount of water in the ground should be such that it moistens the full depth of 40 cm. and the whole bed remains moist for a few days.

## **PINCHING**

When the plants are about 25-30 c.m. and developed 4-6 pairs of healthy leaves the plants are stopped. (i.e., the growing point is removed). The object of stopping is to obtain early blooms and also to get side branches.

## **HARVESTING AND POST HARVEST HANDLING**

The blooms are cut in the early morning. The flowers should be cut with long stem as possible and the bud and the flowers picked should be kept in a container half filled with water. Dipping the end of the stem in boiling water or sealing them in with a candle flame will make the blossoms last longer.

## **PLANT PROTECTION**

Powdery mildew, stem rot, wilt and smut are the common diseases. By spraying 1% Bavistin powdery mildew can be brought under control. To control stem rot the soil should be made porous with a mixture of sand and good drainage ensured.

Aphids, leaf hopper, thrips and red spider mite are the major pests.

By spraying with 1% malathion or metacid the leaf hopper and the thrips are controlled. Red spider mites can be controlled by applying metasyxtox.

# JASMINE

*Jasminum spp.*

Family : *Oleaceae*

Jasmine is cultivated throughout India. It has been cultivated in India for various purposes since early times. The famous jasmine oil is extracted from this plant, which gives extra importance to it, apart from its uses in making garlands, bouquets, decorating hair of women and for religious purposes. The bush jasmine, known as "Kuttimulla" in Kerala (*J. sambac*) is being commercially cultivated in Kerala and is a promising enterprise for small and marginal farmers.

## VARIETIES

These are grown as both shrubs and climbers. The major varieties are:

*Jasminum sambac* : ogimdumeth, viriapakshi, soojimalti, rameabam

*Jasminum grandiflorum* : (O.I. Pichi, CO 2 Pichi, Lucknow etc.)

*Jasminum auriculatum* : Co. 1 Mulla, Co. 2 Mulla, long point, long round, short point, short round.

*Jasminum auriculatum* : Co. 1 Mulla CO2 Mulla, long point, long round, short point, short round Gundu malli, kashthurimalli, sooj malli, Oosi malli.

## PROPAGATION

Jasmine is propagated by cutting and layering. Simple layering give good success in Jasmine.

Cutting is the easiest method of propagation. Cuttings, 15-20 cms long are taken. The percentage of rooting and number of roots per cutting increased with the increase in leaf number. Under intermittent mists the cuttings are found to root better. Rooting hormones (IBA, IAA etc.) are also found to influence the rooting.

## SOIL AND CLIMATE

Well drained rich sandy loam to clay soils are best suited to Jasmine. *Jasminum spp.* are usually grown in the open for commercial flower production. Warm summer and mild winter with sufficient irrigation on sunny days are the ideal conditions for the growth of Jasmine.



## CULTIVATION

The land should be ploughed thoroughly and weeds are to be removed. Pits of size 45-90 c.m.<sup>2</sup> are taken depending upon the soil type. The pits are filled with top soil mixed with 10-15 kg. of well rotten FYM.

Planting distance, the major factor determining flower production varies from place to place and depends upon the species and varieties. The commonly followed planting distances are 1.2 m x 1.2 m. (*Jasminum sambac*) 1.8 m. x 1.8 m. (*J. auriculatum*) and 2.0 m. x 1.5 m. (*J. grandiflorum*). Planting is usually done during June - July.

## MANURING

Quantity of manures and fertilizers for one plant

S. No.	Species	Urea	Mussoriphos of potash	Muniate kg.	FYM
1	<i>J. grandiflorum</i> (Three split doses)	200 gm.	750 gm.	170 gm.	10 kg.
2	<i>J. auriculatum</i> (Two split doses)	264 gm	1200 gm	408 gm	10 kg.
3	<i>J. sambac</i> (Two split doses)	200 gm	750 gm	255 gm	10 kg

The fertilizer can be applied during May-June and September-October under Kerala condition. Basins of 2'-21/2' are taken around plants and manure and fertilizers are to be incorporated into the soil. Watering should be done immediately after fertilizer application.

## PRUNING

Pruning is an important practice for proper growth and flowering in Jasmine. All the shoots of previous seasons are pruned at a height 45 c.m. from the ground. The cut ends are smeared with Bordeaux paste to prevent infection. The ideal time for pruning is November-December.

## IRRIGATION

Plants are irrigated by flooding twice a week. Though sprinkler irrigation saves water, the flower production is reduced. Studies revealed that with sprinkler irrigation though there was a 30% saving in irrigation water, there was 10% reduction in yield.

## HARVESTING AND POST HARVEST HANDLING

*J. sambac* and *J. auriculatum* flowers maximum during March to October, while *J. grandiflorum* flowers throughout the year. The stage of harvest depends on the purpose for which it is used. For fresh flowers, fully developed unopened flowers are picked daily in the morning. For extraction, fully opened freshly picked flowers are required. These flowers are picked before 9-30 a.m.

The stage of harvest and post harvest handling influence the quality of picked flowers. Flowers treated with boric acid, aluminium sulphate and silver nitrate remained fresh upto 72 hours.

The Jasmine plants start flowering from 2nd year onwards and continue upto 15 years. The yield of flowers also varies with species.

*J. auriculatum* yield ranges from 5-5.5 t/ha, while in *J. sambac* it is 5-6 t. *J. grandiflorum* gives maximum yield (6-7 t/ha).

Jasmine flowers are graded according to their shape, size, fragrance and freshness. Corrugated cardboard boxes are used for packing in the case of distant markets while bamboo baskets are used for local markets.

## PLANT PROTECTION

Leaf blight, rust and wilt are the major fungal diseases affecting Jasmine. Due to leaf blight, the plants look unhealthy, and in severe cases vegetative buds and younger branches dry up. The flower production is also adversely affected. By spraying 1% Bavistin or 1% Bordeaux mixture this disease can be effectively controlled.

Dusting sulphur @ 20-25 kg/ha controls rust while drenching the soil around the plants with 1% Bordeaux mixture controls the wilt disease.

The major pests of jasmine are budworms, gallery worms, tinged bugs and scales. Spraying monochrotophos or quinalphos @ 2 ml./litre of water can control these pest. For controlling red spider mites dicophol (0.05% can be used.



