

*Package of Practices of flower crops*

**2017**

**FLORICULTURAL RESEARCH STATION**  
**Sri Konda Laxman Telanagna State Horticultural**  
**University,Rajendranagar,Hyderabad-30**

## FLOWER CROPS

| Crop          | Page no |
|---------------|---------|
| Chrysanthemum |         |
| Crossandra    |         |
| Gladiolus     |         |
| Jasmine       |         |
| Marigold      |         |
| Rose          |         |
| Tuberose      |         |

## *Traditional Flowers*

### **CHRYSANTHEMUM** (*Dendranthema grandiflora*)

Chrysanthemum locally called a 'Chamanthi' is a very popular fragrant flower cultivated for loose flowers and its cultivation is concentrated in the neighbouring districts of Hyderabad. It is cultivated in 1,320 hectare under open conditions for loose flowers and are used for garland making and religious offerings. Recently the cultivation of chrysanthemums is popularized for cut flower production in Telangana.

#### **Soil and Climate**

Well drained, sandy loam soil with PH of 6.5-7.0 is ideal. It is highly sensitive to waterlogged conditions. Chrysanthemum is a short day plant and for vegetative growth it requires long day conditions with bright sunlight and high temperatures ranging from 20 to 27 °C. For bud formation and flowering it requires short day and low temperatures ranging from 10 to 27°C.

#### **Flower Types**

In chrysanthemum flowers are classified by the kind and arrangement of florets into five broad groups 1) Singles, 2) Anemones, 3) Pompons, 4) Decorative, 5) Large flowered.

#### **Varieties**

All the cultivated types can be broadly classified into three groups.

1. The small flower type known as Nakshatra Chamanti or Kasturi Chamanthi
2. Medium flower types or Patnam Chamanti and
3. Large flower types which are mostly used for flower decorations and for cut flowers.

Among these three types, there are variations in colour ranging between yellow to red with different shades of admixture. In chrysanthemum a number of hybrids, promising varieties and locals are available for commercial cultivation.

The following varieties are suitable for loose flowers in telangana state

#### **Yellow**

1. Basanthi
2. Punjab Anuradha
3. CO-1, Co-3
4. Yellow Gold
5. Silper
6. Raichur

#### **White**

1. Ratlam selection
2. IIHR-13
3. IIHR-6
4. Baggi
5. Mother Theresa
6. PAU-107

Red  
Red stone  
Red gold  
Indira  
Co-2

Small  
Button chrysanthemum

- Popular local commercially cultivars are Sugandha white, Sugandha yellow, Marigold, Chandamama yellow, chanadamama white & violet types

### **Planting Season**

Chrysanthemum is a short day plant and flowers during cool season. The best time for planting is June- July while late varieties can be planted upto August. However farmers plant in the month of 2<sup>nd</sup> fortnight of May so as to coincide flowering with festive season. Flowering starts from September and continues upto January.

### **Preparation of Land**

Land is ploughed 3 to 4 times in March-April and 25-30 t/ha of farmyard manure applied in the last ploughing and the land is made into beds of convenient size. It is suggested that 4 ft wide beds are made so that while picking there will not be trampling and damage of plants. 60kg of P<sub>2</sub>O<sub>5</sub>/ha in the form of Superphosphate is recommended incorporated in the last ploughing.

### **Propagation**

Chrysanthemum is commercially propagated by terminal cuttings or through micro propagation. Propagation through suckers is discouraged since there will be transmission of viral diseases from parent material and also there is no uniform flowering

#### **a) Terminal cuttings**

The best time of raising nursery is May-June. select terminal cuttings of 5-7 cms length from healthy stock plants. Dip the terminal cuttings in 2500 ppm Indole butyric acid or any commercial formulations of rooting hormone and planted in raised nursery beds or portrays for rooting. Drench the beds or trays with Bavistin @1g/l and spray Aliette @1g/l to avoid soil borne diseases. The plants are ready for planting in 30-40 days. Nursery raised in 3.2-4 cents will be sufficient for planting an acre.

### **Planting**

Plant well rooted suckers/cuttings in ridges at a spacing of 30 x 30 cm during June-July or August and 44,000 rooted terminal cuttings are required per acre.

### **Manures and Fertilizers**

During last ploughing apply 4 - 5 tons of FYM and 2kgs each of Azospirillum and Phosphobacter along with 1kg of neem cake and 90 kgs of FYM per acre. The fertilizers recommended for one acre are 50 kg of nitrogen, 160kg P<sub>2</sub>O and 80 kg K<sub>2</sub>O which are to be applied as basal dose. Top dress the crop with 50 kg Nitrogen /acre at the time of first pinching. Foliar spray of ZnSO<sub>4</sub> 0.25% + MgSO<sub>4</sub> 0.5% is recommended.

### **Intercultivation and Irrigation**

Irrigate the crop twice at week in the first month and subsequently at weekly intervals. Irrigation depends on soil and weather conditions. Weeding and hoeings's generally done manually as and when required, normally 8-10 times. Mushing can be taken up on raised bed under drip irrigation system. This not only avoids weeds but also conserves the moisture.

### **Horticultural Practices**

#### **i) Staking**

Staking is necessary for tall growing varieties.

#### **ii) Pinching**

the terminal buds are removed at 4weeks after planting to induce more side shoots. This may be repeated on lateral shoots after 7weeks of planting or 100 days before full bloom.

**iii) Desuckering:** Remove the side suckers periodically.

**Growth regulators:** Foliar Spray of GA<sub>3</sub> @ 50 ppm on 30, 45 and 60 days after planting increases the number of blooms per plant

#### **Harvesting**

Depending on the variety plants start yielding flowers after 3-4 months of transplanting. Fully opened flowers are to be plucked by hand picking at 4 days interval with or without pedicel (stalk) for loose flowers purpose.

#### **Yield, packaging and Economics**

Flowering season varies from region to region. The harvesting of the crop commences from September -January and lasts upto February-March depending upon the time of planting.

### **Plant Protection**

#### **Pests**

#### **Aphids (*Macrosiphoniella sanborni*)**

Greenish black nymphs and chocolate brown adults suck the cell sap from growing shoots and lower surface of leaves. Damage results in loss of vigour, yellowing and

premature leaf fall and stunted growth. Honey dew secreted by aphids favours development of sooty mould.

#### **Control**

Spraying of pongamia oil or neem oil 2% gives significant mortality of aphid. Spray Dimethoate or Oxydemeton methyl at 0.05%.

#### **Thrips (*Microcephalothrips abdominalis*, *Frankiniella* spp.)**

Slender white nymphs and black adults feed on tender leaves causing silvery, mottling and distortion of leaves. Damaged flowers discoloured, withered and dried due to scorching.

#### **Control**

Spraying of Acephate or Cartap hydrochloride or Ethofenprox or Dimethoate at 0.05%, at 15 days interval. Drench the soil with chlorpyrifos 0.1% to control pupae.

#### **Bud borer (*Helicoverpa armigera*)**

Round cream coloured eggs are deposited singly on bracts and petals of buds. Larvae feed on growing flowers causing considerable flower loss.

#### **Control**

Sprays Endosulfan 0.07% or Methyl parathion 0.05% or Fenvalerate 0.01% at appearance of eggs. Spraying of NPV of *Helicoverpa* @ 250 LE/ha also gives effective control.

