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FACULTY OF AGRICULTURAL SCIENCES & ALLIED INDUSTRIES

- Botanical name: *Citrus spp.*
- Family: Rutaceae
- Chromosome no: 2n=18

Preamble

- Citrus is the leading tree fruit crop in the world. In India, citrus ranks second in area sharing 12.8% of the total area under fruit crops with 9.6% share in production.
- Under citrus group, mandarins are the most important, occupying 50% of the total area under citrus followed by sweet orange and limes.
- Citrus fruits are grown mainly in Maharashtra, Andhra Pradesh, Punjab, Karnataka and North-Eastern region.

Origin and Distribution

- South East Asia, tropical and sub-tropical regions of Indio-china.
- Major citrus growing countries are USA, Spain, India, Italy, Japan, Argentina, Mexico, Brazil, Morocco, Algeria, Greece, South Africa, Australia, Israel, Egypt, Jamaica, etc.
- Citrus trees are found growing in all the countries (30) between 400 N and 400S latitudes. United States is the largest producer with 35-40% of world production

Soil and Climate

- Grows well in dry semi arid climates producing good quality fruits.
- It can tolerate occasional light frosts. Optimum temperature range is 16-20^{0}C within a range of 17-40^{0}C. Annual rainfall of 500-775 mm is optimum.
- Sweet orange can be grown in any well drained soils, sandy or clay loams are preferable

Species and Cultivars

(Japan) are at two extremes. Swingle (1948) recognized only 16 species under the genus citrus where as Tanaka (1954) described as many as 144 species. He failed to cover many forms of horticultural importance and many species of Japanese, Chinese and Indian origins have been denied. Swingle divided the genus Citrus into subgenera viz; Eucitrus having 10 species and Papeda having 6 species.

- Tanaka's (1954) treatment although considered more comprehensive and detailed, contained excessive number of species, some of them being of doubtful validity. In the mandarin group alone, he described 35 species, resulting into much confusion and obviously to lesser practical utility. Tanaka divided the genus Citrus into two subgenera viz; Archicitrus having 98 species and Metacitrus with 46 species.
- Contrary to Swingle's opinion, citrus forms of hybrids and certain cultivars by Tanaka were questionable and might be avoided. It is accepted that the characters employed for identifying a valid species of citrus should be free from the environmental influence.

Major species of horticultural importance are:

1. ***Mandarin group:***

***Citrus reticulata*:** Chinese origin. Polyembryonic cultivars are Nagpur, Coorg, Khasi of India and Ponkan of china.

***C. unshu*:** Japanese origin- seedless, cultivars are Satsuma mandarins of Japan and Owari, Kara, Silver hill.

***C. deliciosa*:** Mediterranean origin- Polyembryonic cultivars- Willow leaf mandarin, Kinnow, King of USA and Blinda of Algeria.

***C. nobilis*:** Indo-China origin, natural Tangor. Polyembryonic cultivars: Kunembo of Japan, King Orange of USA.

2. ***Orange group:***

***C. sinensis*:** sweet orange Polyembryonic cultivars are Mosambi, Maltablood Red, Sathgudi, Valencia, Pineapple, Washington Navel Orange, Shamouti of Israel, Succari of Egypt, Dobla Fina of Spain, Mudkhed (bud mutant of Nagpur mandarin)

C. aurantium- sour orange.

3. ***Grape fruit group:Pummelo***

C. grandis – Monoembryonic. Malaysia and Polynesia origin. Leaves pubescent in lower surface, fruits in clusters. Cultivars are kaopan of Thailand and Buntan of Formosa. *C. paradisi*- Grape fruit- south china origin, polyembryonic. Leaves non-pubescent, fruits solitary. Cultivars are Poser, Ruby, Marsh, Duncan seedless, Thompson, Red blush, Triumph, Sharanpur special.

4. ***Acid group:Lime***

***C. limon*:** Lemon: weakly polyembryonic, cotyledons white. Cultivars are Eureka, Lisbon of USA, Feminello and Monactiello of Italy, Bernia of spain. Lemon oil is very important.

***C. jambheri*:** rough lemon- polyembryonic Indian origin, cotyledons light green , popular rootstock, fairly tolerant to virus diseases.

***C. aurantifolia*:** Acid lime or sour lime- Polyembryonic, cotyledons whitish- popular cultivar are Kagzi lime-susceptible to tristeza and canker.

***C. medica*:** citron – Indian origin – Monoembryonic, Persisting style.

***C. karna*:** Kharna Khatta- Popular rootstock, cotyledons white.

***C. limonica*:** Rangpur lime-hardy- popular rootstock, tolerant to tristeza and also salt.

Other related wild species are:

***C. indica*-** Indian wild orange with inedible fruits

***C. latipes*-** Khasi papeda- cold tolerant.

***C. macroptera* –** Melanasian papeda- has medicinal value

***C. ichangensis*-** Ichang papeda- cold hardy, fruits inedible.

***C. assamensis*-** Admajor (Gajanimbe)

Related genera:

Ponicirus- Trifoliate orange, fruits inedible, Polyembryonic rootstock.

Fortunella: Kumquat- the species are margarita, japonica, errasiflora, hindsii- Polyembryonic plants ornamental with small oval fruits.