Picadilly



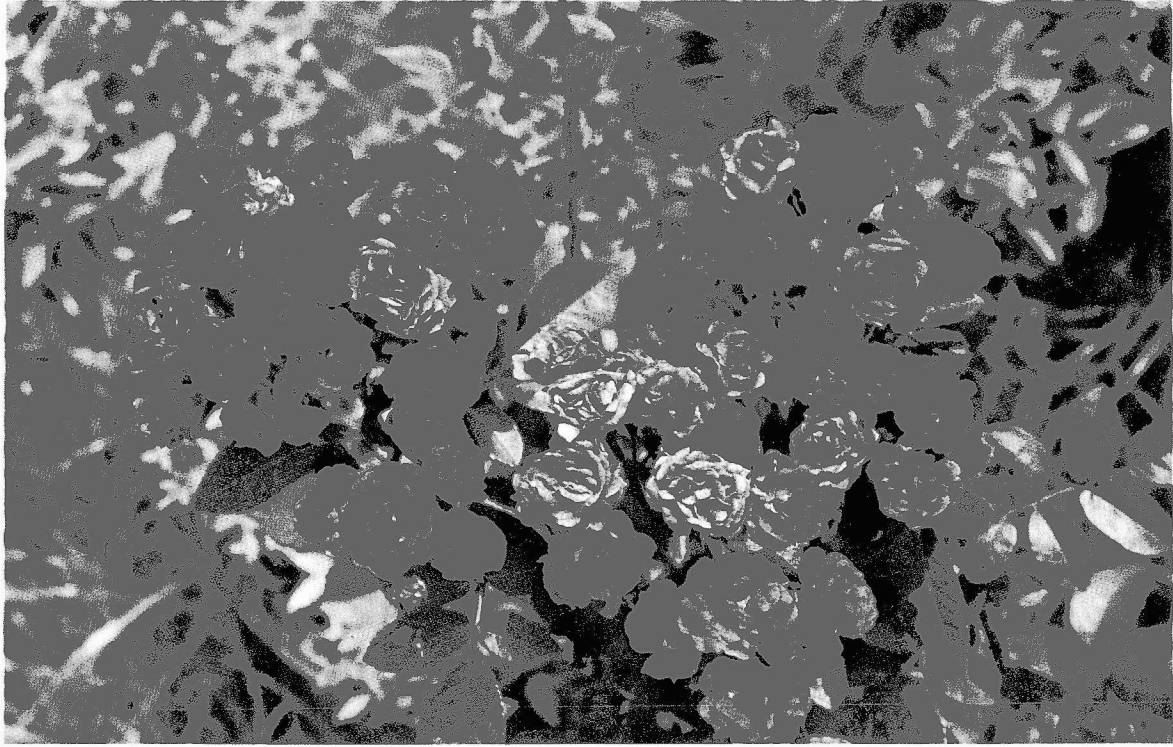
Diorama



Tip Top



Arthur Bell



Floribunda Rose



Dragons Tongue

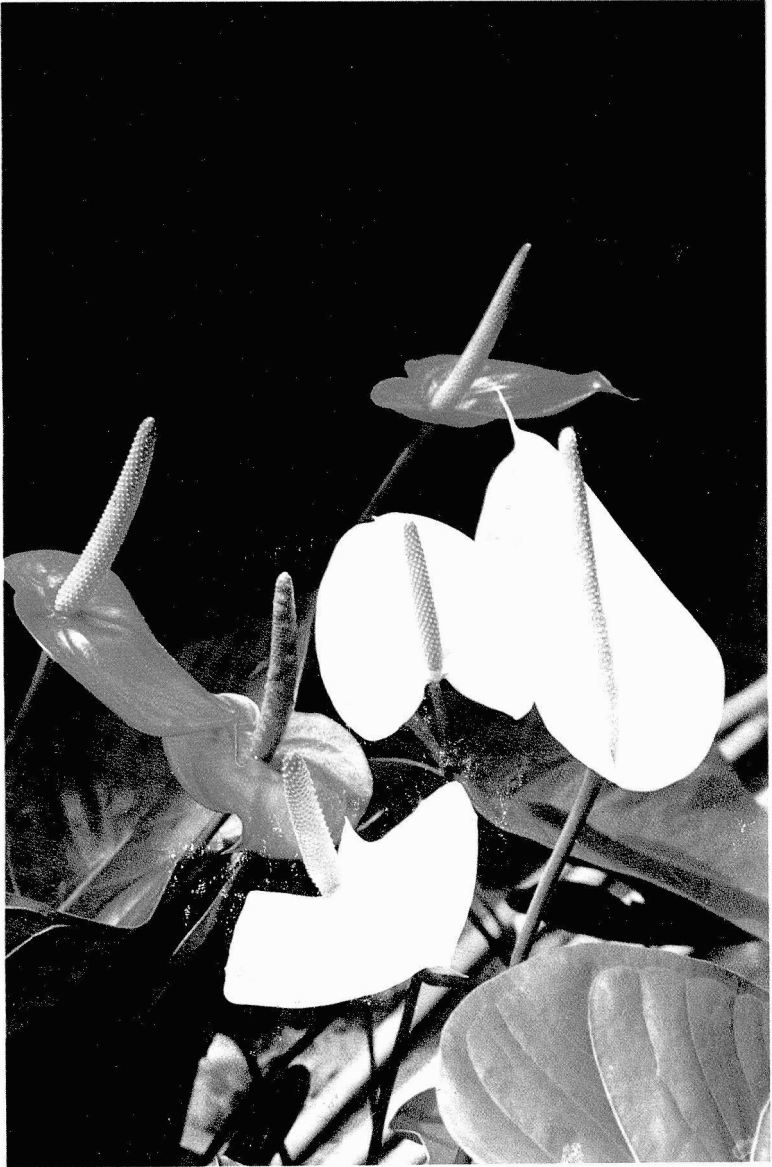




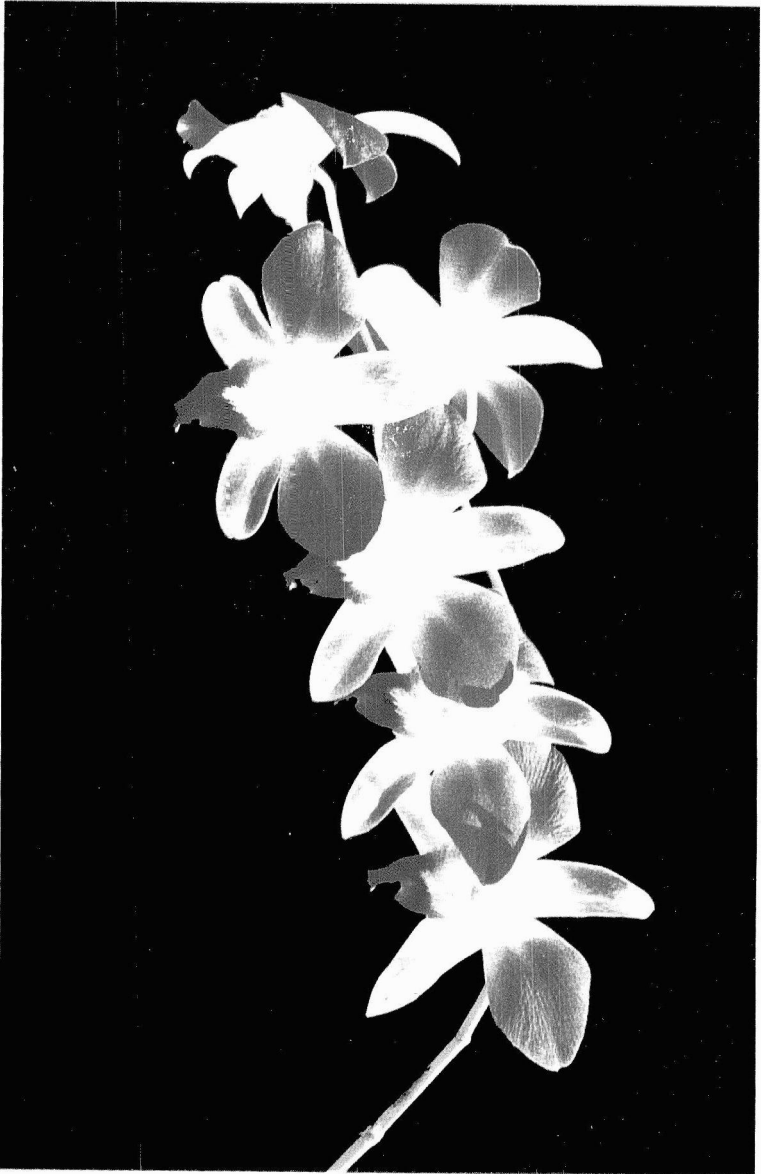
Midori



Lima White



Anthurium Flowers



Dendrobium



Aranda



Phalaenopsis



China Aster



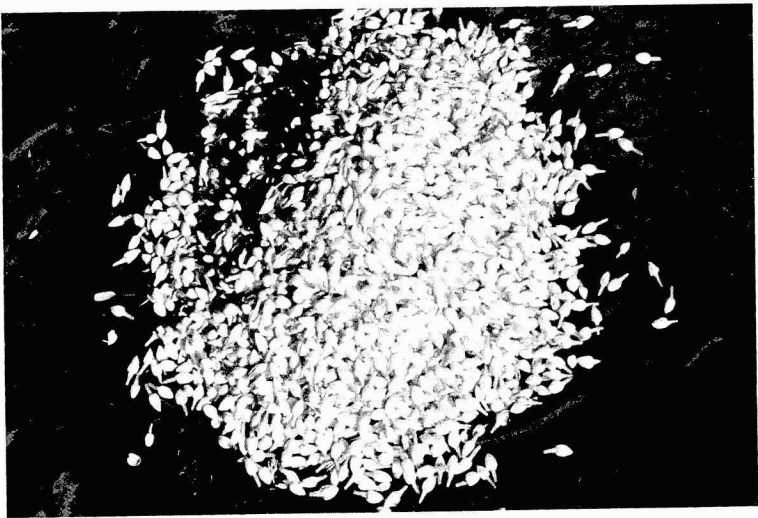


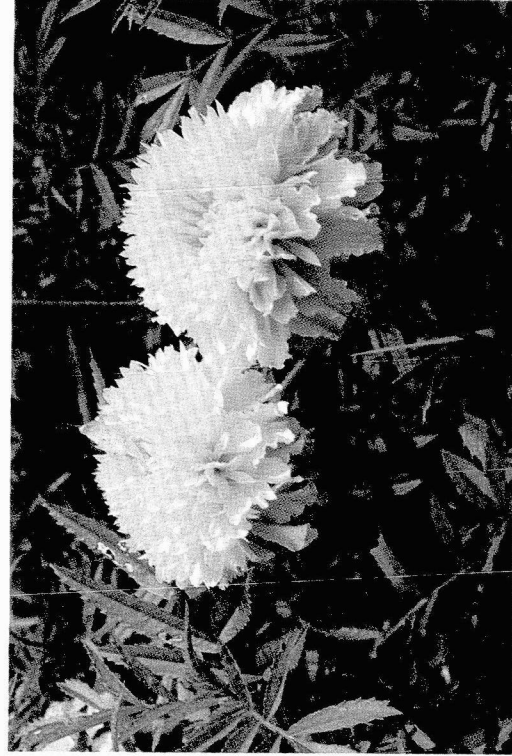
Dahlia





Jasmine

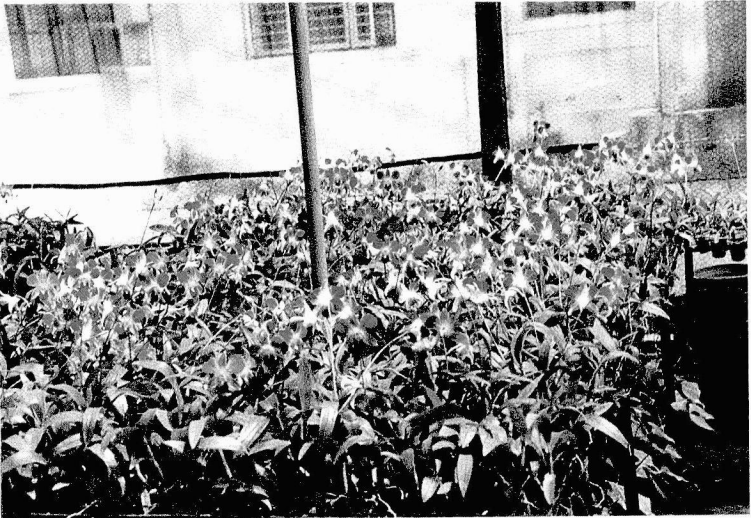




Marigold



Anthuriums & Orchids grown together



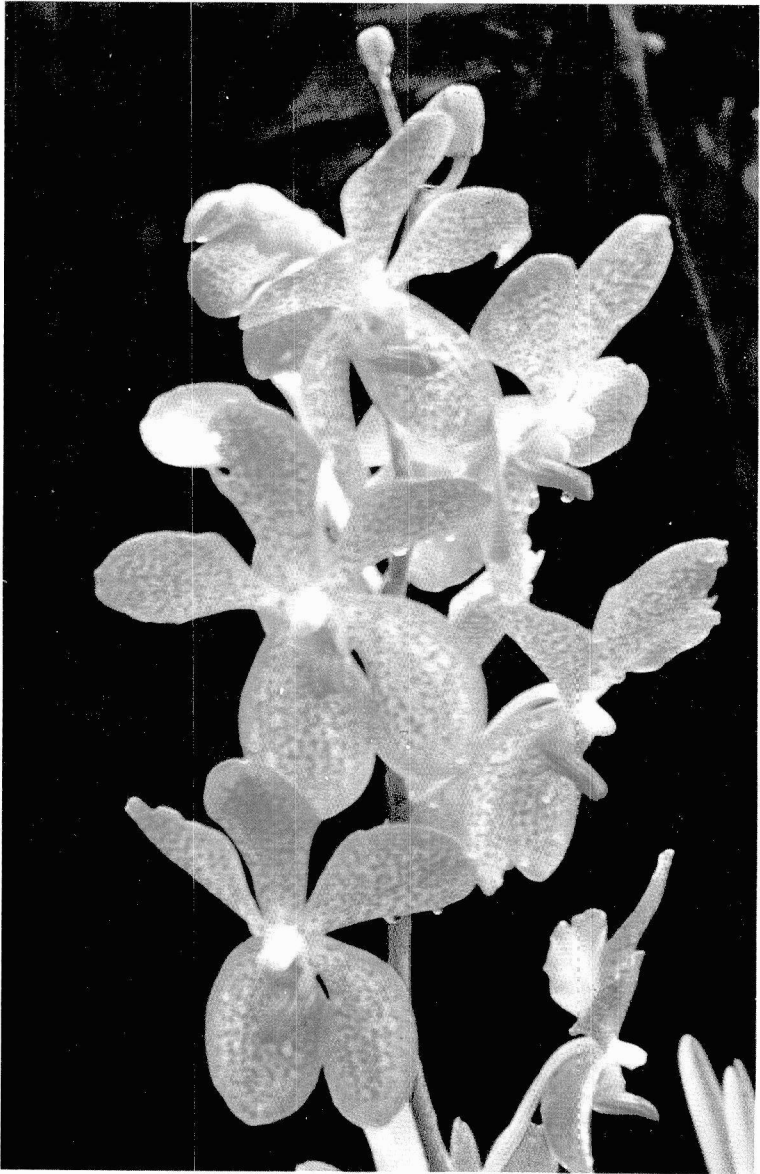
Dendrobiums



Floral arrangement

Floral arrangement





Aranda

# ORCHIDS

Family : *Orchidaceae*

Orchids are a group of attractive flowers having a wide range of diversity in their form, size, colour and texture of flowers. Orchid flower is different from any other flower. It's constitution is a most sophisticated piece of floral engineering. Orchids are perennial herbs. Orchids growing on trees and shrubs are called epiphytes while those growing on rocks are termed lithophytes. The ground dwelling one are called terrestrials.

Orchids, with fascinating flowers and very good keeping quality, are of highest value as cut flowers. Some orchid flowers last for one to three months if remain attached to the plant (*Phalaenopsis*) and as cut flowers they remain fresh for one to four weeks.

Based on the growing habit orchids are divided into sympodial and monopodials. The symodical type produces lateral shoots. Sympodials also produce psuedobulbs which are swollen stems used for storage of food and water. e.g. *Oncidium*, *Dendrobium*. The monopodials (*Vanda*, *Arachnis* etc.) have one upright stem which continues to grow and elongate season after season and produce aerial roots along their whole length.

## VARIETIES

### Vanda

Strapleaved vanda

Terete Vanda

Quarter terete vanda

*Arachnis maggioi*

(Spider orchid)

*Arnada*

(*Arachnis X vanda*)

*Renanthera*

*Arantha*

*V. miss Joaquim*

*V. diane*

*V. bluemoon*

Yellow ribbon

Red ribbon

*A. Peter Evert*

*A. Lucy lay cock*

*A. Majula*

*R. Coccinia*

*R. Storiata*

*A. Anneblack*

(Arachnixa Renanthera)	A. Md. Haneefa
	A. James Storie
Phalaenopsis	P. amabilis
	P. Violacea
	P. gracepalm
	P. pink sunset
