MARIGOLD

- **African marigold:**
  Tagetes erecta

- **French marigold:**
  Tagetes patula

- Family: *Asteraceae*

Genus *Tagetes*

- In genus *Tagetes* there are 33 species, but commercially two species *T. erecta* and *T. patula* are grown in our country and in western countries another species *T. tenuifolia* is also grown.

Importance of Marigold

- Marigold is one of the most commonly flowers garden for garden decoration and extensively used as loose flower for making garlands for religious and social functions.
- It has gained popularity amongst gardeners on account of its easy cultivation, wide adaptability and year round flower production.
- Its free flowering habit, short duration to produce marketable flowers, wide spectrum of attractive colours, shapes, size and good keeping quality has attracted the attention towards it of many amateur and commercial flower growers.
- Marigold is also highly suitable for bedding, edging, herbaceous borders and pots.

Cultivars in Marigold

African Marigold (*Tagetes erecta*):

- Pusa Narangi Gainda, Pusa Basanti Gainda, Giant Double African Orange, Cracker Jack, Crown of Gold, Guinea Gold, Double Eagle, Dubloon, Climax, Hawaii, New Alaska and Spun Gold.

French Marigold (*Tagetes patula*):

- Pusa Arpita, Butter Ball, Flash, Colour Magic, Janie Gold, Janie Yellow, Star of India, Red Brocade, Rusty Red, Susana and Valencia

Interspecies Hybrids:

- Pusa Shankar-1, Nugget, Red and Gold, Red Seven Star and Show Boat.

Soil and Climate

- Marigold can be grown in a wide range of soil. African marigold prefers well maured moist soil, while French marigold prefers well drained light soil. The ideal pH for growing marigold is around neutral.

- Marigold can be grown in a wide range of climatic conditions throughout year except old winters when temperature is less than 10°C. Ideal growing temperature ranges from 15 to 35°C. Very high temperature also affects adversely growth and flowering. Avoid frost/ chilling injury.

Propagation

- Marigold is commercially grown through seeds.
- About 500-600g seed is sufficient to grow marigold in one hectare area.
- Double marigold cultivars are also perpetuated through 5-10cm long terminal stem cuttings taken during July-September.
- These cuttings are treated with IBA/ NAA 500ppm solution for 1-2 minutes before planting in beds/ rooting chamber.
- The nursery becomes ready for transplanting at 4-leaf stage coming after 4-6 weeks

Ideal time for raising nursery in different areas

Area	Summer Season	Rainy/ Autumn Season	Winter Season Crop
Low hills	Feb.-Mar.	May-June	Sep.-Oct.
Mid hills	Jan.-Feb.	May-June	----------
High hills	Mar.-April	May-June	----------

Spacing

- African Marigold: 40 x 30 cm
- French Marigold: 30 x 30 cm
- Dwarf cultivars: 30 x 20 cm
- Pots (20 cm): 1 or 3 seedlings/pot

Nutrition

- African Marigold: 5 Kg FYM, N 30g, P 10g, K 10g/ m^2.
- French Marigold: 3 Kg FYM, N 20g, P 10g, K 10g/ m^2.
- All dose of FYM, 1/3rd N, full dose of P and K are mixed in soil at the time of final field preparation.
- Rest dose of N is applied in two split doses after 30 and 60 days of transplanting.
- In case of French marigold N is applied in two splits one at planting and second after one month of transplanting.

Irrigation

- Irrigation at 7-10 days interval during September-November and twice a week during March-June is ideal.

Pinching

- In pinching terminal growing shoot about 2-3 cm long is removed to overcome apical dominance and to promote side branching when the plants are about 15-20cm height.

Staking

- String or rope is erected at 20, 35 and 50 cm above the ground level in three rows at the same distance along the rows.

Inter-culture and Weeding

- Hoeing once or twice during first 40 days is ideal to control most of the weeds and to maintain soil in good tilth.
- Atrazine or Basalin @ 1-1.5 kg (a.i.) /ha is ideal for spay as pre-planting.

Diseases and Insect-Pests

- Damping off and collar rot (*Rhizoctonia solani, Pythium, Phytophthora*)
- Leaf and inflorescence blight (*Alternaria, Cercospora, Septoria*), and
- Viruses (Cucumber Mosaic)

- Red spider mites, thrips and Hairy caterpillars are important insects.

Damage by Red Spider Mites

Red spider mites attack in marigold

Thrips infestation

Thrips attack in marigold

Hairy caterpillars feeding on marigold

Aphids and mites feeding on marigold

Flower harvesting

- Fully open flowers are harvested during cool hours either in morning or evening in bamboo baskets or crates or gunny or poythene bags.
- Irrigation one day before harvesting increases the shelf life of flowers.

