# Stone Fruit Rootstocks Revisited

## We bring you an update on our rootstock series from the December issue — now including salinity tolerance and drought sensitivity.

Information provided by Dr Piet Stassen with input from Petru du Plessis.

The success of any rootstock is built upon healthy trees with an extensive network of efficient feeder roots. When nursery trees lack feeder roots, have inadequate reserves or are not properly hardened off, they may struggle to establish in the orchard. This is especially true of clonal rootstocks.

Tree production is a slow process — trees must be ordered two years in advance to ensure availability of the preferred rootstock. Failure to plan ahead could mean settling for an inferior second choice.

Flordaguard is an excellent rootstock for early cultivars grown on deep, well-drained soils in areas with low chill, but it is not always well hardened off.

SAPO 778 is not suitable for low-chill regions or early cultivars. Maridon does poorly in the Little Karoo but is outstanding in the Simondium region where bacterial canker may occur.

Rootstock choice impacts the entire lifetime performance of an orchard. Growers would do well to consult a specialist technical adviser when making their selection.



**Table 1** contains information on plant attributes. The parentage of a rootstock will determine characteristics such as tolerance to calcareous soils and salinity, and susceptibility to fungal infections and nematodes.

The difference between early and late ripening was four to eight days. Rootstocks had little impact on the sugar content of fruit. Only SAPO 778 produced significantly lower sugars than other rootstocks when grown in sandy soils.

**Table 1: Parentage and plant attributes**

| ROOTSTOCK | PARENTAGE[1] | GROWTH VIGOUR | RIPENING | FRUIT SIZE | CHILLING REQUIREMENT |
|---|---|---|---|---|---|
| **Atlas** | *P. persica* x *P. davidiana* x *P. dulcis* x *Prunus* x *blireiana* | Moderately strong | Late | Very good | 250 – 550+ PCU[2] |
| **Cadaman** | *P. persica* x *P. davidiana* | Very strong | Middle | Good | 250 – 550+ PCU[2] |
| **Flordaguard** | *P. persica* x *P. davidiana* | Very strong | Early | Good but small if high numbers of ring nematodes occur | 100 – 550 PCU[2] Frost sensitive |
| **Garnem** | *P. persica* x *P. dulcis* | Very strong | Middle | Very good | 350 - 550+ PCU[2] Lower limit unknown |
| **GF 677** | *P. persica* x *P. amygdalus* | Moderately strong | Middle | Good but small with nectarines | 250 – 550+ PCU[2] |
| **Guardian** | *P. persica* | Moderately strong | Middle | Small like Kakamas seedling but better total yield | 250 – 550+ PCU[2] |
| **Kakamas seedling** | *P. persica* | Semi-dwarfing | Early | Small if under stress especially on sandy soils | 200 – 550+ PCU[2] |
| **Marianna** | *P. cerasifera* x *P. munsoniana* | Moderately strong | Middle | Good but small if high numbers of ring nematodes occur | 350 – 550+ PCU[2] |
| **Maridon** | Tetraploid of Marianna | Semi-dwarfing | Middle | Good but small if high numbers of ring nematodes occur | 350 – 550+ PCU[2] |
| **Royal seedling** | *P. armeniaca* cv. Blenheim Royal | Moderately strong | Middle | Good | 350 – 550+ PCU[2] |
| **SAPO 778** | *P. persica* x *P. amygdalus* | Moderately strong | Middle | Very good | 350 - 550+ PCU[2] |
| **Viking** | *P. persica* x *P. davidiana* x *P. dulcis* x *Prunus* x *blireiana* | Moderately strong | Late | Good but small if high numbers of ring nematodes occur | 250 – 550+ PCU[2] |

[1] *Prunus persica* = peach
*P. amygdalus* = *P. dulcis* = almond
*P. armeniaca* = apricot
*Prunus* x *blireiana* = *P. mume* x *P. cerasifera*
*P. cerasifera* = purple-leafed plum
*P. davidiana* = Chinese wild peach
*P. munsoniana* = Munson plum
*P. mume* = Japanese apricot

[2] PCU = Positive Chill Units

Soil texture plays an important role in the performance of rootstocks. **Table 2** shows the soil texture preferences of stone fruit rootstocks.

**Table 3** provides soil and climatic preferences. Most stone fruits are sensitive to salinity. Electrical conductivity of more than 300 mS/m and sodium levels of more than 9 mg/l in irrigation water constitute very high salinity for stone fruit.

Rootstocks with plum parentage can tolerate higher salinity than those with peach parentage. Peach-almond hybrids have intermediate tolerance.