#### **Leaf folder (*Hedylepta indicata*)**

Pale white eggs are laid singly or in small groups on lower side of leaves. Green larva with brown head folds leaves together and feeds on chlorophyll. Affected leaves become skeletonized and dry. The larvae also damage flowers by feeding on petal.

#### **Control**

Cutting and burning of infected parts. Two or three sprays of Methyl parathion or Quinalphos at 0.05% or Fenvalerate 0.01% give effective control of leaf folder.

#### **Lesion nematode (*Pratylenchus coffeae*)**

Stunting of plants with premature yellowing and drying of leaves, reduced flower size, dark lesions on roots.

#### **Control**

Apply neem cake 1t/ha or Carbofuran 2.5kg/ha.

#### **Bud and leaf nematode (*Aphelenchoides ritzemabosi*)**

Interveinal discoloration of leaves and their death. The nematode spread up the plant from base. Dead leaves do not drop.

## **Control**

Hot water treatment of 'stools' at 46°C for 5 minutes. Spray 0.02% Thionazin or 0.01% Methyl parathion to aerial parts.

## **Diseases**

### **Wilt (*Fusarium oxysporum*, *f. chrysanthemi*)**

The infected plants show chlorosis and necrosis starting from lower leaves. The apical leaves show curving and necrosis. At the base of the plants above the soil surface dark streaks are common.

## **Control**

Drenching the soil with Thiophanate methyl or combination of Benlate + lime + nitrate are effective.

### **Stem rot (*Fusarium solani*)**

The symptoms appear as leaf chlorosis, necrosis and decay and discolouration of pith and the adjacent vascular region of the cortex. When flower buds are about to open, small dark streaks are seen at the base of the stem. Root decay is noticed only in the advanced stages of infection.

## **Control**

Soil treatment with Thiophanate methyl or a combination of Benlate + Lime + nitrate is effective.

### **Root rot (*Pythium sp.*, *Phytophthora sp.*)**

Root rot is common in wet weather conditions. Under high soil moisture the affected plants will suddenly.

## **Control**

Besides fungicides like Captan, Mancozeb, Metalaxyl and Fosetyl-Al, soil solarization is useful.

### **Powdery mildew (*Oidium chrysanthemi*)**

The symptoms appear as powdery coating on the leaves. This disfigures the leaves and often results in defoliation.

## **Control**

Use sulphur fungicides or Carbendazim.

### **Leaf spot and flower blight (*Alternaria sp.*, *Septoria chrysanthemella*)**

The infection first appears on the lowermost leaves. The small dark brown spots with yellow surroundings merge and in the advanced stages the entire foliage rots. When the flowering starts the infection occurs on flower buds, which rot completely.

## **Control**

Spraying of Mancozeb at 10-15 day intervals offer good control.

## **CROSSANDRA**

*(Crossandra infundibuliformis)*

Crossandra flowers are very popular for their bright colour, light-weight and long keeping quality. Deep orange coloured flowers are of great demand for garlands and hair adornments.

## **Soil**

Crossandra can be cultivated in a wide range of soils. Fertile, red loamy soils with pH range of 6 to 7.5 and rich in organic matter are ideal for its cultivation. Avoid nemode infested soils.

## **Varieties**

Rcently released varieties Arka Ambara and Arka Shreya are promsing high yielding cultivars with quality flower production. Some times seed may be collected from locally available high yielding genotypes and plants are raised in the nursery.

## **Propagation**

Propagation is by seeds or stem cuttings.

### **i)Seeds and Sowing**

Seeds are sown in June-July in raised beds. About 2 to 2 ½ kg of seeds will be required per ha to plant at a spacing of 60 x 40 cm. Treat the seeds with mancozeb or carbendazim @ 2g/kg . The seeds loose viability very soon and hence only freshly extracted seeds should be used. Care should be taken to protect the germinating seedlings from cut worms by dusting Carbaryl 5% on the beds. The damping off disease can be controlled by applying wetttable ceresin (1g/l) to the seed beds. Vigorous growth of the seedlings can be promoted by applying Ammonium sulphate solution (25g/10 lit of water) to the seed beds twice a week. When the seedlings develop 3-4 leaves they are ready for transplanting. The seedlings are transplanted at a spacing of 60x40cm. Before planting, it is better to dip the roots of the seedlings in wet Ceresan solution to prevent the incidence of wilt disease. The seedlings will be ready for transplanting with in 50-60 days after sowing. In the case of triploid varieties like Delhi, Arka ambara, Arka shreya cuttings are used. Cuttings should be transplanted when sufficient roots have developed.

## **Preparation of Land**

The land is ploughed 4-6 times, 8 t/ha of farmyard manure is applied in the last ploughing and ridges are formed or beds and channels formed at convenient size (60cm apart). Seedlings are transplanted on the sides of the ridges (40 cm).

## **Manuring**

The crop is top dressed 3-4 times with 25-20-45 kg/acre of N: P<sub>2</sub>O<sub>5</sub> : K<sub>2</sub>O each time, at 3,6,9 and 15 months after transplanting . Application of Zinc sulphate @ 5gm/lt 60 days after transplanting increases the flower yield and also quality. The application of fertilizers is to be necessarily followed by irrigation.

## **Irrigation**

Immediately after planting, the crop has to be irrigated twice a week and later irrigation is to be provided at 7-10 days interval based on climate and soil conditions. Dried flower stalks and branches are to be removed at regular intervals.

## **Intercultivation**

Weeding once or twice may be done during the first two months.

## **Harvest and yield**

Crossandra flowers within two to three months after planting and continues to bear flowers throughout the year with a lean production during rainy months. Flowers are to be picked early in the morning by pulling the corolla out of the calyx. Flowers will be available for picking for six months in a year. At each picking, an yield of 5 to 7 kg of flowers will be obtained. After 6 months, about 200-280 kg of flowers per hectare/year will be obtained. Harvesting of flowers is to be done on alternate days. The crop can be retained in the field for about 3 years. After that it has to be removed as it would not be economical to keep it.

## **Plant Protection**

### **Pests**

#### **Brown Scale (*Saissetia nigra*), White scale (*Orthezia insignis*)**

Yellowish nymphs and dark brown adult scales are seen in large numbers under leaves and on petioles and stem. Severe infestation results in stunted growth and leaves turn yellow and drop. Honey dew secreted by *Orthezia sp.* favours development of sooty mould which harms the plant growth.

### **Control**

Removal and burning of infested portion of plants prevents further spread. Application of Carbofuran granules at 1 kg a.i./ha and spraying of dimethoate @ 2ml/lit or acephate @ 1gm/lit or Chlorpyrifos 0.05% at fortnightly intervals.

### **Mealy bugs**

Nymphs and adults suck the sap and weaken the plants.

### **Control**

Spray dimethoate @ 2ml/lit or acephate @ 1gm/lit.

### **White flies (*Lipaleyrodes sp.*)**

It occurs in large numbers on the undersurface of leaves. It is prevalent during August-November and heavy infestation leads to chlorosis and development of sooty mould.

### **Control**

Spray Dimethoate @ 2ml/lit or Acephate @ 1gm/lit or Phosalone 0.05% or Fenthion 0.05% at fortnightly interval repeated twice.

