Role of Rootstocks in Citrus Propagation

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INTRODUCTION

In India, citrus is 3rd important fruit crop after mango and banana with total production of 44.3 lakh tonnes. India ranks 6th among the top citrus producing countries contributing 4.8 per cent to the total world citrus production. However, the average national productivity is confined to mere 8.9 t/ha which is far behind the productivity of advanced citrus producing countries like Brazil, USA, Spain, Japan etc. where it is 25-30 t/ha.

Specifically, speaking about Maharashtra, it tops highest in the list of total area under citrus i.e. 73,115 ha, however, it ranks far behind in the list of productivity i.e. 5.7 t/ha.

Thus, to increase the productivity of India as well as Maharashtra, it is a must to adopt the advanced package of practices in citrus production. One of the most important aspects for successful cultivation of citrus is proper selection of planting material. Citrus being polyembryonic, propagation of certain citrus sp. is done by seeds. However, vegetative propagation is more preferred as it gives true to type plants, uniform quality an early and regular bearing with good yielding capacity. However, for the production of standard quality fruits, which is necessary for citrus industry, budded citrus plantations from selected parents as deemed essential. Thus, selection of root-stocks that are compatible with specific species (scion) and resistant to different pests and diseases, soil and climatic conditions giving a successful scion-stock unionare of prime importance. Rootstocks exert profound influence on the vigor, productivity, quality of fruits, longevity of the scion and also response to different pests and diseases. It is therefore, important to appreciable the need for using the appropriate rootstocks suiting to particular agroclimatic (location) so that the threat of dieback can be minimized. The selection of proper rootstock far different regions is quite complicated and requires serious attention. It has also been well established that not only the different species / varieties require different combinations, but it should be also different far different set of agroclimatic conditions. A satisfactory stock must be congenial with the top budded on it and must form a good union that permits good growth, long life, good yield with quality fruits and scion variety. A wrong choice of rootstock, may lead to complete failure of crop and once the orchard is established with wrong rootstocks, it is not possible to change the plantation without incurring serious losses. The selection of rootstocks is thus an important aspect on which the success of rootstock and scion depends, includes vigor, yield, quality, probable length of productive life of tree and compatibility.

Rootstock Abilities

i) **Nursery adaptability** : Includes ready availability of seeds, high percentage of polyembryony, good germination and seedling growth, ability to attain graftable size in short period, free from pests attack period and easy budding.

ii) **Soil adaptability** : The relative vigor of growth on soils of varied depth, texture,

structure, pH, salinity, moisture and nutrient supply.

iii) **Climatic adaptability** : The degree of hardiness to cold conferred by the stock.

iv) **Biotic adaptability** : the degree of freedom from or resistance to various soil borne diseases or the effect of the stock in its relation to the scion on the resistance of the system to various diseases complexes.

Some rootstocks may be found superior in one or more of these qualities but inferior in other but none is outstanding superior in all respects. It is indeed very difficult to find an ideal and universal root-stocks that possess all the desirable qualities and be equally successful under widely varying condition and situations with different scions. Each of rootstocks presently used has its own merits and demerits and therefore suitable one can choose among the existing lot of rootstocks provided by the selector ha a thorough knowledge of the problems to be faced in the proposed area and the scion.

Polyembryony

Most of the rootstocks cultivars used on commercial scale are highly polyembryonic. However, percentage of zygotic seedlings in the seed bed may vary from 1 to 40 % depending on the cultivars. The zygotic seedlings should be roughed out because trees budded on them will be variable and often inferior in size and production. It is recognised that in citrus, variant seedlings may influence the size and yield of mature orchard trees. In most of the citrus varieties/ rootstocks, the existence of polyembryony make available apomiotic seedlings of nucellar origin and ensure uniform seedlings tree to seed parent at nursery level. This also helps to raise healthy plants as citrus virus are not transmitted through seed. The percentage of polyembryony in certain root stocks are given in following Table 1.