	P. golden feather
Dendrobium	D. Ekapol red
	D. Banyat Pink
	D. Sabire pink
	D. Sonia
	D. Madam pampador
Oncidium	O. goldianum (golden shower)
Spathoglottis	ground orchid

## PROPAGATION

Orchids are propagated through seeds, cutting and through micro propagation.

Monopodial orchids are propagated by stem cuttings. Terminal shoots with one or two aerial roots are ideal for planting. Basal cuttings of 30 c.m. long with few roots and leaves are also good. Cuttings without leaves have poor sprouting. Sympodial orchids are propagated by separating pseudobulbs. A plant with minimum 2-3 pseudobulbs with the basal roots can be taken for planting.

Seedlings produced by embryo culture will take 4-5 years for flowering.

Meristem culture (tissue culture) is very effective in propagating rare promising varieties in large numbers.

## ENVIRONMENTAL FACTORS FOR GROWTH

Both terrestrials and epiphytes grow under varying degrees of shade. Light is essential for flowering. Plants grown under deep shade will have good vegetative growth and poor flowering. Shade and light requirement varies with species and varieties. Shade regulation is very important for better flowering. Some species grow under open sunlight. A humid warm



atmosphere is congenial for most tropical orchids. The ideal atmospheric humidity is 50-80% or and more. Orchids require proper temperature for good growth and flowering. According to temperature requirement orchids are grouped into cool loving orchids (45-50°F) intermediate (50-65°F) and warm (65°F and above) orchids.

## **PLANTING**

Terminal cuttings of monopodial orchids are planted loosely on old coconut husks at a spacing of 30 c.m. between plants and 45 c.m. between rows in long beds. Basal cuttings will sprout within a period of two months. Partial shade upto 50% is required for sprouting. Monopodial orchids can be grown on ground above soil level. A thick bed of 15-20 c.m. are arranged. Old coconut is an ideal medium for growing. Well decayed coconut husks are better than fresh husks. Sympodial orchids can be grown above ground level at a height of 1-1.5 m. They are either grown from on benches above ground level or suspended from above.

