

## **Rootstocks for Citrus Industry**

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In India, citrus is grown 1055 thousand ha with production of 12,746 thousand tons with average productivity of 12 tons/ha. The most important commercial citrus cultivars in India are mandarin, sweet orange and acid lime. Total mandarin cultivation 397 thousand ha, 4113 thousand tons production and 10 tons/ha as productivity, while sweet orange and acid lime cultivation 244 thousand and 245 thousand ha, 2438 thousand and 3468 thousand tons production while 14 and 10 tons/ha productivity respectively. The true citrus fruits are generally considered to be of old world origin having involved in a region bound by Southern China, North eastern India and East Indian archipelago.

Rootstock in Citrus has been a horticultural practice for over a century, it is important to have understanding and full knowledge of rootstocks their characteristics, usefulness and availability. One of the most important factors affecting the performance of citrus grafted trees, is the stock on which scion is worked. The part comprising the root system is called "rootstock" and which comprising shoot system is termed as 'scion'. It has also been well established that the different species/varieties of citrus require different combination of rootstock and scion, which proved fit for one set of agro-climatic conditions. Thus it is evident that rootstocks are of great importance in the intensive cultivation of citrus. Citrus rootstocks have pronounced effects on scion vigor, fruit size, yield, juice content and quality, tolerance to cold, drought, salt, alkalinity and leaf nutrient content. Rootstocks also differ in their ability to soil with different textures, root distribution and mycorrhizal dependency.

Rootstocks research in its infant stages involves only a few rootstocks, primarily rough lemon, sour orange, trifoliolate orange, sweet orange and occasionally grapefruit or Cleopatra mandarin. The budding or grafting of citrus became a practice after appearance of Phytophthora foot rot in the Azores in 1842 and it was the transition point of citriculture from seedling to budded trees. Phytophthora was later noted in all the Mediterranean countries, and by about 1935, it had been observed nearly everywhere. Seedlings were gradually replaced so that budding on to rootstock seedlings propagates today virtually all trees.

The selection of rootstocks is very important aspect on which the success of rootstock and scion combination depends. The points include Vigor, Yield, Quality, Probable length of productive life of tree and Compatibility should be considered at the time of rootstock selection.

A horticultural performance of scion cultivars is affected in several ways by budding onto selected rootstock:-

- i. Early fruiting and avoidance of juvenility
- ii. Uniform tree size
- iii. Cropping and fruit quality control
- iv. Tolerance to unfavorable soil factors such as salinity, high pH and poor drainage
- v. Tolerance to Phytophthora, parasite nematodes and viruses.

Today rootstock problems in citrus industry have assumed a great significance. Citrus growing country is faced with this burning problem and is trying to solve the problem. Almost all the citrus trees in the major producing area are propagated on rootstocks.

#### **Qualities of a good rootstock -**

Rootstock is a very vital component of a grafted plant. Once the trees are budded on a certain rootstock and planted in the orchard, it is not possible to change it without incurring serious losses. The good rootstock should have the following qualities

- a. The rootstock must exhibit a high degree of congeniality with the scion variety and give maximum economic life to the tree.
- b. It should be well adaptable to the agro- climatic conditions of the proposed area.
- c. It should be resistant to diseases and pests prevailing in the proposed area.
- d. It must exercise favorable influence on the performances hearing and quality of fruits of scion.
- e. The stock should also have other desirable qualities like salt tolerance, drought resistant, frost endurance etc. which may be of special significance under certain climatic conditions.

#### **Commonly used rootstocks -**

1. Rough lemon (*C. jambhiri* Lush)

It is probably hybrid origin and is highly polyembryonic, in standard lemon varieties. This is of the most widely used stock in India, S. Africa, Florida and Brazil. Produce large tree, yield high, large fruit, poor cold hardiness, deep rooted, susceptible to foot rot, very susceptible to blight and excess soil moisture, tristeza tolerant, drought susceptible, effects the fruits thickened, Coarseness, lower sugar and acid content of the fruit juice. Best on deep sandy soils but grows well on many types of soil. Rough lemon is tristeza tolerant and susceptible to foot rot and Nematodes. One of its most favourable characteristics is that it grows well as a replant in old citrus soil.