### **Nematodes**

They are serious pests in crossandra. The affected plants shows brown to black colored spots and lesions on the roots. In severe conditions, plants are stunted in growth and finally death occurs.

### **Control**

They can be controlled by application of 4-5 quintals of neemcake per acre during last ploughing. At the time of planting apply Furadan granules 2 8-10 Quintals per acre.

**Lesion nematode (*Pratylenchus delatrei*), Root-knot nematode (*Meloidogyne incognita*), Needle nematode (*Longidorus africanus*)**

Stunting of plants with pinkish to purple and yellow coloured leaves, reduction in inflorescence and flower size, retardation of root growth with brown to black spindle shaped lesions/galls, reduction in yield (22%).

### **Control**

Apply neem cake 2 kg/m<sup>2</sup> in nursery beds. Application of FYM and interplanting with marigold or pangola grass are helpful. Soil application of Carbofuran 2.5 kg/ha or neem cake 1t/ha.

### **Diseases**

#### **Wilt (*Fusarium solani*)**

Wilt caused by *Fusarium solani* will result in yellowing of leaves and death of the plants. The incidence of the disease is found to be more in the presence of root lesion nematode

**Control**

It can be controlled by application of phorate @ 1g per plant. Water logged conditions are to be avoided.

**Foot and Root rot (*Phytophthora nicotianae*)**

In young seedlings, symptoms appear as brown lesions on rootlets followed by rotting of the entire rootlet. On the collar region peculiar brown rot can be seen. The leaves show pink discoloration and drooping. In advanced stages of infection wilting of whole plant can be noticed.

**Control**

Growing seedlings in raised beds drenched with Captan, application of neem-cake to control nematode infestation, prophylactic application of Captaf as soil drench at the time of planting in the main field and application of Fosetyl Al as soil drench 2-3 times at monthly interval during monsoon season are effective.

**Flower blight (*Alternaria sp.*)**

Drying up of flowers during winter months are symptoms. Young flowers fail to open on infection.

**Control**

Spray Mancozeb at fortnightly interval.

**GLADIOLUS**  
(*Gladiolus spp.*)

Gladiolus is an important bulbous cut flower grown under open conditions in periurban areas of Telangana.

**Soils**

Loamy to sandy loam soil is best suited for gladiolus cultivation. Water logging with high salinity areas are to avoided. Clay soil is also not suitable for gladiolus cultivation. Adding sand to make it porous can amend light clay soil. Soil pH of 6.5-7.0 is ideal.

**Climate**

The crop performs well under a temperature range of 27 - 30°C. It requires full exposure to sunlight and performs well with long day conditions of 12 to 14 hour photoperiod.

**Recommended Varieties:** Arka Amar, White Prosperity, Arka Naveen, Arka Kesar, Darshan, Dhiraj, Acc no- 7, Arka Gold, Kajol, Shubangini, American Beauty etc.,

### **Propagation**

Gladiolus are propagated through corms and 3-4 cm diameter corms are selected for planting. Select corms which are disease free and have undergone 3 months of dormancy. For planting in one acre 64,000 corms per acre are required.

### **Planting**

The best planting time is October. Recommended spacing for planting is 30 X 20cm at a depth of 5-8cms on ridge and furrow system. Tunics /scales are removed before planting and dipped in mancozeb @ 2g or carbendazim 1g/lit of solution. Staggered planting at an interval of 15 days is recommended for extended flower harvests..

### **Manures and Fertilizers**

Basal dose of 8-10 tons/acre of FYM, 15-20Kg N, 30-35Kg P<sub>2</sub>O<sub>5</sub> and 30-35 Kg K<sub>2</sub>O is recommended. Later 30-35Kg N is to be applied two times as top dressing at 3 and 6 leaves stage. Apply nitrogen in the form of Ammonium Nitrate instead of urea.

### **Irrigations:**

Flower bud initiation and spike elongation are the most critical stages in gladiolus. Gladiolus is a water loving plant and needs sufficient moisture in the soil till the harvesting of spikes.

Normally, irrigation can be cut down after the harvest of spikes and withheld completely once leaves start yellowing.

### **Staking**

Provide staking for tall growing varieties.

### **Mulching and earthing up**

Mulching with organic or plastic mulch( 50microns) will not only conserve moisture but also controls weeds and improves the quality of flower spikes. Earthing up after 45 days of planting is recommended.

### **Crop rotation**

Follow crop rotation once in 2-3 years to control soil borne diseases and pests.

### **Harvesting**

Depending on variety gladiolus takes 70 to 110 days to produce flower spikes. Harvest the flower spikes when 1-2 flower buds show colour for long distant market. For local

market harvest the flower spikes when lower 1-2 florets are fully opened .Harvest the spikes leaving atleast 4 leaves on the plant for proper development of the corms.

**Post harvest management:** The cut spikes are kept in bucket of cool water and precooled for 2-3hours at room temperature.The spikes are graded based on the length of the florets and packed into bundles of 12 and wrapped in newspapers and transported to local market.The gladiolus spikes are kept in upright position to avoid geotropic bending.

Vase life of cut flowers can be extended by pulsing with 300 to 600 ppm solution of 8 - HQC (Hydroxy Quinoline Citrate) + 4 % Sucrose.

#### **Harvesting and storage of corms:**

After 50-60 days of harvesting of the flower spikes the leaves turn yellow and dry naturally, withhold the water and dig out the corms along with cormels.Treat the corms with bavistin @1g/litre and store in cool place or in cold storage at 4-5<sup>0</sup>C and 75%RH.

### **Plant Protection**

#### **Pests**

##### **Cut worms(*Agrotis segetum*)**

Grown up brown coloured larvae cut the plants at ground level. Plants are vulnerable to attack up to 3 leaf stage. Cut worms also damage underground corms and developing spikes.

#### **Control**

Ploughing during summer exposes pupae to predators. Poison bait consisting of carbaryl or malathion at 0.1% in wheat bran and molasses in the field controls the larvae.

##### **Bulb mite (*Rhizoglyphusechinopus*)**

This slow moving mite is about 0.5 mm long, globular, and yellow-white with brownish legs. Infested corms produce stunted plants with yellow and distorted leaves. Early infestations are found around the basal plate of the old corm. Roots are destroyed first and stems are attacked later. Corms can be completely destroyed by the combined action of the mites and micro-organisms that invade the damaged tissue.

#### **Control**

Hot water treatment will kill the mites, but good sanitation is very important when digging up, storing, or planting out corms.

#### **Aphids**

Several species of aphids attack gladiolus. All infest the foliage and also transmit virus diseases. Aphids are slow moving and plump bodied insects. The colour varies with the species and green yellow, pink, brown and black forms occur.

## **Control**

Spraying contact insecticides like Rogor, Metacid, Malathion etc. along with systemic insecticides like Thimet or Furadan.

## **Thrips (*Taeniothrips simplex*)**

Yellow coloured nymphs and black adults damage leaves and spikes by rasping tissues and sucking the sap. Affected leaves and spikes develop silver streaks, turn brown, get deformed and dry when attack is severe. Corms in storage are also attacked by thrips. Infested corms are sticky, get shriveled and produce weak plants.

## **Control**

Spray Acephate 0.1% 2-3 times at 10 days interval or spraying contact insecticides like Rogor, Metacid, Malathion etc. along with systemic insecticides like Thimet or Furadan.

