Popular Article

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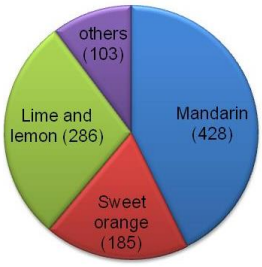
A Snapshot of Citrus in India

India is rich in genetic diversity of citrus and soil and climatic factors prevailing in the country favours its cultivation. It is cultivated throughout tropical and sub-tropical regions of the country. Citrus is the third most important fruits and mandarin, sweet orange and acid limes are the predominating citrus species commercially cultivated in India. Lemons, pummel, and grapefruit are cultivated in limited scale, mostly in home gardens. However, the productivity is far behind when compared to Brazil, China, USA, Turkey, Spain and other countries. Non-availability of disease free quality planting materials, poor orchard management, phytophthora root rot, citrus greening, citrus tristeza virus, canker, salinity, drought, alkalinity, extreme temperatures, etc., are affecting the Indian citrus industry. Use of rootstocks tolerant to different biotic and abiotic stresses and better nutrient, pest and disease management, and adoption of drip irrigation, the production and productivity can be increased in the future.

INTRODUCTION

Citrus, one of the leading fruit crops in the world, is grown in 114 countries and commercially grown in 53 countries. Sweet orange (*Citrus sinensis*Osbeck), Mandarin (*Citrus reticulata* Blanco), limes (*Citrus aurantifolia*Swingle), lemon (*Citrus limon* (L) Burm.f), grapefruit (*Citrus paradise* Macf.) and pummelo (*Citrus grandis* (L.) Osbeck) are occupying the commercial trade in the world. The world citrus is dominated by sweet orange with a 64% contribution followed by mandarins with 20%, limes and lemons 10% and rest of the 6% contributed by grapefruit and other citrus fruits. The fruits are rich in vitamins, minerals and dietary fibre and considered as one of the best source for vitamin C. Besides nutrients, they are also rich in antioxidants. In India, citrus (*Citrus* spp.) is the third most leading fruit crops next to mango and banana. It is cultivated in an area of about 1.003 million hectare with the production of 12.54 million tonnes and average productivity of 12.5 t/ha (NHB, 2018). Mandarins, limes and

lemons and sweet oranges are commercially grown in India (Figure 1 and 2) and Maharashtra, Madhya Pradesh, Andhra Pradesh, Telangana, and Punjab



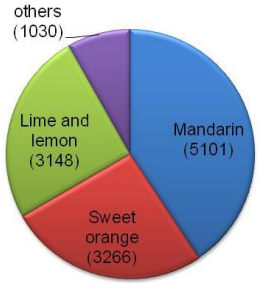


Figure 1.Area of citrus ('000 ha)Figure 2. Production of citrus ('000 MT)

are the leading states in area and production of citrus in India during 2017-18. Over the last 20 years, expansion has been recorded at an annual rate of 5.95% in area and 6.2% in production.

SOIL AND CLIMATE

Citrus is being grown in wide range of soil and climatic conditions in India. Unlike humid sub-tropical climate of China and Japan, it is cultivated in tropical, humid tropical, sub-tropical and humid sub-tropical conditions. The world famous Nagpur mandarin and Mosambi sweet orange are grown in humid tropical region of Maharashtra where temperature goes up to 45-46 0C in summer. Kinnow mandarin is successfully cultivated in Punjab, Haryana, and Rajasthan which have distinct winter season. The Khasi mandarin is grown commercially in humid-sub-tropical climate of Northeastern Hill region where it receives high rainfall during summer and low temperature during winter. Sathgudi sweet orange is cultivated in tropical conditions of Andhra Pradesh and Telangana where there is no district winter. It performs better in well-drained soil rich in nutrients with pH ranged from 5.5 -7.5 and it is susceptible to salinity, alkalinity, and drought.