Table 2: Soil texture preferences

| ROOTSTOCK | 90 – 95% SAND | 80 – 90% SAND | 20 – 35% SILT + CLAY. CLAY LESS THAN 20% | 20 – 30% CLAY | COMMENTS |
|---|---|---|---|---|---|
| **Atlas** | Yes | Yes | Yes | Moderately tolerant | A good overall rootstock for a wide range of soils |
| **Cadaman** | Yes | Yes | Yes | No. | Good for sandy soils |
| **Flordaguard** | Yes | Yes | No | No | Excellent for deep, well-drained, sandy soils. Not for wet or calcareous or alkaline soils. |
| **Garnem** | Not known. | Yes | Yes | No | Vigorous especially in less than 80% sand |
| **GF 677** | No | No | Yes | No | Very sensitive to over-irrigation and poor drainage |
| **Guardian** | Not known. | Yes | Yes | Moderately tolerant | Not for calcareous soils |
| **Kakamas seedling** | No | No | Yes | No | Easily stressed in sandy and stony soils |
| **Marianna** | No | Yes | Yes | Moderately tolerant | Shallow horizontal root system that can grow in soil depth of 450 mm if well-managed |
| **Maridon** | No | Yes | Yes | Moderately tolerant | Shallow horizontal root system that can grow in soil depth of 450 mm if well-managed |
| **Royal seedling** | No | Yes | Yes | No | Excellent for well-drained shales |
| **SAPO 778** | No | Yes | Yes | Moderately tolerant | Can have synchronisation problems with early cultivars. Very sensitive in sandy soils with fluctuating water tables. |
| **Viking** | No | Yes | Yes | Yes | Not recommended for sandy or stony soils |



All available stone fruit rootstocks are sensitive to wet conditions.

Even short-term waterlogging will cause dieback in Flordaguard, Garnem and GF 677 from infections and root rots. Kakamas seedling will also be affected but is less prone to dieback. Marianna and Maridon are more tolerant during winter but sensitive in the initial growing period.

Table 3: Soil and climatic preferences

| ROOTSTOCK | SALINITY[1] | WET SOILS | DROUGHT SENSITIVITY | CALCAREOUS SOILS | CHLOROSIS |
|---|---|---|---|---|---|
| **Atlas** | Sensitive | Sensitive | Moderately tolerant | Tolerant | Shows lime-induced iron chlorosis under free lime conditions but influence on performance not detected |
| **Cadaman** | Sensitive | Sensitive | Moderately tolerant | Tolerant | Only minor yellowing symptoms |
| **Flordaguard** | Very sensitive | Very sensitive | Moderately tolerant | Very sensitive | 100% leaf chlorosis |
| **Garnem** | Sensitive | Very sensitive | Moderately tolerant | Tolerant | Only minor yellowing symptoms |
| **GF 677** | Moderately sensitive | Very sensitive | Moderately tolerant | Tolerant | Only minor yellowing symptoms |
| **Guardian** | Sensitive | Sensitive | Moderately tolerant | Sensitive | Shows yellowing symptoms |
| **Kakamas seedling** | Very sensitive | Very sensitive | Sensitive in sandy soils | Very sensitive | 100% leaf chlorosis |
| **Marianna** | Moderately tolerant | Moderately tolerant | Sensitive in sandy soils | Moderately sensitive | Shows yellowing symptoms |
| **Maridon** | Moderately tolerant | Moderately tolerant | Sensitive in sandy soils | Moderately sensitive | Shows yellowing symptoms |
| **Royal seedling** | Sensitive | Very sensitive | Moderately tolerant | Very sensitive | 100% leaf chlorosis |
| **SAPO 778** | Very sensitive | Sensitive | Not for sandy soils and early cultivars | Very sensitive | 100% leaf chlorosis |
| **Viking** | Moderately sensitive | Sensitive – tolerant | Sensitive | Tolerant | Show lime-induced iron chlorosis under free lime conditions but influence on performance not detected |

[1]Maximum electrical conductivity that will not reduce yield:
a) in soil = 110 mS/m for peaches and 100 mS/m for plums
b) irrigation water = 170 mS/m for peaches and 150 mS/m for plums.
Maximum chloride concentration:
a) in soil = 886 mg/l for Marianna and 355 mg/l for Kakamas seedling
b) irrigation water = 603 mg/l for Marianna and 238 mg/l for Kakamas seedling

Table 4 summarises the resistance of the different rootstocks to nematodes and diseases. Bacterial and fungal infections are more common in wet conditions.
Nematode damage is often underestimated because the culprits are in the soil and above-ground symptoms are non-specific. Young root systems are more sensitive to high nematode numbers than established root systems **FQ**