Table 1. Polyembryony in rootstocks

Sr. No.	Rootstocks	Polyembryony (%)	Status range of embryos
1	Rough lemon	100	3-4
2	Rangpur lime	60	1-2
3	Cleopatra mandarin	93	1-6
4	Pomeroy trifoliate	66	1-3
5	Troyer citrange	86	1-6
6	Carrizo citrange	73	1-5
7	Citrumelo	100	2-4
8	Kodakithuli	100	2-7
9	Kitchli73	1-4	
10	Kharna khatta	20	1-2

Frost tolerance

Cleopatra and Jatti Khatti are tolerant to frost. Hamlin on Cleopatra and Tryoler rootstocks was least damaged by frost and the damage was maximum in Carrizo

Salinity tolerance

The problems of salinity and alkalinity exist in different degree in every citrus growing region. It is well known that certain rootstocks do well under particular soil conditions than others. Trifoliate orange exhibit poor tolerance to salts and lime and a moderate tolerance to boron. Whereas Rough lemon and sour orange stock exhibit good tolerance for lime and moderate tolerance for salts and boron. Certain rootstock scion accumulates more Chloride than others and may suffer from such toxicity. The different rootstocks have their own capacity of exchangeable sodium tolerance limit of ESP. It is reported that Jatti Khatti, Cleopatra mandarin, Karna Khatta, Rangpur lime, Carrizo and Jullundhari Khatti have their sodium tolerance limit of ESP 16.7, 9.5, 10.2, 11.7 and 13.4, respectively. Rangpur lime and Cleopatra mandarin as tolerant, Rough

lemon, Minneola tangelo, Sampson tangles, Sour orange and Pummelos as moderate and Calamondin Florida sweet orange.

Suitability of Rootstocks

Rootstock investigation in citrus has been in progress for a pretty long time in all citrus growing countries in the world. In this regard, every aspect of citrus tree such as growth, longevity, performance, disease resistance, fruit quality etc. are influenced by the root stock. Root stock variability has been reported and careful selection of parent trees is considered necessary. The habit of growth of the scion and intake of mineral elements from the soil also depends much on the rootstock used. A good rootstock for citrus should ensure on economic orchard life about 30-50 years alongwith its tolerance or resist to soil and virus diseases. In addition to it must be polyembryonic, easily propogable with adequate and cheap source of seeds. Troyer citrange, Kichili were found suitable for sweet orange and mandarin. The recommended of some selected rootstocks are summarized and given in Table 2.

Table 2. Recommended important rootstocks

Place	Scion	Best-rootstock
Punjab (Abohar)	Kinnow Mosambi Valencia	Jatti khatti, Kharna khatta Rangpur lime Jatti khatti
Karnataka (Chetali)	Coorg orange	Rough lemon, Rangpur lime, Cleopatra mandarin
Andhra Pradesh (Kodur and Tirupati)	Sathgudi Acid lime	Gajanimma, Sathgudi, Gajanimma
Tamil Nadu (Periakulum)	Satgudi Acid lime	Kichili, Rough lemon, Sour orange Rough lemon, Troyer citrange
Maharashtra (Rahuri and Akola)	Mosambi Nagpur mandrin	Rangpur lime, Marmalade orange Rangpur lime, Rough lemon
Assam	Khassi mandrin	Kata jamir
Meghalaya	Khasi mandrin	Rangpur lime
Uttar Pradesh (Pantnagar)	Lemon Sweet orange	Jambhiri and Trifoliate orange Kharna Khatta

CONCLUSIONS

Select rootstocks having following desirable attributes.

i) Compatibility with the important scion cultivars

ii) Resistance to root-rot disease caused by Phytophthora which seem to take a heavy toll of grown up trees in the field.

iii) Resistance to nematodes, virus diseases like tristeza.

iv) Tolerance to excess salt, drought, water logging.

v) High yield and quality of the fruits.

vi) Tree size control without reducing the yield.

vii) Higher number of seeds/ fruit and high rate of nucellar embryony.

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