## **MANURING**

Application of complex fertilizers 17:17:17 at the rate of 2 gm/litre is followed. In orchids grown as monoploids organic manures such as cowdung or poultry manure.

Foliar feeding is very effective in orchids. As the orchids are slow growing slow release fertilizers are good.

## **PLANT PROTECTION**

### **Fungal and bacterial diseases**

Leaf spot, leaf blight, or collar rot, and collar blotch are the major diseases.

Disease can be controlled by application of captan, Dithane, Bavistin etc.

Pests : Thrips, aphids, spider mites, soft scale mealy bug, etc. are the major pests. All the pests can be controlled by application of contact and systemic insecticides at proper concentration.

# ANTHURIUM

*Anthuriums spp.*

Family : *Araceae*

Anthuriums are a beautiful group of tropical aroids. These are horticulturally divided into foliage types and flowering types. Though all anthuriums bear flowers, in the flowering type the flower spathe is large and ornamental while the foliage is not so attractive as those in the foliage group.

## SPECIES AND CULTIVARS

The important flowering type species are *A. andreanum*, *A. bakeri*, *A. browni*, *A. ferrierense*, *A. ornatum*, *A. regale* and *A. sherzaeannum*. The important foliage types are *A. clairnervium*, *A. cordatum*, *A. crystallinum*, *A. magnificance* and *A. warocqueanum*.

The economic varieties suitable for Kerala conditions are :

Fla white	Mauritius liver red
Mauritius white	Duke of Edinburg
Lady Jane pink	Winston delight
Agnihothi	
Miniature red	Mauritius orange
Mauritius red	chillie red
	Midori

## PROPAGATION

Anthuriums are multiplied by seed and vegetatively by stem cuttings and separation of basal sprouts. Vegetative method, are time consuming because the main stem is available only after several years. The attractive varieties have poor suckering habit. The plant can be multiplied in large members by micropropagation techniques.

## ENVIRONMENTAL FACTORS

Plants will grow under shade with 25% light. Excess light causes yellowing and scorching of leaves. Very low light intensity causes excessive vegetative growth and low flowering. Complete shade under

spreading tree is ideal for growth and flowering. High atmospheric humidity is essential. Plant will grow upto a temperature of 40°C.

