

Citrus Rootstocks for Western Australia

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Selecting the right rootstock for your orchard is very important. A root system that is compatible with your chosen variety, is healthy, and well suited to its environment is essential if your orchard is to be a success.

There is no such thing as the perfect rootstock. Selection is a matter of determining which stock will perform best in your situation.

Rootstocks should be selected for their:

- ability to perform under your soil and climatic conditions;
- resistance to pests and diseases;
- compatibility with the variety you are planting; and
- positive impact they have on fruit yield and quality

To choose the right rootstock it is essential to have all the relevant information. You need to know about:

Soil:

- type and structure
- depth and drainage
- pH and salt content

Pests and diseases:

- what is there already? Is it replant or virgin soil?
- what is the virus/disease status of your trees?

Climatic conditions:

- extreme summer and winter temperatures (frosts etc)

Irrigation:

- water quality: salt and pH
- type of irrigation system (sprinklers, drippers).

Compatibility with the variety you intend to grow.

In other citrus growing states, there has been a trend towards obtaining comprehensive soil surveys that include a soil profile description of proposed orchard sites prior to planting trees. This is a positive move that should be considered by all growers to help in rootstock selection and overall planning and management of the orchard.

When purchasing trees it is very important to ensure that they are free of major viroids and other diseases. Rootstock seed should come from a reliable source and budwood for propagating should be sourced from Auscitrus to ensure freedom from exocortis viroid (CEV) and other viroids that can affect tree health and vigour. Nurseries should be certified free of major diseases and have a good reputation for consistently producing high quality trees.

Rootstocks commonly available

Troyer and Carrizo Citrange

Hybrids of sweet orange and trifoliolate orange are referred to as citranges.

These two named citranges are visually indistinguishable and are both hybrids of Washington Navel and *P. trifoliata*. Troyer citrange is currently the most widely used rootstock in Western Australia.

Both rootstocks are cold hardy, produce vigorous trees and perform well on most soil types though they will not grow well in calcareous soils or under saline conditions. Trees on these rootstocks can be prone to micronutrient deficiencies, especially on calcareous soils.

They are tolerant of the citrus tristeza virus, citrus nematode (*Tylenchulus semipenetrans*) and phytophthora root rot but susceptible to severe strains of the citrus exocortis viroid. Both of these stocks are responsive to viroid dwarfing and recommended for viroid dwarfing of oranges and are suitable for use in replant sites.

Compatibility

Troyer and Carrizo Citrange are compatible with most common varieties of citrus except 'Eureka' lemon. There is a long-term problem with Imperial mandarins on citrange that may be related to overgrowth at the bud union. Citrange and Satsuma mandarins also have compatibility problems causing shortened tree life. Compatibility with some minor varieties is unknown.

Local experience:

Troyer and Carrizo Citrange are grown under a range of conditions in WA. They are commonly known as 'best bet' rootstocks throughout the state and have performed well on the deep sands at West Gingin and in heavier clay loams at Harvey.

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Trifoliata (*Poncirus trifoliata*)

Poncirus trifoliata or trifoliata orange is a rootstock that has been used worldwide for many years and is commonly used in Western Australia where soil conditions are heavy.

Trees grown on trifoliata produce small to standard size trees depending on soil type. They bear well for their size and fruit quality is good. Trifoliata performs best on heavier clay loams to loamy soils and is not well suited to sandy soils where growth is slow and yields less than for most other stocks. Trifoliata is cold hardy but has poor drought tolerance and is poorly suited to saline and highly alkaline or acidic soil conditions.

This rootstock is resistant to citrus nematode, tristeza virus and some species of *Phytophthora*. However, it is very susceptible to the exocortis viroid. It is responsive to viroid dwarfing and recommended for viroid dwarfing of oranges and is suitable for replant sites.

Compatibility

Trifoliata is incompatible with 'Eureka' lemon and because there have been reports of incompatibility with some minor varieties it should be used cautiously with untested varieties.

Local experience:

Trifoliata has become less popular in recent years with West Australian growers as it produces small trees that can take a long time to yield. It is also not as tolerant to saline conditions as some other stocks (an increasing problem in some areas). Trifoliata is known for producing good quality fruit and is better suited to heavy soils, but has performed very poorly in deep sands at West Gingin.

Swingle Citrumelo

Hybrids of grapefruit and trifoliata orange are referred to as citrumelos.