Table 4: Resistance to nematodes and diseases

| ROOTSTOCK | INFECTIONS BY FUNGI AND BACTERIA | ROOT-KNOT NEMATODE[1] | RING NEMATODE[1] | ROOT-LESION NEMATODE[1] | NEMATODE COMMENTS |
|---|---|---|---|---|---|
| **Atlas** | Tolerant | Resistant | Moderately tolerant | Moderately tolerant | High ring nematode numbers do not affect yield and fruit weight |
| **Cadaman** | Sensitive | Resistant | Moderately tolerant | Sensitive | High ring nematode numbers do not affect yield and fruit weight |
| **Flordaguard** | Sensitive | Immune | Sensitive – tolerant | Sensitive | Sensitive to high numbers of ring nematodes. Reduce fruit weight. |
| **Garnem** | Very sensitive | Resistant | Moderately tolerant | Tolerant | Good host but still performs well when ring nematodes occur |
| **GF 677** | Very sensitive | Very sensitive | Sensitive | Very sensitive | High ring nematode numbers reduce fruit weight. More sensitive in sandy soils. |
| **Guardian** | Tolerant | Resistant | Tolerant | Moderately tolerant | Need more information on sandy soils |
| **Kakamas seedling** | Tolerant | Very sensitive | Sensitive | Sensitive | Very sensitive to high numbers of ring nematodes. Reduce fruit weight. |
| **Marianna** | Very sensitive | Immune | Very sensitive | Sensitive | Very sensitive to high numbers of ring nematodes. Reduce fruit weight. |
| **Maridon** | Very sensitive | Immune | Very sensitive | Sensitive | Very sensitive to high numbers of ring nematodes. Reduce fruit weight. |
| **Royal seedling** | Very sensitive | Tolerant | Very sensitive | Sensitive | Very sensitive to high numbers of ring nematodes. Reduce fruit weight. |
| **SAPO 778** | Sensitive | Tolerant | Resistant – tolerant | Sensitive | More sensitive in sandy soil and when scion and rootstock not synchronised |
| **Viking** | Tolerant | Resistant | Tolerant – Sensitive | Sensitive | Sensitive to ring nematodes in stony and sandy soils during summer months |

[1]Immune = rootstock is not a host
Resistant = rootstock is a poor host
Tolerant = rootstock is a host but nematodes do not impact its performance
Moderately tolerant = rootstock is a good host but nematodes do not impact its performance
Sensitive= nematodes impact rootstock negatively
Very sensitive = nematodes have severe negative impact on rootstock



# Getting More Out Of Monitoring

## Is there a missed opportunity?

Hugh Campbell, general manager of Hortgro Science, asks whether monitoring represents missed opportunities. In an interview with Fresh Quarterly, he shared his thoughts on the potential of a standardised monitoring system where data is captured electronically. An inclusive database could be used to manage pests and improve market access at a regional and national level. It would also allow the industry to take advantage of new technologies such as machine learning.

The basis of a monitoring system is to give you information on which to make orchard-based decisions so as to manage your pests and diseases. Any system that you design has to have functionality at that level.

The ideal would be a standardised monitoring system where everyone uses the same protocol. This would allow you to capture the information at orchard level for growers to make orchard-based decisions, as well as to pick up regional trends. For example you could see the early onset of bollworm in a certain area — because you have your early indicator areas just as you have hotspots on a farm. You could see that there's a problem developing. Matthew Addison, Hortgro's crop protection programme manager, has been advocating this approach for many years.

Monitoring gives you the tools to manage pests at low populations and to pick up shifts in pest status early. Take for instance codling moth — by the time you see the damage in the bin, it's too late.

One of the biggest advantages of a digital system is the opportunity to transform monitoring data into maps and overlays so that you can look at trends. In a question of three minutes you can pick up trends within an orchard, across orchards, within an orchard over the last ten years — you can take something like codling-moth trapping data and see where your hot spots are. Digital systems can transform complicated data into easily-understood visual data — it can give the grower the aha! moment at the press of a button.

### MOVING BEYOND ORCHARD MANAGEMENT

I see a window of opportunity to standardise monitoring information relating to phytosanitary requirements. For example fruit fly — we're in the process of finalising the European Union protocol for the systems approach. The systems approach is a management tool that is allowed according to International Plant Protection Convention rules whereby you need to implement two or more independent measures to meet the phytosanitary requirements of the importing country.

One of the foundations of the systems approach is monitoring. So now something that was done from an orchard management point of view is being translated into a regulatory process.

The bigger picture is that you can demonstrate different levels of risk for regions. If a region is an area of no or low pest prevalence, you can claim that status, and it allows you — in a systems approach — to have different levels of intervention. You can even take it down to a place of production. For example if you had everything under nets and you can provide data to substantiate that there are no signs of the relevant organism and it has been inspected by an official for a specified period — that would free you up from implementing any further control measures as the unit would be officially recognised as being pest-free for that organism.

There is great value in having a standard protocol for monitoring and data-capture so that everything can be pooled into a database for further analysis. If we can start by creating that platform for phytosanitary pests, we can build on it.

The potential is greatest for pests that need to be managed on an areawide basis. If you look at global trends, that's becoming the basis of effective management — particularly with fewer and fewer tools for managing pests. Our focus needs to be on the strategic pests where you have to think bigger than just your own orchard. **FQ**