## **CULTIVATION**

Selfing or crossing can be made and seeds are produced. Seeds become mature within a period of 4-6 months after pollination. Mature seeds will have a pulpy coating. Seeds are sown immediately after extraction of seed. Sprouted seeds on cotton are shifted to a sand medium for further growth. Plants are propagated vegetatively by cutting back the main stem into discs of 3-4 c.m. long. If the stem is very thick, the discs can be cut vertically. Each bit should have a minimum two lateral buds. Cut pieces are treated with a fungicide solution and planted on a medium of clean river sand. Cuttings will take 1-2 months for sprouting.

Seedlings and sprouted cuttings of 5-10 c.m. height are transferred to the main field or pot.

A loose medium above the ground is suitable for anthurium. Old chopped coconut (3 c.m. size) husk mixed with brick pieces and charcoal are filled in narrow trenches 10 c.m. below and above ground level. Pots can also be filled with the same mixture. An ideal pot should be 30 c.m. diameter at top with 3 large holes at the bottom on sides. One seedling each can be planted in the pot. In general the spacing is 45 to 60 c.m. depending upon the variety. A thin fresh cowdung sherry can be applied for the first few months at fortnightly intervals followed by irrigation once daily during summer.

## **MANURING**

Complex fertilizers 20:20:20 NPK can be applied at the rate of 10-15g per plant. This can be given as liquid manures also by dissolving it in water at 5% concentration. Manuring can be done once in a month.

## **WATERING**

Anthuriums should be irrigated thoroughly for getting good growth and quality flowers. The right amount of water and the frequency of watering is decided by the type of container and the compost in which the plant is

grown and stage of the plant growth.

### **Harvesting**

Anthuriums are generally cut when the flowers are almost fully developed. The flowers are harvested with its long stem when the spadix become  $\frac{1}{4}$ th receptive which is indicated by the change of colour.

### **PLANT PROTECTION**

Bacterial blight and anthracnose are the two major diseases affecting anthurium. Blackening of the stem and decay of leaf axil are the symptoms. Small circular spots appear on leaf and spadix in case of anthracnose. Spraying Dithane - 45 at 0.3% or Bavistin at 0.1% can control the disease.

By spraying Malathion 2 ml./one litre the major pests of anthurium viz. scales and bugs are controlled.

# CHRYSANTHEMUM

*Chrysanthemum spp.*

*Family : Compositae*

The word chrysanthemum is derived from the words Chryos - golden and anthos - flower. It is a beautiful annual flowering plant. The flowers are very attractive having colour combination of white, yellow, red, purple etc. Chrysanthemum is very suitable for growing in beds and pots as well. It is most suited as cut flowers. The flowers are used for floral arrangements also.

## VARIETIES

A large number of chrysanthemum varieties are being cultivated throughout the world. In India more than 500 cultivars are being cultivated. Major varieties grown commonly in India are listed below :

### *Large flowered*

White : Beauty, Snow Ball, Innocence, Valiant, Ajina White, Premier.

Yellow : Chandrama, Super Giant, Evening star.

Purple, Pink : Ajina Purple, Cover Girl, Pink Turner, Classic Beauty.

### *Small flowered for cut flowers*

White : Horizon, Himani, Jyotsna

Yellow : Basonthi, Nanako, Sujatha, Freedom

Red : Blaza, Jaya, Flirt.

### *Small flowered for garlands*

White : Carol, Lolith, Sharad Shobha

Yellow : Basmanthi, Freedom, Hosur Yellow.

## PROPAGATION

Chryanthemums can be propagated by seeds, suckers, cuttings and recently by micropropagation. Among these propagation through cuttings is the most popular and common method.

Propagation through terminal stem cutting is followed by commercial growers. For this disease free stock plants are first raised. Stock plant is

a young vegetative plant grown from healthy cutting and pinched to induce the growth of lateral shoots. Cuttings are taken from these plants and rooted under optimum environmental conditions. An ideal cutting is 4-6 c.m. long with basal stem diameter between 3.2 and 4.8 m.m Chrysanthemum cuttings are used for planting in the main field.

## **SOIL AND CLIMATE**

Sandy loam soils with good drainage is ideal for chrysanthemum cultivation. They grow well in slightly acidic soils. Light soils rich in organic matter are best suited.

Light and temperature are the most important factors influencing growth and flowering of chrysanthemum. They require high light intensity. Flower buds in chrysanthemum are found to develop above a critical temperature below which only vegetative growth occurs. Most of the varieties need warm nights at the time of flower bud formation.

## **CULTIVATION**

### **Planting**

Soil is to prepared well before planting and mixed well with rotten organic manure. The cuttings are to be planted immediately after they are rooted. Same sized seedlings are planted together for uniform growth. 32 cuttings per m<sup>2</sup> is the ideal planting density. (Spacing 20 × 30 c.m.)

## **MANURING**

Chrysanthemum are heavy feeders and adequate quantities of NPK fertilizers should be applied. Nitrogen is required more at the early stage and potassium is to be given at the flower bud stage. Phosphorus can be given as basal dose and it is needed throughout the growing period.

## **IRRIGATION**

Chrysanthemum require good moisture during the active vegetative growth period. After the flower bud formation less amount of water need be given. For better growth and flowering the soil should be kept constantly moist.

## **Harvesting and Post Harvest Handling**

The flowers are cut when the maximum number of flowers are open in the case of single cultivars. Cutting of flowers should be done about 10 c.m. above the soil and one third of the stems are stripped off leaves. The cut flowers are to be placed in water immediately.

## **Grading**

Flowers are graded into several grades depending on stem length and strength, colour and diameter of flowers. (Grades are Gold, Silver, Bronze and make up)

Flowers are stored dry for 6 - 8 weeks by wrapping in plastics. They are packed in boxes based on grades boxes.

The yield of Chrysanthemum flowers range from 7.5 to 15 t./ha.

## **PLANT PROTECTION**

The common pests of Chrysanthemum are aphids, hairy caterpillar, mites thrips and nematodes. Several fungal bacterial and viral diseases are also found. By timely application of insecticides and fungicides the major pests and diseases can be controlled. Using disease free cuttings and soil sterilization are recommended for bacterial diseases. Use of cutting from virus free stock plants and control of aphids using insecticides are the control measures for viral diseases.

# MARIGOLD

*Tagetes Spp.*

*Family : Compositae*

Marigold is a very popular flower having wide adaptability. Flowering habit, short duration, wide variety of colours, good size and shape and better keeping quality are the major factors for its attraction. It can be used for bedding and for borders. Ideal for rockery and hanging baskets.

## VARIETIES

There are mainly two types of Marigold : African and French. African marigolds have yellow, and orange colours in various shades. (light yellow, canary yellow, golden yellow, bright yellow, golden orange, deep orange and bright orange. In French marigold, besides the above colours crimson and mahogany red colours are also there.

### African marigold varieties

Apricot, Sun Giant, Guinea Gold, Fiesta golden yellow, Hawaii, Honey comb.

### French marigold varieties

Rusty red, Naughty, Marietta, Flame, Star of India and Harmony.

