

B.SC. SEMESTER-II

BOTANY PAPER-II

(MORPHOLOGY OF ANGIOSPERM AND FLORICULTURE)

UNIT-IV: (Skill Development: Floriculture)

1. Floriculture: Definition, commercial aspects.

2. Methods of cultivation of: Important cut flowers such as Carnation, Asters, Gerbera, Dahlia, Marigold with reference to soil type, sowing pattern, weather condition, irrigation regime, fertilizers and harvesting.

3. Diseases and control measures.

1. Floriculture: Definition

- Floriculture is the study of the efficient production of the plants that produce showy, colorful flowers and foliage for human enjoyment and the human environment.
- It is a commercially successful branch of horticulture and agriculture found throughout the world.
- Efficient production practices have been developed over the years, for the hundreds of plant taxa used in the floral industry, increasing the overall knowledge of whole plant biology.
- Plant breeding and selection have produced tens of thousands of new genotypes for human use.
- Jasmine, Marigold, Chrysanthemum, Rose, Orchid, etc. are flowers of commercial demand.



1. Floriculture: commercial aspects.

India boasts a rich floricultural heritage, with a diverse range of indigenous and exotic flowers cultivated across the country. Commercial floriculture has emerged as a significant economic sector in India, contributing to the nation's agricultural output and employment generation.

Here are some key points on the scope and importance of commercial floriculture in India:

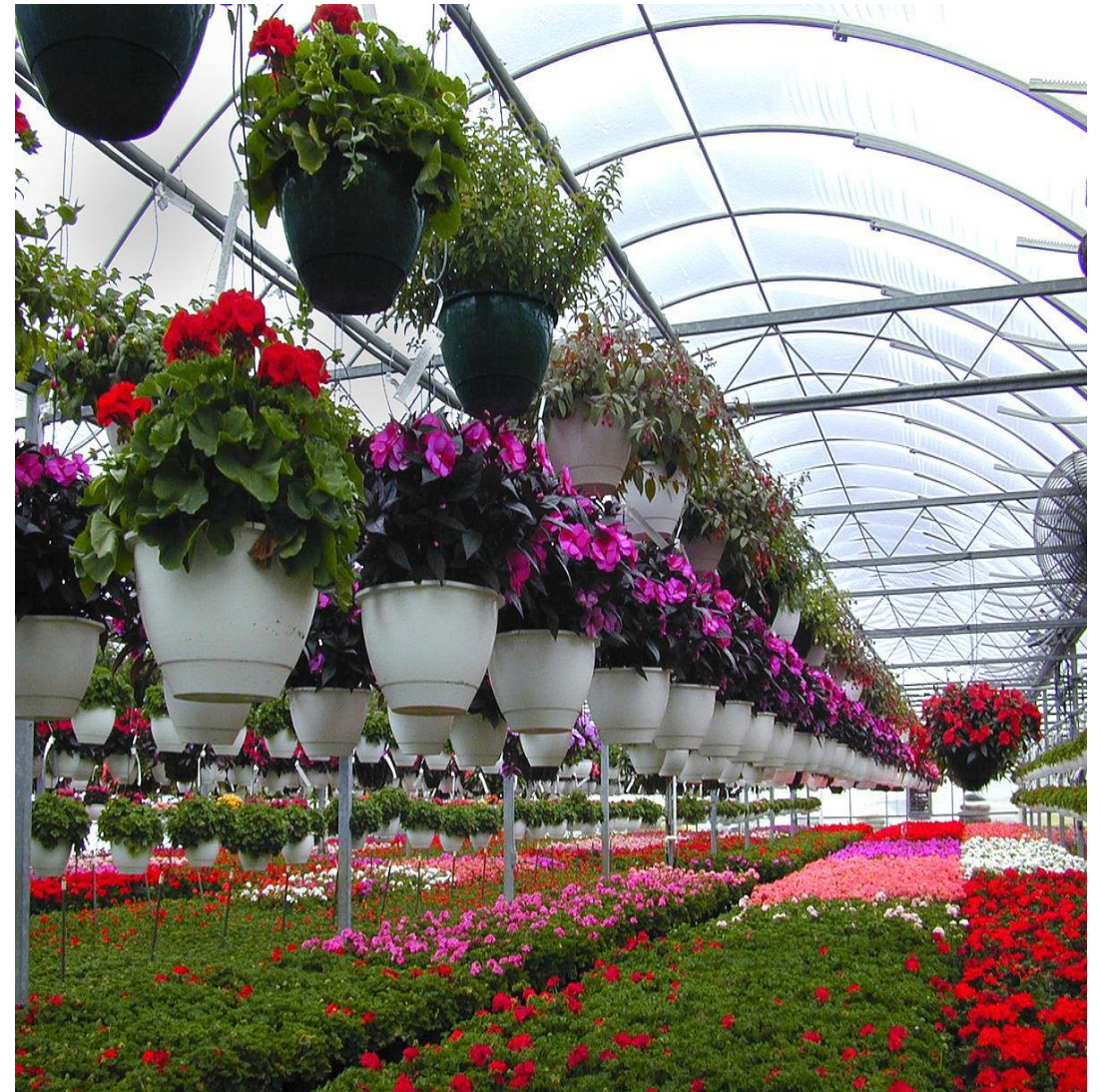
- **Growing Industry:** India's floriculture industry has been growing at 15-20% annually. It has huge potential given the varied agro-climatic conditions.
- **Export Earnings:** India earns significant foreign exchange through export of cut flowers, dry flowers, floral decoratives etc. It ranks 11th in the global cut flower export.
- **Domestic Market:** With rising incomes and awareness, domestic flower demand from festivals, occasions, weddings etc. is growing rapidly in Indian cities.
- **Employment Generation:** Floriculture provides jobs to over 2 million farmers and farm workers especially women. It plays an important role in rural livelihoods.
- **Linkages with Horticulture:** Flower farming can boost horticulture sector by diversifying cropping patterns and ensuring year-round utilization of land resources.