Average Yield

Category		tonnes/ha		Million/ha
African Marigold	10-18	1.5-2.5		
French Marigold		8-12		6-8
Hybrids		15-20	3-5	

TUBEROSE

Botanical Name:

Polianthes tuberosa

Family: *Agavaceae*

Origin: Mexico

Importance of Tuberose

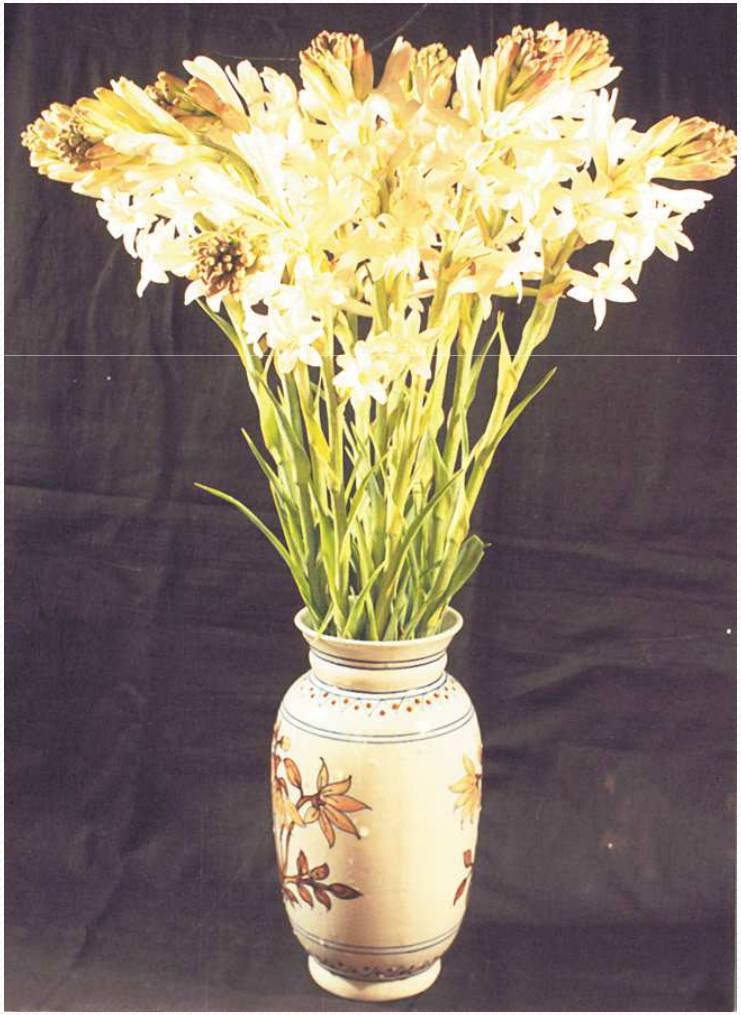
- In India it has gained considerable importance and is being commercially grown in West Bengal, Tamil Nadu, Maharashtra, Karnataka and hilly areas.
- It is grown for long stem cut flowers, loose flowers, beds, borders and pot plant.
- It is also grown for perfumery as its flowers contain about 0.1 per cent oil.

Cultivars

- Single flower type (Rajat Rekha, Shringar, Prajwal, Mexican, Calcuttia and local types)

- Double flower type (Swarna Rekha, Suvasini, Vaibhav, Mexican, Calcuttia and local).

Shringar



Prajwal

Suvasini


Arka Niranthara

Vaibhav

Soil and Climate

- **Soil:**
- Tuberose can be grown in any soil but loam and sandy-loam soil having pH around neutral, good aeration and drainage.
- **Climate:**
- Tuberose grows well in sunny situation having warm humid conditions. The temperature should be 20-35°C as low and high temperatures adversely affect the growth and floral quality.

Planting Time

- Low hills: Sep.-Oct.
- Mid hills: Jan.-Mar., Sep.-Oct.
- High hills: April-May
- Staggered planting at fortnightly interval insure regular supply of cut flowers for longer duration.

Propagation

- **Propagation:**
- Tuberose is propagated by bulbs (2-3 cm diameter).
- **Treatment of Bulbs:**
- Dip bulbs for about 20 minutes in a solution of Emisan (0.2%), Thiram (0.3%), Captan (0.2%), Bavistin (0.2%) or Benlate (0.2%).
- Dry in shade before planting or storing.
- Before planting treat corms in systemic fungicide and before storing in contact fungicide.