CITRUS BIODIVERSITY

India is rich in genetic diversity of citrus, particularly South India, foot hills of Himalaya, and Northeastern region of India. Several citrus species and progenitors are originated in India like *Citrus indica* (Indian wild orange), *C. pseudolimon*(Galgal or Hill lemon), *C. rugulosa* (Attanni), *C. ichangensis*, *C. assamensis*, *C. latipes*, *C. maderaspatana*(Kichili), *C. pennivesiculata*(Gajinima), *C. aurantifolia*(acid lime), *C. jambhiri* (rough lemon), *C. limonia*(Rangpur lime), *C. medica*(citron), *C. karna* (KarnaKhatta) and sweet orange cvs. LikeTasi, *Soh-Nariang*, *Soh-Bitara*, etc. ICAR Central Citrus Research Institute (ICAR CCRI) has collected a maximum of 157 genotypes from Northeast India and 74 genotypes from Uttarakhand alone. At present the centre has the total collection of 638 citrus accessions which includes both indigenous and exotic. Apart from ICAR CCRI; ICAR Indian Agricultural Research Institute, New Delhi; Regional Fruit Research Station, Punjab Agricultural University, Abohar, Punjab; Citrus Research Station, Assam Agricultural University, Tinsukia, Assam; Citrus Research Station, Tamil Nadu Agricultural University, Sangarankoil, Tamil Nadu; and Citrus Research Station, Tirupathi, etc., are maintaining the field gene banks. ICAR National Bureau of Plant Genetic Resources, New Delhi is maintaining the citrus accessions in the *invitro* conservation and field gene banks.

COMMERCIAL CITRUS SPECIES AND VARIETIES GROWN IN INDIA

The major citrus species commercially cultivated in India are mandarins, acid limes and lemons, and sweet oranges. Pummelo and grapefruit are cultivated in limited scale and mainly confined to homestead gardens. Citron, galgal, *C.pennivesiculata*, and *C. madraspatana* are cultivated in isolated areas mainly for pickle making and medicinal uses. Ethnic people of Mizoram and Manipur are collecting fruits of *C.macroptera*from the forest and using it for pickle making and juice preparation. They are also adding its rind (dried or powdered form) to the curries and similarly people of Garo hills, Meghalaya are using *C.indica* for medicinal purposes. The major growing areas and some of the important varieties are given in the table 1. The important traits of major citrus species are mentioned in the table 2.

CHALLENGES IN CITRUS CULTIVATION

India ranks 2nd in area and 3rd in production of citrus in the world. However, the productivity is far behind when compared to USA, Brazil, China, Spain

and other countries. Non-availability of quality planting materials, biotic and abiotic stresses are severely affecting the citrus production and productivity.

A. NON-AVAILABILITY OF DISEASE FREE QUALITY PLANTING MATERIALS

The area under citrus is constantly increasing every year and currently requires 2 crore plants per year approximately. Mandarins, sweet oranges, grapefruit and pummelo are produced by budding with either Rough lemon or Rangpur lemon as rootstocks and acid lime is mainly propagated through seeds. The research institutes supplying genuine disease free quality planting materials could not even able to meet 1% of the demand. The farmers are getting poor quality planting materials from other sources which severely hamper the citrus production at later stages.

B. BIOTIC STRESS

Citrus trees are affected by several fungal, bacterial and viral diseases. Of these, Phytophthora (*Phytophthora*spp.), twig blight (*Botryodiplodiatheobromae, Colletotrichum* spp.), citrus canker (*Xanthomonas citrus* ssp. *citri*), citrus scab (*Elsinoefawcettii*), citrus greening (*Candidatusliberibacterasiaticus*) or Huanglonbing/HLB, Citrus tristeza virus (CTV) and nematodes (*Tylenchulussemipenetrans*) cause huge economic losses. Phytophthora and citrus greening are becoming most lethal diseases of citrus in India