•**Ecological Advantage:** Flower cultivation does not deplete soil health like many conventional crops. Several varieties even grow well in degraded/saline soils.

•**Research & Development:** With strategic R&D, India can develop new advanced varieties and technologies to strengthen the sector.

•**Foreign Exchange Earner:** Floriculture has significant potential to augment farm incomes, boost exports and curtail trade deficit through focused development.

•**Scope for Value Addition:** There is scope to add value through processing activities like cut flowers, pot pourri, essential oils etc. to maximize benefits.



2. Methods of cultivation:

- Fresh flowers harvested along with stem and a few leaves are called cut flowers
- They may be harvested as a single, flowers or clusters or spikes depending upon the species and use. In India, flowers crops such as roses, chrysanthemum, dahlias, gladiolus, gerberas, and etc. have been grown to produce cut flower. Cut flower trade is also an established source of income for gardeners.
- Production of cut flowers depends upon the demand, customs and social culture of the country. In India, cut flowers are used to decorate the heads of women, to make flower garlands for religious offerings and to make bouquets.
- To use as cut flowers, they should have a good longevity The best time to harvest cut flowers is, when the atmospheric temperature is low. Half opened stage or bud stage is ideal for harvesting cut flowers.
- The flowering stem is cut with a sharp knife for harvesting the flowers. Soon after harvesting, the stalks of cut flowers are kept dipped in cold water to avoid dehydration.
- If the cut stem is hard, it is pressed with a hammer or wood piece to facilitate water absorption. These flowers are wrapped with a polythene sheet and sent to the market. The harvesting and handling of cut flowers vary from species to species.

Important cut flowers are as follows:

(1) Carnation:

Dianthus caryophyllus, commonly known as the carnation or clove pink, it belongs to family Caryophyllaceae. The name carnation is believed to come from the Latin "coronae means a wreath, garland, chaplet, crown' as it was one of the flowers used in Greek and Roman ceremonial crowns.

This is a popular cut flower, its large array of colours and excellent keeping quality has made it one of the most demanded flowers. It is available in different attractive colours. The flowers are harvested when the outer florets are opened.

Carnation varieties can be demarcated into three main groups depending upon flower size and their use.

Standard carnation: These have single large flower on an individual stem used as cut flower

Spray carnation: Spray carnation is generally a bunch of flowers on short branches of a single stalk. The flowers are small and compact on each branch

Micro carnation: These have shorter stems and higher production than spray varieties. These are used as ornamental pot plants besides its utility in flower arrangement:

(1) Soil type: Carnations require well-drained, neutral to slightly alkaline soil with pH of 5.5-6.5. red loamy soil.

(ii) Sowing pattern: Carnations were planted in the months of January to November the mid-winter plantings gave the highest yields and the full pliming the lowest.