## **Diseases**

Gladiolus is highly susceptible to fungal attacks by fungi like *Stromatinia*, *Carvularia*, *Fusarium* etc..

## ***Fusarium* corm rot or wilt (*Fusarium oxysporum*, *f.sp. gladioli*)**

In worm soil, *fusarium* attacks the corms causing *fusarium* corm rot. The initial symptom is yellowing of older leaves, whereas the inner leaves remain green. Spike develop dark green colour and petals also develop dark colour. In advanced stages of infection, the plants show wilting. Corms when cut open show brown spots or streaks usually at the base.

## **Control**

In order to control the disease, it is advisable to destroy the infected corms from the field and to spray systemic fungicide like Bavistin on the soil as well as on the plants in the affected field. It is also suggested to treat the corms in a solution of Bavistin prior to planting in the field.

## **Leaf and flower blight (*Curvularia trifoli*, *C.eragrostidis*)**

In warm and humid weather, oval brown spots appear on the young leaves and later on spreads to stems and spikes which is caused by *Curvularia* fungus.

## **Control**

Can be controlled by spraying mancozeb at weekly or 10 days interval.

## **Neck rot (*Pseudomonas marginata*, *Stomatina gladioli*, *Botrytis gladiodotum*)**

*Stromatinia* causes neck rot stunting the growth of the plant and forming brown or black spots on the corms. In cool and humid weather, the plant is attacked by *Botrytis* - yet another fungus causing brown patches on upper side of the leaves which turns grey.

## **Control**

Spray Bavistin or Captan.

## **Root-knot Nematodes (*Meloidogyne spp.*)**

Gladiolus is also attacked by root-knot nematode causing wilting of the plants. Stunted growth, yellowing of leaves and heavy galling on roots.

## **Control**

Use nematode free planting material. Hot water treatment of corms at 57.8°C for 30 minutes. Intercropping or crop rotation with marigold. Apply Furadan granules @ 8-10 q / acre or Carbofuran/Phorate (1g/m<sup>2</sup>).

## **JASMINE** (*Jasminum sps.*)

Jasmine is one of the important flower crops grown on commercial scale in Rangareddy, Nalgonda, Mahabubnagar and Medak districts. The flowers are highly fragrant and used for religious offerings and also used for preparing garlands. Loose flowers are also used for extraction of essential oil which is used in the preparation of perfumes and scented water.

## **Soil and Climate**

Jasmine can be planted on a wide range of soils. Well-drained sandy loams and red loams are ideal for its cultivation. In clayey soils, there is increased vegetative growth and reduced flowering. They give good yield in low rainfall conditions. It is a tropical crop and grows well in moderate humid conditions.

## **Varieties**

Three species are commercially cultivated in Telangana.

### ***i) Jasminum sambac***

Its flower buds are white with single or multi whorled petals and *Jasminum sambac* is usually cultivated on commercial jasmine. Important varieties are Gundumalle, Ramanadhapuram, Motia, Virupakshi, Sujimalli, Madanabanam, Ramabanam,

### ***ii) Jasminum auriculatum***

Commonly known as 'Juhi', The plants produce numerous star shaped, white scented blooms and are very good as loose flowers. The flowers are borne in pubescent compound many flowered flax cymes. Black type of this species is grown in home gardens. The flowers are commonly used for garlands, adorning hair, worship and decoration. It bears flowers from spring to summer and in rainy season. Its high yielding varieties are.

Co-1 Mullai,Co-2 Mullai,Long Round,Short Point,Short Round

### iii) **Jasminum multiflorum:**

Commonly known as 'Kakada'. Flowers are less fragrant or no fragrance. The flowering time is November to February.

#### **Propagation**

*Jasmine species* are propagated by cuttings and layers. The rooting of cuttings can be enhanced by using any of the rooting hormones like IBA (5000 ppm), IAA (1000 ppm) and NAA (5000 ppm). Simple and compound layering methods are followed during June – July to October – November. Layers will be ready for planting within 90-120 days.

#### **Planting**

After ploughing the land, pits of about 40 x 40 x 40 cm size are dug out and filled with topsoil and filled with 15 kg of well-rotten FYM. Planting distance depends on the species and also on soil and environmental conditions.

| <b>Species</b>       | <b>Planting distance</b> |
|----------------------|--------------------------|
| <i>J.sambac</i>      | 1.2 x 1.2 m              |
| <i>J.auriculatum</i> | 1.8 x 1.8 m              |
| <i>J.multiflorum</i> | 1.5x 1.5 m               |

Planting is usually done during June – August.

#### **Irrigation**

Irrigation is most important for jasmines. Constant and adequate water supply (irrigating twice a week) in light soils during peak flowering season (March –October) is essential for high yield of flowers. After flowering is over, the water supply can be cut off.

#### **Manures and Fertilizers**

The plants are usually manured once in every year with organic manures in January before flush season commences at 10-12kg of FYM per plant. In some places tank silt and horse manure are also applied to get high yields. The manures are usually applied after pruning the bushes once in June-July and again December-January.

The fertilizer recommendation also differs with the species grown.

|                       |  |
|-----------------------|--|
| <i>J.sambac</i>       | 90g N, 120g P <sub>2</sub> O <sub>5</sub> and 240g K <sub>2</sub> O – four times at two months interval. |
| <i>J.auriculatum</i>  | 60g N, 120g P <sub>2</sub> O <sub>5</sub> and 120g K <sub>2</sub> O                                      |
| <i>J.grandiflorum</i> | 100g N, 150g P <sub>2</sub> O <sub>5</sub> and 100g K <sub>2</sub> O                                     |

This has to be supplemented with organic manures like neem cake, groundnut oil cake etc. at the rate of 100 g per plant per month.

## Pruning

The pruning of jasmine is an important operation. With the approaching of winter the bushes start to shed the leaves. To promote good flowering water is withheld in the 2<sup>nd</sup> fortnight of November and allow plant to rest and shed the leaves or the plants are defoliated manually. In Telangana the sheep herd is allowed to graze the leaves instead of manual defoliation which not only saves labour costs but also improves the soil fertility by sheep castings.

The pruning is usually done after 2 years of its planting and followed in the month of December to January in *Jasminum sambac* while it is done in February –March *Jasminum auriculatum*. Pruning in *Jasminum multiflorum* is done in August –September.

Generally pruning is done by trimming all branches upto 45 to 50 cm from ground level . Before pruning irrigation is to be with held and all the dried and diseased twigs are to be removed. After pruning, the leaves are also to be removed and irrigated lightly till flower buds appear. Profusely watering is done at regular intervals after the appearance of flower buds..

## Weed control

Manual weeding is effective but expensive. Under drip irrigation system mulching with plastic or organic material may be adapted. Use of weedicides like paraquat is also practiced.

## Harvest

The plants (layers) starts flowering from 2<sup>nd</sup> year after planting and the commercial yields commence from third year onwards. The *Jasminum sambac* varieties flower profusely in summer and also in rainy season (i.e. March-August) while *Jasminum auriculatum* flowers in June-August, while *Jasminum mutiflorum* flowers during November to February.

