

ROOTSTOCK - AN IMPORTANT COMPONENT IN FRUIT PRODUCTION

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Abstract

Rootstocks play a vital role in determining the potential of scion in terms of tree canopy, nutritional uptake, yield, fruit quality and tolerance to biotic and abiotic stresses such as pathogens, pests, extreme temperature, water stress, salinity and nutritional stress. Nowadays, use of suitable rootstock species in establishment of fruit orchard is regarded as a means of sustainable production by compensating the possible effects of external stress on the scion. Owing to its positive impact on yield and quality, improved rootstock varieties of fruit crops are developed through breeding programmes throughout the world. Appropriate rootstocks for vigour, precocity and stress management has been identified and put underutilization in several fruit crops including apple, peach, plum, cherry, mango, grapes, citrus, etc.

Introduction

Rootstock is a component of a plant, often an underground part, from which new above-ground growth are often produced. It could also be described as a stem with a well-developed root system, to which a scion bud from another plant is placed. The relationship between rootstock and scion are of more relevance to fruit production technology.

Unfavourable soil and environment conditions like stress, drought, flooding, salinity and contamination of organic pollutants hinder the production of fruits, thus doesn't meet the demands of the rising population. However, to combat this problem in fruit production, an alternative has been introduced i.e., use of appropriate rootstocks, which are capable of reducing the effect of external stresses on the scion (Higgs and Jones, 1991).

The use of rootstocks is most commonly associated with fruiting plants and trees, and is useful for mass propagating many other types of plants that do not breed true from seed, or are particularly vulnerable to disease when grown on their own roots. Rootstock not only influences the size of the tree but also provides other characteristics such as earliness in production, some attributes of disease resistance and resistance to extreme temperatures. Thus, no matter the species or variety used as rootstock, obtained plant will reach, at the adult phase, an ever smaller size than an equivalent plant if it were obtained by seeds (seedling) i.e., through sexual process.

The role of rootstocks and its use in different fruit crops has significant impact on fruit crop production by influencing canopy architecture, nutritional uptake, flowering, yield and fruit quality (Rom and Carlson, 1987). A certain rootstock can be used for a single species or cultivar since different rootstocks confer different properties, such as vigour, fruit size and precocity while others may be selected by their characteristics such as drought resistance, pests and diseases tolerance.

Another desirable feature in a rootstock is its adaptability to environmental conditions viz., tolerance to wet or dry soils, acidity/alkalinity of the soil or high/low air temperature. Rootstocks can be used as interstocks, a small piece inserted between the rootstock and scion to overcome

incompatibility barriers between stock and scion. These trees are known as “three piece” trees (Nimbola *et al.*, 2016).

Characteristics of Rootstocks

- It should produce strong fibrous root system
- It should have vigorous growth habit, healthy and resistant to pest, diseases and frost
- It should be easily propagated by cuttings
- It should have thick bark to hold the bud
- It should be free from suckers
- It should have uniform growth rate
- It should be for the fruiting growth and fruiting characters
- It should tolerate wide range of biotic and abiotic conditions

Description and characteristics of rootstocks in fruit crops

Sl. No	Fruits	Rootstocks	Characters
1.	Apple	M9 M4,M7,M106,M24 M-111, M- 104 Merton-793 M-27 (M13 × M9)	Dwarfing, Suitable for high density planting Semi-dwarf, Resistance to wooly apple aphid Semi-vigorous, Drought tolerant and wooly aphid Vigorous, Resistant to collar rot, Early fruiting Ultra- dwarf, Suitable for high density planting
2.	Plum	Myrobalan Marianna St. Julien Beach plum Nanking cherry Brompton	Vigorous, resistant to crown rot and drought but susceptible to oak root fungus Vigorous, resistant to nematodes, crown gall and oak root fungus Dwarfing Very dwarfing Very dwarfing Semi vigorous
3.	Peach	Nemaguard Nemared Hansen 536 Cadaman Cornerstone Viking, Atlas Fortuna, Controller 5	Vigorous, resistant to root-knot nematode Resistant to root-knot nematode Extremely vigorous, immune to root-knot nematode, drought tolerant, tolerant to calcareous soil conditions Vigorous, tolerates root asphyxia and iron induced chlorosis, resistant to root- knot nematode Tolerant of high pH soil and is resistant to iron induced chlorosis Vigorous rootstocks Dwarfing rootstocks
4.	Pear	Quince <i>P. pashia</i>	Dwarfing rootstock Vigorous rootstock
5.	Cherry	Mahaleb Mazzard Colt	Vigorous, cold hardy, resists crown gall, bacterial canker and some nematodes Vigorous, resistant to root-knot nematodes and oak-root fungus Semi-vigorous

Sl. No	Fruits	Rootstocks	Characters
		Gisela 5 Krymsk 6 NEWROOT-1	Semi-dwarf Semi-dwarf, tolerant to hot climates and also very cold hardy Dwarfing, promotes early bearing
6.	Walnut	<i>J. hindsii</i> <i>J. nigra</i> <i>J. microcarpa</i> <i>J. sieboldiana</i>	Resistant to oak root fungus and root-knot nematode Tolerant to crown gall, phytophthora and oak root fungus Suitable for high boron, chloride and soil pH conditions Resistant to phytophthora and cold hardy
7.	Grape	Riparia Clorie <i>V. rupestris</i> St. George Ramsey 110 Ritcher Dogridge Salt Creek Freedom	Resistant to phylloxera Resistant to black rot, downy mildew and PM Tolerant to drought Tolerant to salinity Tolerant to drought Tolerant to salinity and drought. It can be used in all conditions Resistant to phylloxera, tolerant to salinity Resistant to nematode
8.	Citrus	Flying dragon <i>Poncirus trifoliata</i> <i>Citrus jambhiri</i> <i>Citrus reshni</i> <i>Citrus limonia</i> <i>Citrus karna</i> <i>Citrus limettoides</i> <i>C. pennivesiculata</i>	Ultra- dwarfing rootstock, resistance to phytophthora root rot, nematode but highly susceptible to iron chlorosis Dwarfing, resistant to phytophthora and nematodes, susceptible to tristeza virus High yield, vigour, suitable for deep soils, highly susceptible to nematode and phytophthora Salinity tolerant High yield and vigour, suitable for deep soils High vigour and yield High vigour and yield for sweet orange and lime High vigour and yield for sweet orange and lime
9.	Mango	Kurukkan Moovandan Nekkare Olour Vellaicolumban Gomera 1	Salt resistant and polyembryonic Salt resistant Salt resistant Dwarfing rootstock, salt tolerant Dwarfing rootstock Salt tolerant
10.	Guava	<i>P. friedrichstalianum</i> <i>P. pumilum</i> <i>P. cattleianum</i> var. <i>Lucidum</i>	Dwarfing, resistant to wilt Dwarfing Resistant to wilt

Source : Anon, 2020; De and Patel, 2019; Reighard et al., 2014

Conclusion

Rootstocks provide an efficient way of raising uniform trees capable of bearing good quality fruits with high yield even under unfavourable conditions like drought, salinity, heavy metal toxicity, pests

and disease incidence, etc. However, further study regarding the rootstock-scion relationship is necessary to aid in breeding programmes and selection of potential rootstocks in future.

Reference

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