(iii) Weather Condition: The ideal climate for carnation production should have a cool but stable temperature, low humidity and long day with high light intensity, these plants are long day plant, and the difference between day and night temperatures should be minimum, free circulation of air relative humidity: 50-60%

(iv) Irrigation regime: Irrigation is provided with drip system ence in 2-3 days according to soil moisture to maintain water holding capacity at 60 % to 65 %. The optimum water requirement of the crop is 4-5 lit/m³/day



(v) Fertilizer: Start fertilization from 4th week onwards until 8th week (per 1000 m² every day) Fertilization from 8 week onwards until 12 week: (Per 1000 m² every day). If possible, have the soil analysed every two or three weeks to determine whether it is essential to alter the fertilization program. Fertilization out of 12th week onwards until the end of flush: (Per 100 m² every day). Neem cake 2.5 tonha, Phosphorus 400 g/100 sq. feet and Magnesium sulphate 0.5 kg/100 sq. feet are applied as basal

(vi) Harvesting: 1. Standard cultivars for local market are harvested when flowers are half opened or at painting brush or puter petal is perpendicular to stem, while for distant market cross is developed on buds and colour is visible



Disease And Pest In Carnation

- always maintain Cleanliness, cleanliness environment is vital due to environmental restrictions, spraying application, which requires weekly implementation.
- Identifying the disease at the initial stage is important.
- The most favorable conditions for fungi are humidity and higher humidity.
- Maintaining optimal pest and disease control can be achieved by keeping a regular preventative spraying program.
- Don't spray on weak plants as a result of extreme sunlight sown in a comparatively dry condition.



Diseases :

The significant carnation diseases and their potential control measures are described below.

1. *Fusarium* Wilt

- The disorder caused by *Fusarium oxysporum* is among the most serious disease
- Wilting of foliage, often only on a couple of branches, followed by departure. Rotting of the stem below floor level with inner brown streaking extending around the stem.
- When pulled, the plant breaks off easily while the company roots stay in the soil. Infected cuttings wilt and die quickly.

Control Measure

- The ideal control measures are dirt sterilization or chemical fumigation of the soil, use of pathogen-free crops, and basic sanitation at the greenhouse.
- Rogue and destroy diseased plants to decrease the source of disease.
- Benomyl or Ridomil @ two gm/lit of water drenching.

2. Butt Rust – *Rhizoctonia Solani*

Butts occasionally show a brownish discoloration and breaking just below ground level. The brown rot can stretch up the stem.

Control Measure

- Plant substance derived from pathogen analyzed stock into the fumigated land.
- proper ventilation, Fantastic drainage, shallow planting increase carnation immunity against *R. solani*
- Moderate fertility level.
- drenching with fungicide reduce butt rust
- (Bavistin or Benomyl @ two gm/lit) before planting.
- If the infection develops, eliminate infected plants and start Ridomil or Benomyl treatment.

3. Rust-*Uromyces Dianthii*

- Initial infections appear as pale green shellfish such as swellings, which erupt, releasing red to dark brown powdery masses of spores. The disease is normal under warm, humid conditions.

control measure

- Avoid leaving wet.
- Rogue contaminated plants.
- Maintain a routine preventative spray program with Mancozeb

4. Grey Mould-Botrytis Cinerea

- Symptoms: Originally, a moist tan-colored blotch grows on petal tips and spreads quickly throughout the petals to make a fluffy grey mold.
- This disorder could create on cut flowers while in transit.

control measure

- Reduce humidity, keep excellent ventilation, and hygiene clinics.
- Avoid injuring blossoms

5. stem and root rot

Withering and yellowing of foliage, foliage departure, outside browning of stalks, and inner workings in nodes. Stem and root rot might be present. Wet conditions, overwatering, and poorly drained soils prefer developments of this illness.

control measure

Avoid overwatering and poorly drained soils.

Drenching using Benomyl @ two gm/lit or Rovral (0.5 gm/lit).

Drench using Thiram @ 3 gm/lit.

ASTER (*Aster amellus*)

Family: Asteraceae

Varieties

Kamini, Poornima, Shashank, Violet Cushion, Phule Ganesh White, Phule Ganesh Pink, Phule Ganesh Violet, Phule Ganesh Purple.

Climate:

Prefers cooler climates with day temperature of 20-30°C, night temperature of 15-17°C and relative humidity of 50-60%. Bright sunlight is required for growth and flowering.