## Yield

Yield of flowers and jasmine oil vary according to the species and management practices.

| Species              | Flower Yield (t/ac) |
|----------------------|---------------------|
| <i>J.sambac</i>      | 1.0-2.0             |
| <i>J.auriculatum</i> | 1.8-3.6             |
| <i>J.Mutiflorum</i>  | 1-2                 |

Since the jasmine flowers are highly perishable and will have to be disposed off in the market within few hours after picking.

## Plant Protection

Jasmine is comparatively a hardly plant.

## **Pests**

### **Bud and Shoot borer (*Hendecasis duplifascialis*)**

Caterpillar makes hole on the flower bud and feeds on the inner content. Larva attacks 2 -3 buds .Petals are eaten by the larvae. Larva is greenish with pale body hairs and black head. Adult - small white moth with black wavy lines on hind wings and abdomen.

#### **Control**

Spray 0.15 – 0.20% carbaryl or 0.06% Dimethoate (2ml/lit)

Spray 0.15 – 0.20% carbaryl

### **Stick Bugs (*Antestia cruciata* )**

Adults and nymphs of this bug suck the sap from leaves, tender shoots and flower buds, reducing the market value.

#### **Control**

Spray 0.05% Malathion

### **Thrips (*Thrips orientalis*)**

Nymphs and adults attack the flowers. Brown streaks are seen on flower petals.

#### **Control**

Spray 0.06% Dimethoate (2ml/lit)

## **Disease**

### **Leaf blight (*Cercospora jasminicola*)**

Jasmine plants affected with leaf blight develop red-brown circular spots on their upper surface. The infection spreads rapidly, especially during the rainy season. And as it progresses, infected leaves curl and dry at the margins. In severe cases shoots, buds and young branches dry out as well. Leaf blight severely reduces flower production, but is not dangerous.

#### **Control**

Spray affected plants with bordeaux mixture to control the disease.Can be controlled by spraying 0.2% mancozeb or 0.1% benomyl

### **Fusarium wilt (*Fusarium oxysporium*)**

Wilt slowly kills the root system of the jasmine, starving the plant of essential nutrients. Uprooted jasmine plants with wilt show roots that are blackened in patches and girdled with the white mycelia that cause the disease.

#### **Control**

Can be controlled with 1% Bordeaux mixture.

### **Rust (*Uromyces hobsoni*)**

Brown coloured pustules develop on the lower surface of the leaves and in severe cases on stems and flowers.

### **Control**

Spray 0.2% zineb or any Copper fungicide.

## **MARIGOLD**

(*Tagetes erecta* and *Tagetes patula*)

Marigold is one of the most important flowering annuals cultivated round the year in Telangana. It has gained popularity on account of its easy culture and wide adaptability, wide attractive colours, shape, size and good keeping quality.

(African Marigold – *Tagetes erecta*)

(French Marigold – *Tagetes patula*)

### **Climate**

Marigold requires mild climate for luxuriant growth and flowering. Depending on environmental condition, planting of marigold is done in 3 three seasons' i.e rainy, summer and winter. Planting of African marigold after 1<sup>st</sup> week of February and before 1<sup>st</sup> week of July greatly affects the quality and yield of flowers. So staggered planting between 1<sup>st</sup> week of July to 1<sup>st</sup> week of February at monthly intervals assures supply of flowers to market over an extended period from October to April, however maximum yield can be obtained from September planted crop.

### **Soil**

It can be grown in a wide range of soils except water logged conditions. However, a deep fertile soil having good water holding capacity, well drained, sandy loam soil rich in organic matter is best suitable. Neither too acidic not too alkaline soils with p<sup>H</sup> 6.0 to 7.5 are suitable.

### **Selection of site**

A sunny location is ideal for marigold cultivation. Under shade, it produces more vegetative growth and do not produce any flowers.

**Varieties:**Arka Bangara-1,Arka Bangara-2,Arka Agni,Pusa Narangi Gainda ,Pusa Basanti Gainda

## Season

| Season           | Sowing time           | Transplanting          |
|------------------|-----------------------|------------------------|
| 1. Rainy season  | Middle of June        | Middle of July         |
| 2. Winter        | Middle of August      | Middle of September    |
| 3. Summer season | First week of January | First week of February |

Highest yields are obtained when planted in September. Rainfall during rainy season and high temperatures during summer will affect the flower quality.

## Propagation

Marigold is generally propagated either by seed or by herbaceous cuttings.

### By Seed

Seed rate for marigold varies from 0.8 – 1 Kg per acre and takes about 5-7 days for germination. Seeds can be sown on nursery beds in lines in shallow furrows. During preparation of nursery beds 8-10 Kg of well decomposed farm yard manure per 1sq.m bed is thoroughly mixed with the soil. The width of the seed bed should not be more than 1.2m and height should be 15 cm. Before sowing of seeds a little amount of foliodol dust is applied to the nursery bed to avoid ant or termite infestation. During winter beds should be covered with a layer of straw to accelerate germination process. However the straw should be removed as soon as the seedlings are visible above the soil. Seeds germinate 5-7 days after sowing.

### By herbaceous cuttings

Varieties like Giant African yellow, Giant African orange do not set seed. Therefore these are usually multiplied by herbaceous cuttings. Apical shoots of 10cm long are usually used for vegetative propagation. Herbaceous cuttings each with one or two pair of leaves are inserted in sand medium either in seed pan or nursery bed. Before putting the cuttings in rooting medium the basal portion of the cuttings is treated with a hormone powder which is marketed as seradix B-1, Rootex-1 to encourage profuse and early rooting. Shade should be provided initially to the beds. Regular watering should be done to keep the bed in moist conditions. Within 8-10 days, rooting is observed in the cuttings which are later used as planting materials.

### Transplanting of seedlings

Land should be ploughed 2 to 3 times to bring the soil to a fine tilth. One month old seedlings with 3-4 leaves are fit for transplanting. Watering of nursery bed one day prior to uprooting will lessen the damage to root system. Uprooting of seedlings and transplanting should be done in the evening hours for better establishment.

### Spacing

Proper spacing between plants is required for better development of plants and for higher flower yield. The following spacing is recommended for marigold.

### **1) African marigold**

60 X 30 cm or 45 X 30cm.

### **2) French marigold**

20 X 20cm or 20 X15cm

### **Manures and Fertilizers**

Incorporate 20 tonnes of Farm Yard Manure during the last ploughing. Apply 20-40 kg N, 80 kgs of P<sub>2</sub>O<sub>5</sub> and 80 kgs of K<sub>2</sub>O per acre. Half of nitrogen, entire dose of phosphorus and potash should be applied as basal dose, preferably one week after transplanting and rest half nitrogen should be applied one month after the first application. Irrigate after application.

### **Intercultural operations**

In marigold control of weeds is an important operation. If the weeds are not removed in time, a great loss would occur in terms of growth and productivity of marigold particularly during rainy season. Hoeing and weeding should be done 3 to 4 times during the crop period to make the soil loose and weed free.

### **Irrigation**

At all stages of vegetative growth (55-60 days) and during flower production sufficient amount of moisture in soil is essential. Moisture stress at any stage affects normal growth and flowering. In lighter soils more frequent irrigations are required than in heavy soils. In sandy loam soil, weekly irrigation is necessary between September to March while during summer months between April to June irrigation at 4-5 days intervals is required.