## Propagation

Marigold is commonly propagated by seeds and cuttings.

## SEEDS

For raising seedlings, seeds can be sown in pots, seed boxes or on raised beds. Before sowing BHC should be added to the soil to prevent ants carrying away the seeds. Seeds should be sown lightly and covered with sand or sieved leaf mould. During the entire period the nursery should be kept moist. Marigold can be raised three times a year.

## Cuttings

From the stem adventitious roots are produced which helps in establishment of cuttings. 6-10 c.m. long cuttings are made from the apical portion of the shoot and treated with root promoting chemicals like IAA or IBA.



Cuttings are planted in sand for rooting and then the rooted cuttings are transplanted.

## **CULTIVATION**

The land is to be ploughed well and FYM at the rate of 20 t/ha should be applied. The marigold seedlings are transplanted at the 3-4 leaf stage. Transplanting is done in well prepared land and at a spacing of 40 × 30 c.m. (African marigold) and 45 × 45 c.m. for french marigold.

## **MANURING**

A basal dose of fertilizers @ 112.5 kg. N, 60 kg. P<sub>2</sub>OS and 60 kg. K<sub>2</sub>O are to be applied. Second dose of fertilizer is to be applied 30-45 days after transplanting (112.5 kg. N)

## **IRRIGATION**

For marigold moisture is essential at all stages of crop growth. In lighter soils heavier irrigation is required. Irrigation is done once 4-6 days.

## **PINCHING**

Pinching (removing the terminal portion of the plant) is to be done once in 30-45 days. Pinching enhances the flower yield.

## **HARVESTING**

Harvesting is done when the flowers attain full size. The marigold flowers can be harvested in about 4<sup>1</sup>/<sub>2</sub> months after transplanting. Plucking is done easily by hand. Plucking of flowers is done either morning or evening. By regular plucking of flowers the productivity of plant increases. The yield of flowers of French marigold is 8-12 tonnes while that of African marigold is 11-18 tonnes/ha.

## **PLANT PROTECTION**

Marigold is affected by fungal diseases like collar rot, leaf spot and blight flower bud rot, powdery mildew etc. By spraying Dithane, most of these diseases can be controlled. The major pests of marigold include mites, leaf hoppers, bugs beetles etc. Mites can be controlled by spraying kelthane, while bugs and leaf hoppers are controlled by spraying malathion.

# TUBEROSE

*Polianthes tuberosa*

Family : *Amaryllidaceae*

Tuberose has gained considerable economic importance and is cultivated commercially for its varied uses. It can be grown in pots, beds and borders. These flowers remain fresh for a long time and withstand long distance transportation. The long flower spike are excellent as cut flowers and are also used for garlands, floral arrangements and bouquets. The flowers are highly fragrant and are the source of tuberose oil.

## VARIETIES

These are three types of tube rose, single, double and semi double, classified based on the number of rows of corolla segments. The major varieties are Mexican single, Rajatha Rekha, Suvarna Rekha, Calcutta single and Calcutta double.

Single flowered type is more fragrant and is commercially cultivated.

## PROPAGATION

Propagation is mainly through bulbs. Spindle shaped bulbs free from diseases and having an average diameter of 1.5 c.m. or above are usually selected.

## SOIL AND CLIMATE

Tuberose grows well in places having plenty of sunlight. It is sensitive to extremes of high or low temperature. Warm humid areas with temperature range of 20-35°C is ideal for tuberose.

Though tuberose grows in a wide range of soils, loam and sandy loam soils with a pH of 6.5-7.5 with good aeration and drainage is ideal. The soil should be rich in organic matter and retain sufficient moisture.

## CULTIVATION

The field should be worked deep to a fine tilth and properly manured. Well rotten FYM @ 50 t/ha is to be applied. Weeding should be also done.

Bulbs of size 2.5 or above are to be planted at a depth 4 to 7 c.m. at a

spacing of 20 × 25 c.m. The ideal planting time is May-June.

### **MANURING**

Farm yard manure should be applied at the rate of 50 t/ha the time of land preparation. NPK fertilizer at the rate of 100:50:50 kg/ha is recommended. Nitrogen is applied in two split doses. One is basal and the other dose when the flower spikes begin to appear.

### **IRRIGATION**

Irrigate before planting to provide optimum moisture for sprouting and then withhold until the bulbs have sprouted. Afterwards irrigation is to be done at an interval of 10-15 days during dry weather.

### **HARVESTING AND POST HARVEST HANDLING**

Tuberose is harvested by cutting the spikes from the base and individual flower is picked from the spike depending upon the purpose for which it is used (Table decoration, garlands etc.). Picking of flowers should be done either in the morning or in the evening. Loose flowers are packed in bamboo baskets and transported to nearby markets. The flowers after grading are packed in bundles each having about 100 sticks. The stem portion of the bundles is wrapped in wet newsprint sheets. The whole bundles, after wrapping with tissue paper or polythene is packed in cardboard boxes and shipped by air.

Average yield of flowers is 5-9 t/ha.

### **PLANT PROTECTION**

Tuberose is a hardy plant and loss due to incidence of pests and diseases is meagre. Pests like aphids, thrips, mites and grasshopper may pose problems. By spraying malathion 0.1 per cent these pests can be controlled.

Stem rot is the major disease affecting tuberose, which results in falling of leaves. This can be controlled by soil application of Brassicol or zineb at 3 week intervals.

# GLADIOLUS

*Gladiolus spp.*

Family : *Ixiodeae*

Gladiolus, a very popular flowering plant is also known as 'sword lily' because of its sword shaped leaves. It has magnificent inflorescence with a variety of colours. It is suitable as herbaceous borders, for beddings, rockeries, pots and as cut flowers.

## VARIETIES

There are a large number of varieties under different colours in gladiolus.

White	Athena, Dream girl, Lipstick, White Friendship etc.
Green	Armstrong, Green Bay, Green Willow, Emerald
Cream	Classmate, Landmark, Dairy queen etc.
Yellow	Fatima, Golden Harvest, Morning Sun etc.

## Major varieties evolved in India and its characteristics

Manmohan	Primrose yellow with orchid purple splashes
Muktha	Sulphur yellow with splashes of orchid purple
Mohini	White splashed with tyrian rose and throat primrose
Apsara	Ruby red with barium yellow flecks in throat
Aarti	Poppy red with purple red and canary yellow blotch
Shobha	Shell pink with empire yellow throat
Meera	Snow white
Agnirekha	Fire red having scarlet stripes blends with saffron yellow
Mayur	Lilac purple with dark purple throat.

## PROPAGATION

Gladiolus is propagated through seed, cormels and corms. Seed propagation is to evolve new varieties. Cormels, produced in clusters between mother and daughter corms, are the important sources for increasing multiplication. Cormels are selected carefully to prevent diseases. Hot water treatment or soaking in water for 4-7 hours helps in easier and uniform sprouting. Corms and cormels are propagated by division to

increase the number of planting materials.