Planting density and spacing

- Important factors are the purpose of cultivation whether for cut flowers, planting material or both, nutrient status of the soil, bulb size, cultivation in greenhouse or open fields.
- Low planting density results in wastage of inputs and very high planting density leads more plant competition, thus reducing individual bulb enlargement.
- For economic returns the optimum planting spacing is 20 x 20 cm row to row and plant to plant, respectively or 30 x 20 cm.
- About 15-20q bulbs are required for tuberose cultivation in one hectare area.

Planting depth and Methods of planting

- **Planting depth:**
- It should be 2.5 times than the diameter of bulbs. Planting depth of 8-10 cm is ideal for production of quality cut flowers and bulbs.
- **Methods of planting:**
- Planting is done in flat beds in low hill areas and on ridges in mid and high hill areas.

Nutrition

- If soil contains sufficient nutrients then there is no need for applying chemical fertilizers and FYM @ 5 kg N: 30g, P: 20g, K: 10g/m^2 is sufficient.
- Apply half of N and full dose of P and K at the time of planting and rest N at the time of spike emergence

Irrigation

- Soil should have 60-90 per cent moisture and no watering is required until bulbs sprout.
- Depending upon weather 8-12 irrigations of 2.5-5 cm depth are required.
- Stage immediately after sprouting and 4-6 leaf stage are very sensitive to water deficit. Irrigation once a week is ideal.

Staking or Plant Support

- Earthing up to 10-15 cm height is done when plants are 15-20 cm high.
- Staking with bamboo or wooden sticks is done in beds and string or rope may be tied in three rows along the plant-rows to avoid lodging of plants.

Weeding

- High manure and irrigation requirement creates congenial conditions for the growth of various weeds.
- Three-four hand weedings are sufficient.
- Atrazine (1.5 kg/ha), oxyfluorfen (0.5 kg/ha) are sprayed as pre-emergence or Stomp @ 3.3 l/ha (pendimethalin @ 1.0 kg/ha) control very effectively weeds when applied as pre-emergence and after 45 days of planting in about 3000 litre water.

Diseases

- Stem rot (*Sclerotium rolfsii*)
- Alternaria leaf spot (*Alternaria polyanthi*)
- Blue mould (*Botrytis elliptica*), and
- Flower bud rot (*Erwinia* species)

Insect-pests

- Grasshopper
- Aphids
- Thrips
- Caterpillars
- Red Spider Mites, and
- Nematodes

Harvesting of Flowers

- Tuberose flowers are ready for harvesting after 100-120 days of planting.
- Harvesting is done in cool hours either in the morning or evening.
- **Local market:** Cut flowers are harvested when lower one pair of flowers is fully open
- **Distant market:** Lower pair of flower buds have just burst
- **Loose flowers:** Fully/ half open flowers

Grading and Packaging

- **Grading:**
- Tuberose cut flowers are graded according to spike length, rachis length and number of flowers per spike.
- Loose flowers are graded according to flower size.
- **Packaging:**
- Cut flowers are marketed in bunches of 25, 50 or 100 and these bunches/bundles are packed in bamboo baskets, card board cartons/containers and are transported vertically.
- Loose flowers are packed in bamboo baskets or gunny bags or polythene bags lined with newspaper.

Bulb Harvesting

- Harvest bulbs after 40-50 days of flowering or foliage start turning yellow.
- Treat bulbs before storing.
- The bulbs are graded into two sizes as small less than 1.5 cm in diameter and large more than 1.5 cm in diameter.
- Tuberose bulbs are harvested/lifted after 2-3 years.

Average Yield

Year	Cut Flowers (Lakhs/ ha)	Loose Flowers (Ton/ha)	Bulbs (Lakhs/ ha)
First	3.5-5.0	6.0-10.0	-----
Second	5.0-6.0	10.0-12.0	18.0-20.0

Jasmines

- Botanical name**: *Jasminum spp.***
- Family **: Oleaceae**
- Origin : **India**
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- Jasmine is one of the most popular commercial flowers grown in India and are used for making garlands and *veni* and *gajra* for adorning the hair of women.

Species and Cultivars

- A number of jasmine species are grown in India. Commercially grown important species are *J. sambac, J. grandiflorum* and *J. auriculatum.* The brief description of these is given below:
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- ***J. sambac*:** Also called Arabian Jasmine. The flowers buds are white, with single or multi-whorled petals, used for garland-making, adorning hair and extraction of perfume. It is a bushy weak-stemmed shrub with pubescent branches.
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- **Varieties:**
- Gundu Malli, Single Mohra, Double Mohra, Madanban, Ramabanam, Kasthuri malli.
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- ***J. grandiflorum:*** Also called Royal or Spanish Jasmine, Chameli, Pitchi. It is a large shrub pinnate leaves. Flowers are white, often tinged with purple. It is suitable for concrete extraction.