Soil:

Open sunny locations with well drained red loamy soils with pH of 6.0 to 7.0

Planting Season:

Throughout the year under mild climatic conditions (like Bangalore)

Propagation and planting:

Propagated through seeds; seed rate is 2.5 - 3.0 kg/ha. 30-45 day old seedlings are transplanted in raised beds of 120 x 60 x 10 cm size.



Nutrition:

FYM @ 10-15 t/ha is applied during field preparation. NPK recommendation is 180:60:60 kg/ha of which 90:60:60 kg/ha is applied as basal and 90 kg/ha of N is applied as top dressing 40 days after transplanting.

Land preparation and sowing

Soil is made into fine filth and flat beds are formed. Seeds are sown either by broadcasting or line sowing at 20 x 15 cm.

Irrigation

Irrigation is given once in 4-7 days according to soil moisture conditions.

Pinching:

Pinching of growing tips is done 30 days after transplanting to induce lateral shoots.

Manuring

Apply 5 t FYM/ha along with NPK 70 : 175 : 75 kg/ha as basal.

Weeding

The crop needs two hand weedings.



Plant protection

Pests

Semilooper: Spray Quinalphos @ 1.0 ml/l or Carbaryl @ 1g/l

Leaf miner: Spray Monochrotophos @ 0.5 ml/l or Imidacloprid @ 0.5ml/l

Diseases

Collar and root rot: Soil drenching with Copper oxychloride @ 2.5g/l

Wilt (*Fusarium sp.*): Soil drenching with Carbendazim 1g/l

Harvesting:

For cut flower : Flowers along with stalks or whole plants are harvested

For loose flower: Individual flowers are harvested with short stems attached

Yield: 18 - 20 t/ha.



GERBERA (*Gerbera jamesonii*)

Family: Compositae

Climate:

Production of quality flowers requires shade house (50%) or naturally ventilated polyhouse. Day temperature of 22-25°C and night temperature of 12-16°C are ideal.

Soil:

Well drained, rich, light, neutral or slightly alkaline soil with pH range of 5.5 - 7.0.

Season

The crop can be cultivated throughout the year.

Propagation:

Commercially propagated through division of suckers and tissue culture plants.



Field preparation and planting:

- Soil fumigation with Formaldehyde (100ml in 5l/m²) or Dazomet (30g/m²) is recommended to control soil borne pathogens (*Phytophthora*, *Fusarium* and *Pythium*). Raised beds of 1-2m width and 30cm height are prepared.
- Growing media consisting of FYM: sand: cocopeat/paddy husk (2:1:1) is ideal.
- Before starting gerbera cultivation, disinfection of the soil is absolutely necessary to minimize the infestation of soil borne pathogens like *Phytophthora*, *Fusarium* and *Pythium* which could otherwise destroy the crop completely.
- The beds should be drenched / fumigated with 2% formaldehyde (100 ml formalin in 5 litres of water / m² area) or methyl bromide (70 g / m²) and then covered with a plastic sheet for a minimum period of 2 to 3 days.
- The beds should be subsequently watered thoroughly to drain the chemicals before planting. Well developed tissue culture plants having 4-6 leaves can be planted firmly without burying the crown.



Spacing:

40 x 30 cm or 30 x 30 cm

Irrigation

Drip irrigation is done once in 2 – 3 days @ 3.75 litre/drip/plant for 15 – 20 minutes. Average water requirement is about 500 – 700 ml/day/plant.

Nutrition:

Fertigation is adopted from 3rd week after planting as per the following schedule.