Intergeneric hybrids:

Citrange- Trifoliate orange x *C. sinensis*, cultivars are Troyer, Carriyo, Morton, Stonia, Rusk, Coleman.
Citrange quat- Trifoliate orange (*Ponicirus x citrus*), citrange x fortunella- trigeneric hybrid (kumquat)
Citrangedin: (*Ponicirus trifoliate* x *C. sinensis*) x *C. mitis* (calamondin) – bigeric hybrid.
Citrangor- citrange x *C. sinensis*
Cicitrange- citrange x *ponicirus trifoliate*
Citrandarin- *P. trifoliata* x *C. reticulata* (mandarin).
Citrumelo- *P.trifoliata* x *C. paradisi* (grape fruit).
Citermon- *P. sp* x *C. aurantium*
Citrumquat- *P. sp* x *C. japonicum* x *F. margarita* (kumquat)

Hybrids of fortunella (kumquat)

Procimequat: *F. japonica* x *C. aurantifolia* (acid lime) x *F. hindisi*
Limequat: *C. reticulata* x *F. japonica* x *F. margarita* .

Intrageneric hybrids:

Tangor: *C. reticulata* x *C. sinensis*, cultivars are temple, clamentine, montreal, Umatilla, monoembryonic
Tangelo: *C. reticulata* x *C. paradise*, cultivars are Orlando, Sampson, Seminole.
Lemonima: *C. limon* x *C. aurantifolia*
Lemmonnage: *C. limon* x *C .reticulata*

Sweet Orange

- Second largest citrus fruit in cultivation and commercially grown in Andhra Pradesh (Ananthpur, Cudappah, Nalagonda, Mahaboobnagar and Chittor district).
- Maharasthra: Marathwada, Ahmednagar, Pune and Nasik. Karnataka, Punjab, Haryana, Rajasthan

Cultivars:

Blood red in Haryana, Punjab and Rajasthan-Jaffa, Hamlin, Pineapple- exotic, Mosambi in Maharasthra and Sathgudi in A. P

Manuring

The bearing tree should be given the fertilizer dose at the ratio of 550 gm: 370 gm: 550 gm NPK/plant/year, depending upon its performance.
Graded dose of fertilizers can be applied from 1st year to 10th year.
Fertilizers should be applied in a ring 30-40 cm wide just below the canopy of the tree at a distance of at least 1-2 m from the trunk.
As sweet orange shows deficiency symptoms of many micronutrients it is always better to give a composite spray of:

Zinc sulphate	2.25 kg
Copper sulphate	1.45 kg

Magnesium sulphate	0.90 kg
Manganese sulphate	0.90 kg
Ferrous sulphate	0.90 kg
Boric acid	0.45 kg
Slaked lime	4.00 kg
Urea	4.50 kg

Applied in 450 liters of water 2-4 sprays every year on the new flush of fully grown leaves.

Two sprays minimum during the new flush is recommended

- 1st spray-on new flush
- 2nd spray-after the leaves on new flush fully expand.

Irrigation

- Irrigation requirements depend upon soil and weather conditions.
- Irrigations should be regular during fruit development.
- Water should never come in direct contact with the trunk of the tree; For this reason double ring or check bund method is best suited for this crop.
- Presently drip irrigation is becoming popular which helps in saving of irrigation water.
- Stopping irrigation 1 or 2 months prior to flowering is beneficial to the crop, till the tree withers and drops half of its leaves.

Intercultural

- During the pre-bearing stage of the plants, vegetables other than solanaceous crops can be grown, taking care not to waterlog the soil around the trunks of the plants.
- Leguminous crops are the best Intercropping with 'pea' was found to improve the yield of sweet orange. Cucurbits also can be grown successfully.
- Weeds can be controlled with pre-emergence spray of diuron @ 3 Kg/ha twice at 120 days intervals.
- Other weedicides used are simazine, atrazine, bromacil, 2, 4-D. etc.

Pruning and Training

- No regular pruning except removing dead, diseased and over crowding branches after harvesting of the fruit.
- Plants should be trained during first 3 years to have a well distributed frame work at 1mt height on a single trunk.

Harvesting and Yield

- Sweet orange takes 9-12 months for maturity. Being non-climacteric should be harvested only after full maturity of the fruits. Harvesting seasons are Dec-Feb in

North India, Oct-march in South India, Nov-Jan (Ambebahar), March-May (Mrigbahar) in central and western India.

- Yield varies from 500-2000 fruits/tree depending upon the variety, agro-climatic conditions and age of the tree.

Post Harvest handling and storage

- Post-harvest handling consists mainly of washing, drying, storing, grading and wrapping in tissue paper and packing in corrugated boxes.
- Fruits can be stored for 20 days at room temperature by dipping in 500 ppm Benlate or 0.1 % carbendazim (Bavistin).
- Malta fruits can be stored for 2-3 months at 4.40C Sathgudi for 4 months at 20C and Mosambi for 3 months at 50C and 85-90 % RH.

Physiological Disorders

Fruit Drop

Citrus drops flowers and fruits at different stages as a natural means of adjusting to it resources. These are normal and may not affect the yield. Pre-harvest drop of well grown fruits prior to maturity is a serious problem reducing the yield.

The main causes may be

- Climatic factors
- Improper water management
- Lack of nutrition
- Relation of seed to fruit drop.

Control

- Spraying 10 ppm 2, 4-D 2 months before harvesting. Fruit drop may be due to presence of pests and diseases also which can be controlled by spraying 1 % Bordeaux Mixture.