Swingle has been the most widely and thoroughly tested of the many named and unnamed citrumelos throughout the world, although experience in Australia is more limited. It is a hybrid of 'Duncan' grapefruit and trifoliata orange. In Australia, Swingle is attracting attention as an alternative to Troyer and Carrizo as a stock for navel and valencia oranges and grapefruit.

The size of trees produced varies in vigour depending on the variety and soil type. Grapefruit are known to be very productive on Swingle overseas while in Australia navel oranges on swingle have performed well. It is thought to be more salt and drought tolerant than other trifoliata hybrids. Swingle will not perform well on shallow poorly drained sites and highly calcareous soils.

Swingle is tolerant of *Phytophthora* spp., tristeza and the exocortis and xyloporosis viroids. It is also resistant to nematodes and suitable for use in replant situations.

Compatibility

Swingle is incompatible with 'Eureka' lemon and there are reported incompatibility problems with some mid season orange and mandarin cultivars.

Local experience:

Swingle has become popular with many West Australian growers in recent years, particularly in the Bindoon/Chittering area. It appears to be more salt tolerant than

some of the other commonly used stocks and produces reasonably sized manageable trees. Experience suggests the vigour varies depending on soil type and climate. In general it is more vigorous than Trifoliata (especially in the establishment years) and less vigorous than Troyer and Carrizo citrange. In trials at West Gingin it has taken quite a while for trees to reach a productive stage and it is probably not suited to the light sands of this area.

Volkameriana (*Volkamer Lemon*)

This is a relatively new rootstock to Western Australia, which may have potential in lighter sandy soils and as an alternative rootstock for 'Eureka' lemon.

Volkameriana seedlings are fast growing and vigorous and are adaptable to a wide range of soil conditions. Like Rough Lemon, it will grow well in deep sands where some other citrus rootstocks struggle. It is likely that fruit quality will not be as good as that produced on citrange and trifoliata stocks, however, it is reported to be better than that produced by Rough Lemon.

Volkameriana is not susceptible to tristeza virus or exocortis and xyloporosis viroids. It is susceptible to citrus nematodes. Volkameriana is also susceptible to phytophthora root rot but less so than Rough Lemon. It is not recommended for replant situations.

Compatibility

Volkameriana is compatible with lemons, and most orange and mandarin varieties. Mandarin varieties that are susceptible to internal granulation (drying) such as Imperial should not be planted on Volkameriana as this stock has been shown to enhance this problem.

Local experience:

This rootstock has not been widely trialed in Western Australia. It has performed quite well in a Newhall navel rootstock demonstration block planted at West Gingin in 1995. In the sandy soils at this location it has out yielded other stocks including Troyer, Trifoliata and Swingle in the early production years.

Rough Lemon (*Citronelle*)

During the establishment of the citrus industry in Western Australia Rough Lemon was the most widely used rootstock. It is still widely used for lemons and for backyard plantings of oranges and mandarins.

It produces large vigorous, highly productive trees that are drought tolerant. It grows well on a wide range of soils but is particularly well adapted to deep sandy soils. It does not perform well on poorly drained soils and is also sensitive to saline conditions. Fruit quality can be poor. Poor skin colour and thick skins are a potential problem. Good water and nutrient management is important to get the best out of this stock.

Rough Lemon is susceptible to citrus nematodes and phytophthora root rot and is not recommended in replant situations. It is tolerant of tristeza virus and exocortis and xyloporosis viroids.

Compatibility

Rough Lemon is unsuitable for some mandarin varieties such as Ellendale and Satsuma types. As with Volkameriana it should not be used with mandarin varieties like Imperial that are susceptible to internal granulation (drying), especially in areas where this is a problem.

Local experience:

This stock is no longer extensively used by local industry because of its susceptibility to phytophthora. Its main use now is as a stock for Eureka Lemon.

Cleopatra Mandarin

Cleopatra mandarin is a small-fruited mandarin, which has been used as a rootstock in other parts of the world for many years. It has not been used extensively in Western Australia.

It is the most salt and lime tolerant of the commercially available stocks. Trees are slow growing in the nursery. Early production tends to be poor with trees taking a long time to reach maturity. Trees reach a large size at maturity. Fruit quality is good but small fruit size may be an issue with some varieties. Trees perform well on both heavy and light soils with best results on loam.