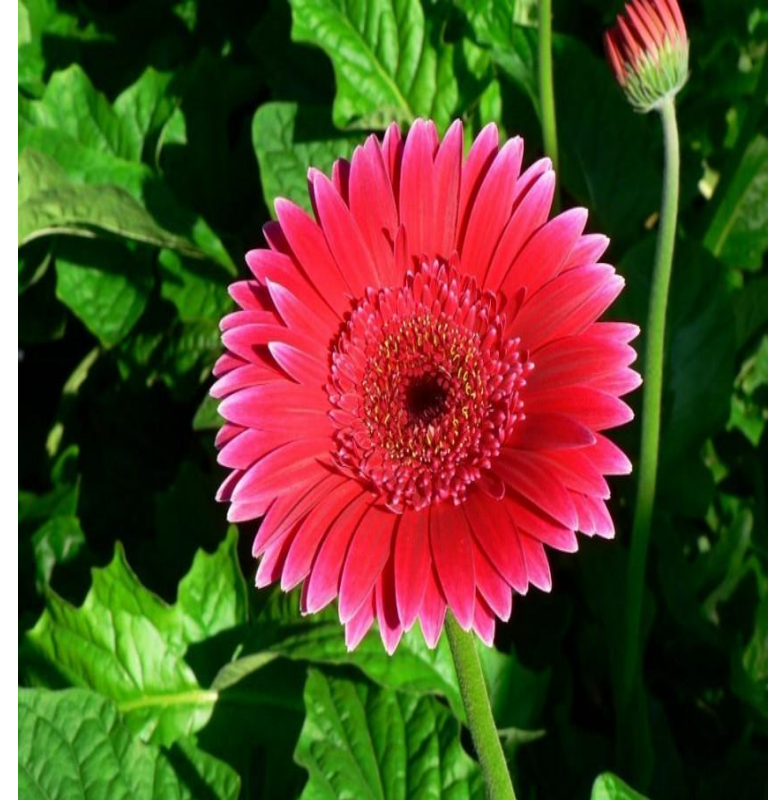
Manuring

Basal

Neem cake 2.5 ton/ha, P - 400 g/100 sq.ft., MgSo₄ - 0.5 kg/100 sq.ft.

Top dressing

Calcium Ammonium Nitrate and Muriate of Potash at the ratio of 5:3 is mixed and applied at 2.5 g/plant/month



After cultivation

1. Hand weeding is done whenever necessary.
2. Remove the flower buds up to 2 months and then allow for flowering
3. Rake the soil once in 15 days to facilitate easy absorption of water, fertilizer and to provide air to the roots.
4. Remove older leaves to facilitate new leaf growth and good sanitation.

Plant protection

Pests

Aphids:

Apply Imidacloprid 17.8 % SL @ 1 ml/l or Dimethoate 30 EC @ 2 ml/l

Whitefly:

Spray Imidacloprid 17.8 % SL @ 2 ml/l or Dimethoate 30 EC @ 2 ml/l

Thrips:

Spray Fipronil @ 2 ml/l or Dimethoate 30EC @ 2 ml/l

Red spider mite:

Spray Abamectin 1.9 EC @ 0.4 ml/l or Propargite @ 1 ml/l

Nematode:

Soil application of *Bacillus subtilis* (BbV 57) or *Pseudomonas fluorescens* @ 2.5 kg/ha at the time of planting for the management of root knot nematode.

Diseases:

Flower bud rot: Spray copper oxychloride @ 2 g/l

Powdery mildew: Spray wettable Sulphur @ 2g/l or Azoxystrobin @ 1g/l

Season of flowering and Harvesting :

When flowers completely open, harvesting is done. Flower stalk is soaked in Sodium hypochloride solution (5-7 ml/lit of water) for 4-5 hours to improve vase life.

Post harvest handling:

Harvesting is done when outer 2-3 rows of disc florets are perpendicular to the stalk. The heel for the stalk should be cut about 2-3 cm above the base and kept in fresh chlorinated water. Flowers should be graded and sorted out in uniform batches. Flowers packed individually in poly pouches and then put in to carton boxes in two layers



Botanical Name: *Dahlia variabilis*

Family: Compositae

Soil and Climate:

Dahlias grow well in rich and porous soil. Well drained, deep fertile, pH 6.5, open and sunny place, cold atmosphere free from frost is required.

Propagation:

Dahlias are propagated from seeds, tuberous roots and cuttings. Multiplication by grafting is also possible. Propagation through meristem culture may be used for producing virus-free plants.

Soil Preparation:

Dahlias are grown both in pots and in ground. The ground should be dug and manured a few weeks before planting. About 5 kg of FYM per m² should be mixed thoroughly with the soil.

Planting:

Dahlias are generally planted in Sept-Oct. In the plains, and in April in the hills. The planting distance will vary according to the type i. e. about 75 cm in case of tall, large flowered types, 60 cm for medium sized plants and 30 to 45 cm in case of dwarf cultivars.

Manuring and Fertilization:

- Proper nutrition is essential for successful cultivation of dahlia.
- 40 kg N, 50 kg P_2O_5 and 40 kg K_2O per acre were optimum for flower yield.

Harvesting:

- Blooms are cut in the early morning, the sun being avoided by all means, and kept immediately in a container half filled with water. The flowers should be cut with as long as possible.