### **Pinching**

In tall cultivars of African marigold, plants first grow upwards to their final height and later on produce a terminal flower. After the formation of terminal flower bud, axillary branches develop which also bear flower. However, if the apical portion of shoot is removed early, large number of axillary shoots arise resulting in well shaped bushy plant bearing more number of uniform sized flowers. Removal of apical portion of shoot is known as pinching. It is observed that pinching at 40 days after transplanting enhances flower yield. However, Giant double African yellow and orange do not require pinching as the plants are bushy and branching type.

### **Harvesting**

Marigold flowers are plucked when they attain full size. Harvesting should be done either in the morning or evening hours. Field should be irrigated before

harvesting of flowers so that the flowers keep well for longer period after harvest. Productivity of plants increases considerably by regular plucking of flowers and beheading the dried flowers .

## **Yield**

### **Flower**

Yield of flowers varies with type and variety. Normally 4-6 tonnes of flowers per acre can be obtained. However, Giant African yellow when planted in September, may give 10 tonnes of flowers per acre.

### **Seed**

Seeds should be collected only from winter crop.

### **African marigold**

120-150 Kg /ac

### **French marigold**

400-500 Kg/ac.

## **Packing**

After harvest, flowers are packed in moist gunny bags or bamboo baskets covered with moist cloth or polythene sheets and sent to market.

## **Plant Protection**

### **Pests**

#### **Bud caterpillars (*Helicoverpa armigera* and *Phycita sp.*)**

Eggs are laid singly on young buds. Larvae feed on developing flowers by damaging florets. Larvae of *Phycita sp.* feed on heads of buds and flowers.

### **Control**

Collection and destruction of infested buds and flowers. Sprays of Endosulfan 0.07% or Methyl Parathion 0.05%.

#### **Aphids (*Aphis gossypii*)**

Aphids mainly infest lower surface of flowers and base of petals. Nymphs and adults suck the sap from the flowers causing discoloration and withering.

### **Control**

Spraying of Oxydemeton methyl 0.05% or Moncrotophos 0.05%.

### **Thrips**

Thrips infest young leaves, buds and flowers and suck the sap. Affected leaves get distorted, while petals of flowers turn brown and dirty.

**Control**

Two or three sprays of Oxydemeton methyl, Diemthoate 0.05%, at 10 days interval.

**Diseases**

**Wilt and Stem rot (*Phytophthora cryptogea*)**

The fungus attack roots and collar portions of the plants. In nurseries the infection results in damping off and is aggravated by high soil moisture. In the field the infected plants show wilting.

**Control**

Treat soil with Captaf, Mancozeb and Metalaxyl.

**Collar and root rot (*Pellicularia filamentosa*, *P.rolfsii*, *Pythium ultimum*, *Scelrotinia sclerotiarum*)**

Rotting of root and collar portions is noticed resulting in wilting of the plant.

**Control**

Soil fumigation and planting healthy seedlings.

**Leaf spot and blight (*Alternaria sp.*, *Septoria sp.*, *Cerospora sp.*)**

Brown circular and brownish grey spots appear.

**Control**

Spraying fungicides regularly.

**Powdery mildew (*Oidium sp.* *Leveillula taurica*)**

The fungi cause powdery patches on leaves.

**Control**

Foliar application of sulphur compounds, Carbendazim, Triadimefon, Fenerimol, Penconazole and Triforine.

**ROSE**  
(*Rosa sp.*)

**Climate**

Rose usually dislikes humid climate, but can tolerate high temperature. At a temperature below 10° C flowering is affected and blind shoots and bull heads are developed. Rose plant should receive 8 hours exposure to sun rays. Shady area is not at all suitable for rosary.

**Soils**

Sandy-loam, red-loam, silty-loam soil are best suited for rose cultivation. The soil pH of 6.0 to 7.5 is ideal for rose. Rose is very sensitive to saline soils as sodium carbonate which is present in the saline soil is harmful to the plants. Soils rich in organic matter with good water holding capacity are ideal for its cultivation.

**Varieties**

Hybrid teas and Floribundas are grown in for garden decoration and as potted plant . Among Hybrid Teas Gladiator, Raktima, Grand gala, Aditya etc and among Floribundas Red front, Olympic gold, Mother Teresa etc are suitable. For loose flowers mostly scented rose(*Rosa demacena*), Ruby star, Tri star etc., are suitable for commercial cultivation in Telangana.

**Land preparation**

Plough the land 4-5 times thoroughly during May followed by 15 days exposure to sun rays. For rose cultivation, pits of size 45 cm X 45 cm X 30 cm are prepared for plantation of rose plantlets. After exposing to sun rays for 15 days the pits are refilled with soil-manure mixture in the following composition.

|                         |       |
|-------------------------|-------|
| i. Soil                 | 40%   |
| ii. Cow-dung            | 40%   |
| iii. Leaf-mould         | 10%   |
| iv. Oil-cake, Bone-meal | 10%   |
| v. Urea                 | 25 g  |
| vi. SSP                 | 100 g |
| vii. MOP                | 50 g  |

## **Spacing**

0.75m from pit to pit & 0.75m from row to row in low density cultivation accommodating about 7,000 plants per acre with plant density 1.729/m<sup>2</sup>. In case of green house culture, high density plantation will accommodate 28,000 plants per acre having plant density 7/m<sup>2</sup>, (1 hectare= 2.471 acres). Standard roses are planted at a spacing of 90-100cm. Plantlets are planted after a week of refilling the pits.

## **Planting**

The roses are planted in circular pits of about 60-90 cm across and 60-75 cm deep. The pits are to be prepared atleast a month before the date of planting. The best time for planting roses in the plants is during September or October. The planting materials are planted in the prepared pits during evening hours. Before planting, 5 gram of Furadan 3G is to be applied to the pit for controlling pests.

## **Propagation**

Roses can be propagated by seeds, cuttings, layers and by budding. Seed propagation is done in the production of new varieties. Budding is the best method for commercial propagation.

## **Root Stocks**

*R.multiflora*, Briar and Edward roses are best suited. Multiflora is suited for hill stations. Briar for medium and Edward for both.

## **Budding**

When a rose plant comes into flower small swellings are visible between the stem and stalk of the leaf. Select the eyes which are plump and not started to elongate and grow. Cut off the portions of the branch with the eyes selected is called as 'bud wood'. With a budding knife remove a shield shaped piece of the bark and the eye. The Root stock should be kept ready by cutting the branches and side shoots which are not required. Make a sharp horizontal cut at a suitable height in the stock and then make a vertical 'T' shaped cut in the stem of the stock. The 'eye' should point towards the top and is tied with fibre.

## **After care**

Stock sprouts should be frequently removed very often, off shoots or suckers from the root-stock stem come up at the base of the plantlets or below the grafted point which, if allows to grow by mistake, will retard the growth of the grafted part ultimately leading to its death. The off-shoot of the root-stock part will be seven leaved and odd pinnate which is to be pinched off as soon as it comes up. Such unwanted suckers should be removed by nail pinching or by a sharp knife.

Dust setting on the leaves should be washed by spraying water on the foliage.

A basketful of FYM is sufficient for one year.

A small quantity of iron sulphate may be applied @ 50-75 g/shrub by dissolving in water.

### **Irrigation**

Twice a week during October to March, Thrice a week during April to June. No irrigation is required during the rainy season. Irrigations should not result in water logging.