## **SOIL AND CLIMATE**

It can be grown in a wide range of soils. Deep well drained soils, with a pH of 5.5-6.5 rich in organic matter are ideal. Though grown under a variety of climate, mild climate (not very hot and not too cold) is preferable. In general, gladiolus prefers the sunny situation to humid atmosphere.

## **CULTIVATION**

### **Planting**

First ploughing is done to a depth of 30 c.m. two months before planting and 2-3 weeks before planting second ploughing is done. Weeds are to be removed at this time. Large sized corms are usually used. Only healthy and disease free corms should be used. Corms are planted in furrows at a distance of 30 c.m. The medium and smaller sized corms are planted at 7 c.m. deep while larger corms are planted at a depth of 15 c.m.

## **MANURING**

FYM at the rate of 25-30 t/ha is to be applied at the time of soil preparation. Fertilizer application at the rate 50:60:60 kg. NPK per ha is recommended.

## **IRRIGATION**

At the time of planting the soil should be kept moist so that the sprouting will occur easily. During summer watering should be done twice a week to wet the roots.

## **HARVESTING AND POST HARVEST HANDLING**

Depending on the variety, the flowering starts in gladiolus from  $1\frac{1}{2}$ -3 months. The flowers should be cut at the tight bud stage with atleast four leaves left on the plant. The whole spike with two leaves are cut. Around 2 lakh spikes can be obtained from 1 ha. For local sales, spikes may be taken submerging it in water. For long distances these are carried in card board or wooden boxes.

## **PLANT PROTECTION**

The major pests infesting gladioli are aphids, thrips, cutworms, mites etc. Aphids can be controlled by spraying dimethoate thrips are controlled by spraying monocrotophos.

The major diseases affecting gladioli are fusarium rot, blight, leaf spots, bacterial and viral diseases.

Most of the seed borne diseases can be prevented by hot water treatment and disinfection before planting. Through certain cultural practices also the diseases/pests can be prevented. Corms showing abnormality are to be discarded at the time of planting. Corms are to be planted under full sun. Corms should not be injured at the time of lifting. The corms should be used, clean and treated with fungicides.

# CARNATION

*Dianthus caryophyllus*

Family : *Caryophyllaceae*

The word *Dianthus* is derived from a Greek word meaning the 'Divine Flower'. Carnations are excellent for cut flowers, beddings, pots, borders, edging etc. and thus occupy a dominant place among the commercial flowers of the world. In India, though the cultivation is very limited there is great scope for growing carnations for the production of quality cut flowers.

## CLASSIFICATIONS

Carnations are classified as follows :

a) Border carnations and picotees

These types are characterised by their well frilled flowers having smooth edged broad petals. They are dwarf in habit and branch mainly at the base.

b) Perpetual flowering

They are hybrids involving many *Dianthus* sp. Plants in their class flower throughout the year. Though the plants are not hardy, the flowers are of better quality and stand long distance transportation.

c) Marguerite Carnations

This is a group of carnations have clove scented flowers of all shades of colour with fringed petals. Though they do not last long when cut, are free flowering over a long period and easy to cultivate.

## VARIETIES

The major commercial varieties grown in India are the following

- |         |  |
|---------|--|
| White   | : Fragrant Ann, Icecap, Snow clove, White perfection and white sim |
| Pink    | : Baileys supreme, Crowley sim, Linda, Pink Sim and shocking pink  |
| Scarlet | : Alex sparkes, Britania, Royal Mail, Scania and Wiliam Sim        |
| Crimson | : Baileys Masterpiece, Diplomat, Joker and Royal crimson           |

Yellow : Beauty of Cambridge, golden rain, Helios and yellow sim.

Apricot selfs : Harvest moon, Mandarin sim and tangerin sim

Fancies : Arthur Sim, Candy sim, Dusty Rose, Orange Triumph.

## **PROPAGATION**

Carnations are propagated by seeds, cuttings and layers. Seed propagation is practised in raising plants of marguerite carnations and for the purpose of hybridisation. Perpetual flowering carnations are vegetatively propagated by means of stem cuttings.

## **SOIL AND CLIMATE**

Carnations do well in a well-drained soil, rich in lime and sunny situation. Deep planting, water logging and mulching with manure are harmful.

## **CULTIVATION**

Ground beds, raised benches or pots may be used for growing carnation. The planting is done at a spacing of 15 × 15 c.m. during June-July. Cuttings should be planted in the same depth as they were in the rooting medium.

### **Planting in pots**

The potting mixture should consist of one part of cowdung, one part of red earth or garden soil are part of leaf mould and half coarse sand. To prevent water logging small pieces of charcoal may be added in the potting mixture. The plants should be potted in 25 c.m. or 30 c.m. pots. When the plants are 25 c.m. long they are staked with split bamboo sticks and inserted into the soil near the plant.

## **MANURING**

The mineral mixture for beds should consist of one part of bonemeal, sulphate of potash, and Calcium nitrate. Sixty grams of this mixture is added per square meter area. It can be used in liquid form also by dissolving 30 g of mixture in 15 litres of water and applied at the rate 5 litre



per square meter at fortnightly intervals.

## **PINCHING**

The tip of the stem is removed when the lateral shoots from the lower pairs are about 5 c.m. long or have about 6-7 pairs of leaves. Uniform pinching of all shoots is done twice, 40 and 60 days after planting.

## **HARVESTING AND POST HARVEST HANDLING**

The carnations come to flowering in about 4-6 months after planting. The flowers are harvested when the outer petals are unfolded nearly perpendicular to the stem. Spray type carnations are cut when two flowers open and the remaining buds show colour.

Flowers are harvested by cutting them with a sharp knife or with small pruning shears. After harvesting the flowers should be kept in water or preservative solution.

The harvested flowers are graded into three or four grades based on certain standards and then bunched in units of 25 stems. Carnations are packed in corrugated cardboard containers. About 800 carnations are packed in a standard size carton 30 c.m. high 50 c.m. wide and 122 c.m. long.

## **PLANT PROTECTION**

The major fungal diseases are wilts, stem rots, and rust. Mites, aphids, and thrips are major pests.

By soil fumigation and treatment with benomyl (1 g benomyl in 10 litres of water/m<sup>2</sup>) the wilt disease can be controlled. By spraying rogor (0.25%) aphids can be controlled. Regular fumigation with BHC smokes kill the thrips.

## CHINA ASTER

*Callistephus chinensis*

Family : *Compositae*

Aster is one of the most popular flowering annuals native to China. Wide range of colours are available. Grown for cut flowers and the cut flowers last long and are used for flower decorations. Dwarf types are grown for bedding and also for flowering potted plants.

### VARIETIES

***American Branched*** : The most popular cut flower variety. Long stemmed flowers. Wide range of colours - blue (dark and light) rose, salmon, violet, white and pink.

***Bouquet Powderpuffs*** : Medium sized flowers on rigid stems with wide range of colours.

***Princess and gaint princess*** : Large extra double flowers on long woody stems. Wide range of colours.

***Gaint of California*** : Large and late flowering type, wide range of colours.

***Ostrich feather*** : Medium sized flowers with curved petals and a wide range of colours

***Gaint erego*** : Flowers, petals long and ribbon like. Early flowering type.

***Rainbow or Chinensis single*** : Single daisy like flowers with yellow centres.

***Pompon*** : Globular shaped flowers, with quilled petals having wide range of colour - white, yellow, dark blue, rose etc.