**Rough Lemon**

## 2. Rangpur lime (*C. limonia* Osb.)

Rangpur lime is probably a mandarin hybrid and not a lime like the true acid limes, (*C. aurantifolia* (Christm) Swingle, used as scions. Trees on Rangpur lime are vigorous and highly productive, particularly as young trees and yield medium to large size fruit with low to moderate juice quality. Rangpur lime also grows well in loam and clay loam soils and trees on Rangpur lime have grown well in areas where rough lemon is short-lived and are very salt and lime tolerant. Trees large and vigorous, exocortis sensitive, tristeza tolerant, salt tolerant, high yield, medium fruit quality, tolerant to foot rot and fruit quality is better than rough lemon. Adapted to wide range of soils. Promising for oranges, grapefruit and mandarin.



**RANGPUR LIME**

### 3. Sour Orange (*C. aurantium*)

Sour Orange is the premier citrus rootstock, common throughout the world where tristeza does not preclude its use and especially valued as a rootstock. Trees on Sour orange are moderately vigorous, produce good crop with high TSS and acid content. Sour Orange can be grown on sandy to loam or clay soils. It is well adapted to heavy, often wet type of soil partly because of its moderate resistant to *Phytophthora* foot rot. Trees on sour orange are essentially unaffected by exocortis or xyloporosis.



**Sour Orange**

### 4. Troyer citrange

It is a hybrid of Sweet orange and trifoliate orange and has thus inherited good qualities of both the parents. It is highly resistant to gummosis and quick decline. The trees bear early and good crops of large size fruit of excellent quality. Trees budded on Troyer citrange are better cold resistant than trees on sour or Sweet orange.



**Troyer citrange**

#### 5. Cleopatra mandarin (*C. reshni*)

Cleopatra mandarin is one of the most widely and thoroughly studied rootstocks. Among its attributes are tolerance to tristeza, exocortis, xyloporosis, salt, cold and calcareous soils. Cleopatra has been included in many rootstock trials, particularly in areas where sour orange was eventually replaced because of tristeza. Cleopatra is deep rooted with extensive lateral root development on sandy soils but it thrives best on heavier soils or those with a clay layer close to the soil surface. Large tree, fruit size small, fruit quality high, slow growth in nursery, tristeza, salt, cold tolerant, susceptible to foot rot, burrowing nematode and blight is very low. Adapted to a wide variety of soils, used as rootstock for mandarin, Pineapple, Hamlin, Tangelos, oranges and grapefruit.

#### 6. Alemow (*C. macrophylla* Wester)

Alemow is a hybrid species possibly of citrus celebica and *C. grandis* native to the Philippines cultivars budded on a lemon produce large, vigorous, grow well on both sandy and high pH, calcareous soils and high yielding trees. *C. macrophylla* have a deep, dense root system that imparts drought tolerance to the scion. It is an excellent rootstock for mandarin, lemons and limes. *C. macrophylla* is better adapted to cool dry climate and it is more tolerant to foot rot than true lemons. It is a classic example of a rootstock that processes outstanding traits along with poor ones. They are the most tolerant to hi of soil boron, chloride and calcium and tend to have high level of leaf m. It is considered Phytophthora resistant.



**Alemow**

#### 7. Trifoliate orange (*Poncirus trifoliata* (L) Raf)

The genus *Poncirus* consists of a single deciduous species, *Poncirus trifoliata* and has been a very significant source of rootstock cultivars. Smaller than standard trees, high yield, high fruit quality, good cold hardness, foot rot resistance, tristeza and Phytophthora tolerant, resistant

to nematodes, low salt tolerance, used for oranges, grapefruit, has a relatively small root system and soils. It performs poorly in infertile sandy soil, where salinity is a problem. Trifoliate orange is resistant to rot, tristeza, and the citrus nematode. They have shallow root systems consisting of weak lateral root development but abundant fibrous roots.



**Trifoliate orange**

### **Conclusion -**

Rootstocks development is an open unended process. This is time to test the new rootstocks for dwarfness, disease resistance, drought tolerance, quality fruit yield and for high density plantation on large scale in different agro climatic conditions.