### **Mulching**

Mulching is an agro technique for conservation of soil moisture around the root zone of the plants and to facilitate gradual supply of nutrients to the plants. It is particularly very much important in arid and semi-arid zones where water becomes scarce during summer. The technique is very simple - agro wastes like straw, dried leaves, grass clippings, rice husk or other wastes like Saw dust, used tea, or leaf-mould are spread around the root of the plants with a radius of 1 to 2 feet and 4 inches thickness. Now-a- days, black polyethylene sheet is used as mulch which is proved to be more efficacious and easy to manage.

### **Pruning**

It is a peculiarity with the rose that the old stem gradually stop giving healthy shoots to bear good flowers. If old and weak stems are pruned after wintering, healthy shoots come up which bear good flowers. Therefore, wintering followed by pruning are the two important operation under the general maintenance cares. Without periodic pruning of old and weak stems, at least once a year during October rose plant cannot yield qualitatively as well as quantitatively.

Pruning is done to produce best quality flowers and to maintain good shape and to keep plant healthy by removing dead parts. Three to four months after planting the rose plant is first pruned. Four branches placed in four directions are chosen and these are pruned back to an outer bud leaving two to four buds on the stump. All other branches are thinned out. If the plant has only one or two weak shoots they are to be cut back to two or three buds. The first fortnight of October is usually considered to be the best time for pruning. Some hybrid Teas requires severe pruning. In Tea roses strong shoots are pruned to 2/3 of their length. Climbing roses needs no pruning. Pruning is to produce the required number of new shoots because rose bears flowers terminally on current season wood. Too many shoots on plants will reduce the size and quantity of flowering. Limiting the number of flowers promotes flower size. Depending on the variety and severity of pruning roses takes about 35 to 60 days from pruning to flowering.

## **Manures and Fertilizers**

The best time to add organic manure is at the time of pruning. FYM, leaf mould and oil cakes are good sources of nitrogen. It is better to apply fertilizers in a mixture such as 'roxe mix'. Rose Mix can be prepared as:

|                     |   |      |
|---------------------|---|------|
| Neem cake           | - | 5 kg |
| Bonemeal            | - | 5 kg |
| Ammophos            | - | 2 kg |
| Sulphate of Ammonia | - | 1 kg |
| Superphosphate      | - | 2 kg |
| Potassium Sulphate  | - | 1kg  |

100g of this mixture can be used per plant. The chelated compounds of iron, magnesium and manganese are available in the market under names like 'Sequestrene Plus' which are helpful in bringing out the full colour of flowers. In general for each rose plant urea 20-30g, superphosphate 30-50g, Potassium Sulphate 20-30g and Cakes ½ kg to 1 kg, in two to three split doses is recommended.

## **Harvesting**

After initial planting in July- August rose starts blooming from october and plant will yield on economic scale for 3 years.

## **Plucking Stage**

For commercial purpose, roses are plucked at the bud stage just prior to blooming stage having a stalk of 9" to 12" long as per the preference of the market.

## **Time of Plucking**

Buds must be cut out from the plant by a sharp knife during the evening hours to keep them fresh.

## **Packaging**

Buds with long stalk are made to bundles of 100 as need may be and put in the bamboo baskets which are kept floating on water so that the cut end touch the water. Flowers are transported to market while covering the baskets with wet linen or news paper

## **Plant Protection**

### **Pests**

#### **1)Aphids (*Macrosiphum rosae*)**

They occur in clusters on tender shoots, buds and flowers and sucks the plant sap making the plant weak

## **Control**

The affected flowers and buds should be lightly dusted in the mornings or evenings with 9.2% Pyro dust or spray Nuvacron, Metacid etc. Nicotine sulphate solution is, however, specific in controlling aphids.

## **2)Thrips (*Rhipiphorothrips cruentatus and Scritothrips dorsalis*)**

These are very minute insects which distort the leaves. In normal condition. these insects effect the normal photosynthesis of plant. Curled leaves with brown marks and deformed buds with burnt margins are the main symptoms of damage.

## **Control**

Spray Metacid, Rogor or Acephate or Profenofos or Ethofenprox or Imidacloprid at 0.05%.

## **3)Jassids (Leaf hoppers)**

They suck the sap from the plant parts. The leaves lose their natural colour and become dull whitish yellow and subsequently dry up and the damaged plants have a sickly appearance.

## **Control**

Spray Methyl parathion 1.5ml/lit.

## **4)Ash Weevil (*Myloccerus spp.*)**

Eggs are laid in soil. Grubs feed on roots, grey coloured adults feed on leaves from margins in a regular fashion and cause severe foliage damage.

## **Control**

They cause damage to the rose leaves by cutting neat, circular or oval patches from the leaf margin and are controlled by applying 5% Carbaryl.

## **5)Red Scale (*Aonidiella aurantii*)**

It is an insect which form small and round red or brown scales on the stem near the base and then gradually spread upwardly. The insects live inside the scale and suck the sap of the plant. It appears as reddish brown waxy scale like marks on tender shoots and stems and the affected portions dry up.

## **Control**

Dip a cotton swap in 0.1 Malatihon solution and rub the affected parts. If it is on large scale, spraying of 0.1% Methyl parathion or Malathion or Rogor, Metasystox and applying granular Furadan 3G to the soil should be done.

**6)Red Spider Mites or Two spotted spider mite (*Tetranychus urticae*)**

Very minute insects or mites spin webs on the under side of leaves which can be seen through a magnifying glass. Red mites infest only during dry months. The affected leaves look dull as mite suck sap from leaves. It is difficult to eradicate red mites completely.

**Control**

Insecticidal spray with Dicofol, and dusting with Sulphur can control this pest.

**7)Chaffer Beetle (*Adoretus spp.*)**

Rose chafer beetle cut away the leaves. In severe cases the plants reduced to a mere skeleton.

**Control**

Spray 0.5% Malathion @ 2 ml/lit or 0.05% Methyl parathion @ 1 ml/lit or Endosulfan 0.07% @ 2ml/lit.

**8)Mealy-bug (*Planococcus citri*)**

Bug with white woolly incrustation are found on the branches which suck sap from young stem and leaves.

**Control**

Spray Malathion, Rogor, Metacid etc.

**9)Leaf-rolling larva (*Archips rosaceana* )**

It is a larva of an insect that first feed on the young leaves and then roll the leaves for its shelter

**Control**

Spray Malathion.

**10)Leaf-miner (*Stigmella anomalella*)**

It affects the photosynthesis of the plant.

**Control**

Spray Malathion or Metasystox.

**11)White ants (Termite) (*Microtermes obesi*)**

White ant which inhabitates beneath the soil is menace to rose plant. The attack starts under dry soil conditions. They mainly feed on the roots and spread to stem and damage bark in case of severe infestations. Affected plants wilt, dry and die consequently.

**Control**

Deep ploughing destroys termite colonies. Timely irrigation prevents pest buildup. Drenching soil with Chlorpyrifos 0.05% or Endosulfan 0.07% ml or Malathion 0.1% or soil may be mixed with 10% BHC or Aldrin before planting.