***Liliput*** : Erect habit, fully double, small flowers.

***Dwarf Colour carpet*** : Dwarf plants (30-40 c.m.) flowers 4 c.m., suitable for potted flowering plants or for bedding.

***Pinocchio*** : Large number of star shaped flowers appear on dwarf and compact plants, excellent for bedding and window boxes.

### PROPAGATION

Propagated by seeds. The optimal temperature for germination of aster seeds is 21°C and seeds germinates in approximately 8 days. The presence or absence of light has no effect on germination. Seedlings can be produced bare rooted or in containers. Seedlings grown in containers are usually more

uniform.

## **SOIL AND CLIMATE**

Well drained loamy soils are best suited for aster production. Avoid water logging since it will result in the incidence of soil borne disease. Though a winter season annual, it is grown throughout the year. High night temperature reduces stem strength and flower size.

## **CULTIVATION**

### **Transplanting**

Seedlings can be transplanted when they are 3-4 leaves old. Seedlings should be hardened before transplanting to avoid transplanting shock. Asters are usually grown in beds 1 m wide. The seedlings are planted in rows 15 to 20 c.m. apart with 15 to 20 c.m. between plants.

## **MANURING**

NPK mixture (5:6:5) at rate of 5 kg. per 20 c.m. can be broadcasted on the bed as preplant applications.

After ploughing 34 g ammonium sulphate 50 g superphosphate and 18g muriate of potash per 5 sq.m. can be given. Aster also respond well to application of micronutrients.

## **IRRIGATION**

Asters need continuous soil moisture for the entire growth period. Hence irrigation is essential for successful commercial aster production. Overhead microjet or drip system of irrigation is recommended.

## **HARVESTING AND POST HARVEST HANDLING**

Flowers must be harvested at the correct stage of development. Asters are cut when the outside petals are fully unfolded. It is desirable to cut stem lengths atleast 30 c.m. and upto 45 c.m.

Immediately after harvest, the flowers are to be placed vertically in a container having clean water. The leaves are usually stripped off the lower one third to half of the stem. During packing care should be taken that there is no contact between the flower and the packing material. Clear plastic films are good packing material.

## **PLANT PROTECTION**

The major diseases affecting aster are fusarium wilt and Botrytis blight. The major pests include leafhoppers, aphids, spider mites, mealy bugs etc. Spraying kelthane at 1 ml/litre of water can control the mites. The diseases can be controlled by spraying the plant with fungicides and also by soil drenching of fungicides.

# GERBERA

*Gerbera jamesonii*

Family : *Compositae*

## INTRODUCTION

Gerbera, named after a German naturalist Traugott Gerber, produces very attractive flowers. This is suitable for beds, pots, borders and rock gardens. The flowers are of various colours and last for a long time when placed in water.

Plants are stemless and tender perennial herbs. The flowers are in wide range of colours including yellow, orange, cream white, pink, brick red, salmon, maroon, terracota and other intermediate shades. The flower stalks are thin and leafless.

## VARIETIES

Though the genus *Gerbera* consists of about 40 species only *G. jamesonii* is under cultivation

*Gerbera* varieties of commercial importance are Cream clementine, Maron Clementine (orange) Flamingo (Pale rose), Delphi (white), Vesta (red) Uranus (yellow), Terraqueen (pink), Dusty (red) Valentine (pink) etc.

## PROPAGATION

Propagated through seeds, vegetative propagation (divisions, cuttings) and micro propagation.

### Seeds

Propagation through seeds, is simple and economical. The medium for sowing should be light to provide aeration and optimum temperature for germination is found to be 25° C. The seedlings are picked at 2-4 leaf stages (5-6 weeks).

## VEGETATIVE PROPAGATION

### Divisions

The large clumps are divided into smaller units. The roots and leaves

of the suckers are trimmed keeping the central shoot in tact.

### **Cutting**

For taking cuttings, suitable plants are kept without water for 3 weeks, roots pruned, and held at 25-30°C with 80 per cent relative humidity. The buds in the axils of the leaves are detached and rooted in rooting medium. They will be ready for transplanting within 2-3 months. About 40-50 plants can be produced within 2-3 months from a single mother plant.

### **Micropropagation**

This involves rapid multiplication of explants by repeated subcutting and preparation of divisions for planting in the soil. Shoot tips and inflorescence are employed as explants for micropropagation.

### **Soil and climate**

Well drained, rich, neutral or slightly alkaline soil is best suited for gerbera production. Gerberas are grown in the open. During summer months light shading is to be given.

## **CULTIVATION**

### **Planting**

Gerberas are to be planted in raised beds in rows 30 c.m. apart. The spacing in rows ranged from 20-40 c.m. Close spacing is ideal for annual crop and wider spacing for perennials. Growing of gerbera in raised beds improves drainage and aeration.

### **MANURING**

Organic manuring is very important for gerberas. Application of 7.5 kg. rotten farm yard manure per m<sup>2</sup> is found to be ideal. NPK fertilizers in the ratio 2:1:3 was found to be ideal (3-4 gms/litre given as foliar spray).

### **IRRIGATION**

Gerberas need to be heavily irrigated during summer months. Number of flowers and quality of flowers were found to be increased when irrigated thoroughly instead of light sprinkling at frequent intervals.

## HARVESTING AND POST HARVEST HANDLING

The flowers are to be harvested when the outer two rows of disc florets are perpendicular to the stalk. The flowers should not be cut before the outer row of flowers show pollen.

The gerbera flowers respond well to recutting of stem before placing in water or preservative solutions. They are not suitable for long term storage since the flowers lose 40 per cent of their vase life even after 7 days storage. For good vase life cut flowers should be placed in fresh water immediately after harvest

## PLANT PROTECTION

### Diseases

The important diseases include root rot, foot rot, blight, powdery mildew bacterial blight and viral disease. (Tobacco rattle virus) Soil sterilization gives good control of root rot while drenching difolizaton at the rate of 1g/m<sup>2</sup> controls foot rot. Treatment with 0.1% thiram controls blight.

### Pests

The major pests are white fly, leaf miner, mites and aphids. Dimethoate at 0.1% gave good control of leaf miners. Dusting with sulphur can control mites in non flowering plants. Spraying dichlorvos at 0.1% controls the aphids.



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## FLOWER SYMBOLS

1 Anemone	I am foresaken
2 Bluebell	I am constant
3 Butter cup	Ungrateful
4 Heather	Solitude
5 Hyacinth	Ready for fun and play
6 Lilac	First love
7 Lobelia	Watch out - malevolence
8 Lupin	Voraciousness
9 Marigold	Grief
10 Pink or Carmat an	Bold
11 Poppy	Consolation
12 Rose	Love
13 Stock	Everlasting beauty
14 Red tulip	I love you
15 Wall flower	I'll stick with you in 'll troubles