Cleopatra is tristeza and exocortis tolerant and moderately susceptible to phytophthora root and collar rots. It is susceptible to citrus nematodes and not generally recommended for replant sites.

Compatibility

No reported compatibility problems and is considered a good stock for most mandarin varieties.

Local experience:

This stock has rarely been used in Western Australia and very little local information is available.

Sweet Orange

Seedlings of Sweet Orange have been used as rootstocks in many places around the world for many years. Although widely used in the Sunraysia and Riverland areas of Australia in early plantings, this stock has not been widely used in Western Australia because of its susceptibility to phytophthora root and collar rot.

Sweet Orange does best on well-drained deep sandy soils and can tolerate calcareous soils. It is sensitive to dry conditions and will not tolerate water logging. Fruit quality is generally good.

It is very susceptible to phytophthora root and collar rots as well as to citrus nematode. It is tristeza and exocortis tolerant. Sweet Orange is not suitable for replant sites.

Compatibility

There are no reported incompatibilities with this stock.

Local experience:

This stock has rarely been used in Western Australia and very little local information is available.

Benton Citrange

This citrange was developed by the NSW Agriculture rootstock-breeding program and selected for its tolerance to footrot (*Phytophthora* spp.) and compatibility with 'Eureka' lemon. It is a hybrid of Ruby Blood sweet orange and trifoliolate orange (*P. trifoliata*). This stock has not been evaluated under West Australian conditions.

Benton produces trees with similar vigour to Troyer and Carrizo, however, there have been mixed results from trial planting's within Australia. In some trials with 'Eureka' lemon it has performed well while other trials with oranges have been less encouraging.

It is *Phytophthora* spp. and Tristeza tolerant.

Compatibility

No incompatibility with 'Eureka' lemon reported. It is also compatible with most other orange and mandarin varieties.

Local experience:

This stock has rarely been used in Western Australia and very little local information is available. Local nurserymen have described it as being difficult to propagate.

C-35 Citrange

Developed in California this citrange is a hybrid of trifoliolate orange (*P. trifoliata*) and Ruby Blood sweet orange. It has not been trialed under West Australian conditions. There is some interest in it as an alternative rootstock for navel oranges.

C-35 citrange reputedly produces medium sized trees, which are around 25% smaller than trees produced by Troyer and Carrizo. Yield and other characteristics are similar to other citranges.

It is tolerant of *Phytophthora* spp., citrus nematode and tristeza.

Compatibility

Very limited compatibility and performance data is available at this time, however the rootstock is planted in a number of comparative trials around Australia and further information will become available soon.

Local experience:

This stock has rarely been used in Western Australia and very little local information is available. Established orchards on C-35 in Harvey are being monitored.

Cox mandarin hybrid

This is a hybrid of Scarlet mandarin and trifoliolate orange (*P. trifoliata*) bred by NSW Agriculture. It was released in 1995 and is compatible with 'Eureka' lemon. It has not been trialed under West Australian conditions.

Cox is resistant to phytophthora root and collar rot. Seedlings of Cox are moderately vigorous and easier to grow than Benton Citrange making it more nursery friendly.

Compatibility

Information on performance and compatibility (other than with 'Eureka' lemon) is very limited.

Local experience:

This stock is currently only present in a limited number of trial sites in Western Australia. No performance information is available in WA at this time.



Selecting the right rootstock for your conditions is vital. The difference between right and wrong may cost you many dollars.

References and further reading

Related Farmnotes:

- Note: 157 'Mandarins, tangors and tangelos for Western Australia'
- Note: 156 'Orange varieties for Western Australia'

References

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- Gallasch, P.T. and Staniford M "HRDC The final report of project CT 98033 – New Valencia clones and rootstocks for improved fresh juice production."
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Web sites

- The Australian Citrus Growers Inc. web site at www.australiancitrusgrowers.com has factsheets available on many different varieties of *mandarins, oranges, grapefruit and lemons*.

Other citrus links of interest include:

Florida USA citrus site – www.ultimatecitrus.com

Florida Department of Citrus – www.fred.ifas.ufl.edu/citrus/

NSW Agriculture site – www.agric.nsw.gov.au/reader/4631

Queensland Department of Primary Industries and Fisheries – www.dpi.qld.gov.au

South Australian Research and Development Institute SARDI – www.sardi.sa.gov.au

University of California, Riverside Citrus Variety Collection www.citrusvariety.ucr.edu/



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