Table 1. Commercial citrus species and varieties in India

Common name	Botanical name	Major growing regions	Varieties
Mandarin	*C. reticulata*	Maharashtra, Madhya Pradesh, Punjab, Rajasthan, Himachal Pradesh, Coorg region of Karnataka, Lower Pulney Hills of Tamil Nadu, Northeast India	Nagpur mandarin, Coorg mandarin, Khasi mandarin, Sikkim mandarin, Darjeeling mandarin, Kinnow
Sweet orange	*C. sinensis*	Telangana, Andhra Pradesh, Maharashtra, Madhya Pradesh, Punjab, Mizoram	Sathgudi, Mosambi, Batavian, Katol Gold, Nucellarmosambi, Malta, Pera, Natal, Hamlin
Acid lime	*C. aurantifolia*	Maharashtra, Madhya Pradesh, Odisha, Punjab, Andhra Pradesh, Telengana, Tamil Nadu, Karnataka, Himachal Pradesh, Bihar, Chattisgarh, Uttaraghand	PKM-1, Balaji, Vikram, Pramalini, SaiSarbati, PhuleSarbati, NRCC acid lime-7, NRCC acid lime-8
Lemon	*C. limon*	Northeast India, Uttaraghand,	Assam lemon, Pant lemon, Baramasi lemon, Gandhraj
Pummelo	*C. grandis*	Home gardens in Northeast India, Bihar	NRCC pummelo-5, US-145
Grape fruit	*C. paradisi*	Limited in cultivation	Marsh Seedless, Red Blush, Flame Seedless, Star Ruby, NRCC grapefruit-6

Table 2. Important characters of commercial citrus species

Citrus Species	Average Fruit weight(g)	Fruit length(mm)	Fruit dia. (mm)	Rind thickness (mm)	Juice content (%)	TSS (%)	Vit. C (mg/ 100gm)	Acidity (%)
Mandarin	134.39	55.63	64.84	2.59	43.82	7.68	29.58	0.69
Sweet Orange	271.33	76.98	77.13	4.16	50.97	8.51	36.11	0.35
Acid lime	47.45	46.78	43.01	1.52	66.82	6.70	27.14	6.28
Lemon	116.57	62.86	59.72	2.29	48.16	6.26	26.87	4.43
Grapefruit	322.02	83.66	84.67	5.56	45.24	6.49	33.15	0.77
Pummelo	1050.00	140.48	139.40	21.10	39.80	6.60	48.30	0.82

(Note: The values are average value of varieties mentioned in table 1 to respective species evaluated at ICAR CCRI)

which is mainly responsible for citrus decline, particularly mandarins and sweet oranges. Canker is one of the serious problems in acid lime which affects the production and productivity.

C. ABIOTIC STRESS

Abiotic stresses like salinity, drought, alkalinity, flood, and extreme temperatures limit the citrus production. Drought and salinity are the two most important abiotic factors affecting the production and productivity of the citrus in India. Drought causes imbalance between water uptake and transpiration which leads to reduction in leaf gas exchange and net photosynthesis thereby affects the citrus production. Salinity is caused by Na^+ and Cl^- ions which could cause osmotic and ion injury to plants leading to reduction in production and productivity. Citrus trees accumulate Na^+ and Cl^- ions in their leaves thus alter the physiological and biochemical mechanisms.

CONCLUSION

Citrus is the third leading fruit crop of India cultivated in most parts of the country. The production and productivity are affected by non-availability of disease free quality planting materials and several biotic and abiotic factors. Besides these problems, the citrus industry is steadily growing. Further, the demand for citrus fruits has increased after Covid-19 because of its rich nutrients and better health awareness. Phytophtora root rot, greening and drought are the major factors causing huge economic losses to the farmers. Use of tolerant rootstocks like Alemow (*C.macrophylla*) and other hybrid rootstocks coupled with integrated disease management, vector control, and nutrient management could alleviate the problem of Phytophthora and greening. Adoption of drip irrigation and water conservation measures are necessary for sustainable citrus production. Focus should be given to increase the fruit quality so that the export market could be increased from present 15-20% to 30-40%. The focus on processing and value addition should be given priority and it may be the key factor for increasing the income of the farmers.