Pests and Diseases

- Slugs and snails are serious pests in some parts of the world, particularly in spring when new growth is emerging through the soil. Earwigs can also disfigure the blooms.
- The other main pests likely to be encountered are aphids (usually on young stems and immature flower buds), red spider mite (causing foliage mottling and discolouration, worse in hot and dry conditions) and capsid bugs (resulting in contortion and holes at growing tips).

Diseases affecting dahlias include

- powdery mildew, grey mould (*Botrytis cinerea*), verticillium wilt, dahlia smut (*Entyloma calendulae f. dahliae*), phytophthora and some plant viruses. Keep the foliage as dry as possible by allowing for good air circulation. More serious are leaf
- spot and dahlia wilt and viruses. Plants with viral infections often manifested by leaves that yellow in an irregular pattern, should be destroyed.
- There is no cure and the virus will spread. *Dahlias* are a source of food for the larvae of some Lepidoptera species including angle shades, common swift, ghost moth and large yellow under wing.

AFRICAN MARIGOLD (*Tagetes erecta* L.)

Family: Asteraceae

Varieties

Local types (orange & yellow), Pusa Narangi Gainda, Pusa Basanthi Gainda (IARI varieties) and MDU 1 can be cultivated.

Soil

Well drained loamy soil is found suitable. The soil pH should be 7.0 to 7.5. Saline and acidic soils are not suitable for cultivation.

Seeds and sowing

The seeds are sown throughout the year. Nursery is raised with 1.5 kg seeds/ha and the seedlings are transplanted after four weeks on one side of the ridge at 45 x 35 cm spacing. Treat the seeds with *Azospirillum* (200 g in 50 ml of rice gruel) before sowing.

Irrigation

Irrigation is done once in a week or as and when necessary. Water stagnation should be avoided.



Manuring

During last ploughing, incorporate 25t/ha of FYM. Apply 45:90:75 kg NPK/ha as basal and 45 kg N/ha as top dressing 45 days after planting.

After cultivation

Weeding should be done as and when necessary. Irrigation should be given immediately after planting and life irrigation on third day after planting. Water stagnation should be avoided. Based on the soil moisture condition, irrigation should be done.

Plant protection

Pests:

Mealy bug:

Damage symptom: Mealy bugs are crowdly present in young shoots, stem and leaves. Flattening and crinkled with dark green leaves. It's segregate honey like substances because of that leaves are converted into black sooty mould. Apical parts of the shoots show retarded growth.

Control measures

Spray prophenophos or dimethoate @ 2ml/litre.

Spray Fish oil rosin soap @ 25g/litre

Thrips - Thrips tabaci:

Damage symptom

Discoloured or distorted plant tissue is clues that thrips were present. Thrips prefer to feed in rapidly growing tissue. Damaged leaves become papery and distorted. Infested terminals may discolour, rolled and drop leaves prematurely. Petals may exhibit “colour break,” which is pale tissue that was killed by thrips feeding before buds opened.

Control measures

Set up yellow sticky trap 20 per acre

Released *Amphellicies cucumeris* spider parasitoid.

Fipronil 1.5ml/litre or spiromesifen 0.75ml/litre or azadirachtin 3ml/litre

Spider

It can be controlled by spraying Kelthane 1 ml/lit of water

Leaf spot

Leaf spot can be controlled by spraying Bavistin 1 g / lit of water

Root rot

Drench 1 g/lit of Bavistin to control root rot.

Crop duration

The crop duration is about 130 - 150 days.

Plant protection

Pests:

Cut worms and *Helicoverpa armigera*

Spray spinosad 45 SC @ 0.75ml/litre. Spinosad 45 SC is quickly biodegradable and is accepted by the importers

Mealy bug: Spray Prophenophos @ 2ml/l Fish oil rosin soap @ 25 g/l

Bud borer: Spray Spinosad @ 0.75 ml / l

Leaf miner / thrips: Spray Fipronil @ 1.5ml/l

Red spider Mite: Spray Abamectin 1.9 EC @ 0.5 ml/l or Fenazaquin @ 2 ml/l or Exodus (natural lactones) @ 2 ml/l

Diseases:

Leaf spot : Foliar application of Hexaconazole @1ml/litre or Mancozeb @ 2g/litre

Yield: Flowers : 30 - 35 t/ha.

Xanthophyll : 1.7 - 1.9 g/kg of fresh flowers.

Harvest

Flowers are picked once in 3 days beginning from 60 days after planting.

Yield

The average yield is about 18 t/ha.



THE END