## **Diseases**

### **1) Powdery (*Sphaerotheca pannosa*) and Downy Mildew (*Pernospora sparsa*)**

These are very common fungal diseases of rose. Foliage, young stems and stalk of flower buds of rose are coated with powdery dust or downy masses causing leaves to fall, young shoots to wilt and perish and preventing buds to bloom. The disease starts-with a small white dot and then rapidly proliferate affecting the entire plant. High temperature difference between day and night triggers the disease, according to some experts.

#### **Control**

Spray sulphur compound i.e. Thiovit 2g/lit or Bavistin 1g/lit of water at weekly intervals during winter season against Powdery mildew.

Spray Fosetyl-Al or Metalaxy MZ against Downy mildew.

### **2) Black Spot (*Diplocarpon rosae*)**

This is also very common in India and it can be distinguished by almost circular black spots on the leaves causing severe defoliation and is a common fungal disease of rose. Initially, brown or yellow spots appear on the lower leaves which then turn into black spots. The affected leaves turn yellow and fall off. In severe cases leaves drop and growth ceases.

#### **Control**

Spray copper fungicide like Blitox, Dithane M-45 or Captan at the rate of 2g in 1 lit of water or 1% Bordeaux mixture or by systemic fungicides like Bavistin, Calixin etc. at weekly intervals.

### **3) Rust (*Phragmidium spp.*)**

Yellowish to black swellings called pustules are produced on the leaves, petioles and stem imparting a rusty appearance on shoots.

#### **Control**

Foliar spray with 1kg of 'Ferbam' plus 1kg of wettable sulphur in 500 lit of water with Sandovit as a spreader.

### **4) Die-Back (*Diplodia rosarum, Colletotrichum sp.*)**

This is the most dreaded disease of rose. The stems die back from top down wards and gradually the whole plant. The disease, according to plant pathologists, is due to injury to the roots by fungi or careless root pruning or poor drainage in the root zone or due to shortage of essential food elements.

#### **Control**

The affected stem or branch is cut 2-3 inches below the effected part and a cap of fresh cow-dung mixed with Copper Sulphate or Bordeaux paste alone is put over the cut wound. Over watering, particularly in coastal areas, should be avoided. It is also advisable to procure buddlings from reliable nurseries only.

## **TUBEROSE** (*Polyanthes tuberosa*)

Tuberose, is a popular fragrant flower grown under open conditions for loose flowers and cut flowers. Flowers are utilized for preparation of garlands and as cut flower for flower arrangements.

### **Climate**

The commercial cultivation of tuberose is mainly confined to warm, humid areas with average temperature ranging between 18 to 32<sup>0</sup> C. The ideal temperature for plant growth ranges between 26 and 30<sup>0</sup> C. The tuberose needs a long growing period in order to blossom in early to late fall. The spike production, along with the quality flowers declines to a great extent during December –January except in “double varieties” of tuberose.

### **Soil**

The plant can be successfully grown on a wide range of soils, even in soils affected by acidity or alkalinity to some extent. The plant is very sensitive to water-logging which damages the root system and affects the plant growth. Loam and sandy loam soil having pH range of 6.5 to 7.5 with proper aeration and drainage are considered best for tuberose cultivation. The soil should be rich in organic matter and retain sufficient moisture for proper growth.

### **Season**

Tuberose can be commercially grown throughout the year but highest yield is obtained from July planted crop.

### **Spacing**

Bulbs are planted at a spacing of 30-20 cm between the rows and 20-10cm between the plants.

### **Propagation**

Propagation of the plant can be done by means of bulbs. The bulbs of 2-3 cm wide are suitable for propagation. Planting of fresh bulbs produce less number of flowers hence, bulbs should always be kept in store for a month or more to ensure better production of flowers. Larger bulbs result in early flowering and higher yields. The bulbs should be planted 4-5 cm

deep in beds and soil moisture should be maintained after planting of bulbs before monsoon starts.

### **Varieties suitable to Telangana**

1) Singles ('Single' with one row of corolla segments)

Prajwal, Hyderabad single, Shringar, Arka Nirantara

2) Double ('Semi double' with two to three rows of segments)

Hyderabad double, Suvasini, Vaibhav

### **Manures and Fertilizers**

During preparation of the soil, a basal application of farm yard manure (FYM) at the rate of 8 to 10 tones per acre should be done to ensure better growth and flowering. A fertiliser dose of 80 Kg N, 80 Kg P and 80 Kg K is recommended. Entire dose of P and K and 1/3 dose of N should be applied as basal dose and remaining N should be applied at 60 and 90 days after planting as top dressing.

### **Weeding**

Weeding is carried out after a fortnight, especially in the initial stage of the bulb sprouting and the growth of plants. Hand weeding is eco-friendly but expensive. For chemical control, Atrazine can be applied.

### **Irrigation**

Soil moisture is an important factor affecting the growth, flowering and bulb yield of tuberose. Field should be irrigated after planting the bulbs and further irrigation should be avoided until the sprouting of bulbs. The crop should be irrigated at weekly interval in the absence of rainfall. However, irrigation should be avoided at the maturity stage of bulbs during December-January.

### **Harvesting**

Tuberose is harvested by cutting off the spikes from the base for decoration or the individual flowers are picked from the spike for making garlands. The cut flower spike are immediately placed in cold water.

### **Flower yield**

Flower yield varies with variety, plant density and bulb size at planting time and crop management. In singles, the loose flower yields is nearly 20-25 quintals/acre and in doubles the spike yield is 1.0-1.2 lakhs per acre.

### **Packaging**

Loose flowers are packed in bamboo baskets, covered by cloth. The spikes are graded as per length of the spike, length of the flowering rachis and quality of individual flowers.

The flower spikes are packed in 50-100 spikes per bundle and wrapped in newspaper and send to market.

### **Harvesting of bulbs**

Harvesting of tuberose bulbs at the proper stage of maturity is important for storage of bulbs and their growth.

### **Yield of bulbs**

The bulbs reach maturity when the flowering is over and the plant growth ceases. At this stage, the old leaves become dry, plant growth ceases and bulbs are almost dried. About 40 quintal of bulbs can be harvested from one acre of land.

## **Plant Protection**

### **Pests**

#### **1)Thrips**

Thrips feed on leaves, flower stalk and flowers. They suck sap from these parts and ultimately damage the whole plant. Some times they are associated with a contagious disease known as bunchy top where the inflorescence is malformed.

#### **Control**

Thrips can be managed by spraying endosulfan twice at 10 days interval or by spraying dimethoate @ 2ml/lit.

### **Diseases**

#### **1)Stem rot or Basal rot (*Sclerotium rolfsii*)**

The soil borne diseases can be identified with symptoms like appearance of prominent coarse mycelial masses on the leaf surface at or near the soil level. Infected leaves loose green colour due to rotting, which extends to the whole leaf and detaches the affected leaves from the plant.

#### **Control**

The infected plants should be burnt immediately to check further infection. Drenching with Copper oxychloride @ 2gm/lit or 1% Bordeaux mixture will reduce the disease.

#### **2)Flower and bud rot or Flower blight (*Botrytis elliptica*)**

It is also a bacterial disease. The disease appears mainly on young flower buds and results in dry rotting with brown scorched necrotic discolouration of peduncles. In the advanced stage, buds become shrivel and dry.

#### **Control**

Destroy or burn the infected plant debris to check further infection and spray carbendazim @ 1gm/lt.

\* \* \*