Species and Cultivars……cont

- **Varieties:**
- Pin type, Thrum type, J.G.1 (Bangalore), J.G.2 (Coimbatore), J.G.3 (Lucknow), J.G.4 (Tenkasi white), J.G.5 (Thimmapuram), J.G.6 (Triploid), Surabhi, CO1 Pitchi, CO2 Pitchi.
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- ***J. auriculatum:*** Also called Jathi Malli, leaves are mostly simple, usually trifoliate. The flowers are star shaped, white-scented blooms, borne in flan cymes. Black type of this is grown in home gardens.
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- **Varieties:**
- CO1 Mullai, CO2 Mullai, Pari Mullai, Long point, Long round, Medium point and Short round
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- **Other important species of floricultural importance:**
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- ***J. multiflorum***
- It is also called Kakada, Tundam. Resistant species, not scented and is very ornamental.
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- ***J. arborescens***
- It is also called as Tree Jasmine, Muta, Bela. It is a large shrub with fragrant white flowers.

Planting

- Jasmine is perennial in nature.
- The plants remain in the same spot for many years.
- Generally planted during rainy season. Pits of 45x45x45 cm are dug at least one month before planting, the pits are filled with 2 parts of well-rotten cow dung manure and one part each of fresh earth and coarse sand.
- In termite – prone all as, dry leaves may be burnt in pits or a handful of BHC may be added to filling pit/ minture. Pits should be irrigated to settle the minture/ pit.
- Well-rooted, healthy and strong plants are planted in pits (one in each). Soils with proper drainage and irrigation facilities and sunny condition are ideal.
- Planting distance plays an important role in flower yield. To get the highest yield, recommended distances are:
    - *J. sambac*, 1.2 x 1.2 m
    - *J. grandiflorum*, 1.5 x 1.5 m
    - *J. auriculatum*, 18 x 1.8 m
- Climbing species are spaced to a wider distance, which depends on the purpose and choice of growers.

Pruning

- Pruning is essential to get optimum yields and to keep the bushes within manageable size.
- The first pruning is done in the year following planting and thereafter once a year. The bushes are pruned during December – January every year.
- Irrigation is stopped 15 days before pruning and pruned to a height of 75-90 cm. from ground level. After pruning the soil around the bushes is dug upto a depth of 15 cm and a diameter of 60-75 cm all around leaving 30 cm of area close to the bush undisturbed.
- The dug basins are exposed for a week. After this manures and fertilizers are applied and irrigated sparingly (once in week) at initially and increased after the appearance of flower buds (once in 4 days).

Manuring

- Many commercial growers use early organic manure by mining one part each of horse and donkey manure and tank silt.
- The minture/pit is applied @ 10 kg / plant / year. A fertilizer doze of 100g : 150g : 100g of NPK over a basal doze of 10 kg FYM / pH / year is ideal for getting minimum flower yield may be obtained if Mg (40 kg/ha), Zn (10kg / ha) and B (5 kg/ha) are applied along with NPK fertilizers.
- The Nitrogen doze can be reduced to half (50 g / pH / yr) if applied as foliar spray in equal dozes beginning from first week of February at fortnightly intervals.
- In *J. auriculatum*, 120:240:240 g of NPK is recommended / plant / year. In *J. sambac*, 90:120:240 g NPK / pH / year is recommended and most beneficial at Coimbatore.
- For *J. multiflorum*, 120 g Nitrogen / plant / year is recommended at Bangalore.

Irrigation

- Moderate watering is good for jasmine. It is more essential during flowering.
- During blossoming, the water should be applied twice a week if there is no rain and once a week during out of the months.
- After the cessation of flowering, watering is to be completely stopped until pruning and fertilizer application.
- With the advancement of cold weather, the plants begin to shed the leaves.
- After pruning and manuring, watering is resumed.
- In *J. sambac* flowers come in phases. Each phase lasts for 7 days during which the blossoms are put forth in perfusion. There is an interval of about a month between one bloom and the commencement of the next with the close of each flowering phase, watering is completely stopped for weeks together till the appearance of fresh flowering buds.

Harvesting:

- Unopened but fully developed flower buds should be picked in the morning and marketed immediately.
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- **Average yield:**
- ***J. sambac*** (Gundu malli) – 6200 Kg/ ha
- ***J. grandiflorum*** (Pari malli) – 10,000 Kg / ha
- ***J. auriculatum*** (Jathi malli) – 11,000 Kg / ha