This is the first in an eight part series of articles on the history of rootstocks in the South African wine, table and raisin grape industries since the discovery of phylloxera. This article focuses on the discovery of phylloxera in the late 19th century, the efforts of the Cape government to limit the effects and spread of the pest, the first experiences with rootstocks in the Cape and the domination of Jacquez rootstock until the early 1960s. It also gives a summary of the role of nurserymen in the use of rootstocks in the industry and the process of plant improvement that followed.

The series will continue with the origin, natural habitat, distribution and characteristics of the native American Vitis species used by European breeders to develop the commercial rootstocks in use today, not only in South Africa but world-wide. Furthermore the criteria for deciding on the most suitable rootstock for a specific site will be discussed in detail. A large section will focus on the use of our commercial rootstocks Richter 99, Richter 110, 101-14, Ramsey, Paulsen 1103, Ruggeri 140, US 8-7, SO 4 and 143 B throughout the industry, focusing on the history of each, the soil adaptability, characteristics and regions where each have found application. Some comments are also made on the future use of these commercial rootstocks. The changes in the rootstock spectrum over the past 40 years, as well as the reasons therefore are then discussed. The series concludes with some interesting new rootstocks that have been imported recently and their possible potential for use in South Africa.

Please note that the common names will be used for rootstocks to avoid confusion, for example 101-14 Mgt will be referred to as 101-14 only, and 143 B Mgt as 143 B.

**Phylloxera arrives in the Cape Colony**

The most important reason for the use of rootstocks in the grape industry is the occurrence of the root louse phylloxera. Phylloxera attacks the roots of *Vitis vinifera* vines with the resultant decrease in vine performance and in some cases the eventual death of the vine. Professor J.E. Planchon was the first to identify phylloxera on the roots of *Vitis vinifera* vines in France in 1868. The insect decimated European vineyards during the second half of the 19th century since all *Vitis vinifera* vines were established on their own roots. Importation of non-*Vitis* “self-bearing or self-producer” species from the United States of America, especially those that were native to the Mississippi Valley where phylloxera was present (all native species present here resist phylloxera to some degree), resulted in the introduction of the insect to Europe. It spread across European grape growing regions and eventually to South Africa through imported plant material.

The following extract from the *Bulletin of Miscellaneous Information* published by the Royal Botanic Gardens at Kew in England in 1889 concerning the existence of phylloxera in South Africa, makes interesting reading. It gives detailed insight to the seriousness of the

![Typical symptoms of phylloxera on a vine root hair showing the characteristic hook-shape of the galls.](source: Phylloxera and Grape Industry Board of South Australia)
situation at the time and the importance the Cape government placed on the issue.

"At the time of the International Phylloxera Congress at Bordeaux in October 1881 there was no evidence to prove that the Phylloxera had invaded South Africa. Mr Roland Trimen, F.R.S., F.Z.S., Director of the South African Museum, was, however, delegated as representative of the government of the Cape Colony, and he reported on its proceedings on December 29, 1881. In the 25th paragraph of his report, after having fully discussed the matter with the late Professor Planchon, the most eminent authority on the subject at the time, he stated: 'I am entirely in favour of reasonable precautionary measures, and I think that those which Professor Planchon recommends are fully sufficient. The total exclusion of all vines should be maintained; the admission of all other plants from countries where Phylloxera in the vine does not exist should be allowed; and the admission of plants other than vines from phylloxerized regions should be conditional as satisfactory certification that they have not been grown in the immediate vicinity of vines.' " This was the first attempt at regulating the spread of the pest through a quarantine system.

"It can hardly be doubted that had it been possible from the first to enforce such regulations efficiently, South Africa would have remained free from the ravages of the Phylloxera. Nevertheless, it appears from the evidence of Mr Louis Peringuey before the Select Committee of the Cape House of Assembly on the Vineyard Diseases Act (presented with their report, July 29 of the present year) that the insect was first identified by him in South Africa on January 1, 1886. 'It came from Kotze's at Mowbray. 'This is in the neighbourhood of Cape Town. The infection of the Cape vineyards is now unhappily thoroughly established."

The Cape government, after receiving the report, sought the assistance of the French government, who assigned M.P. Mouillifert, professor of Viticulture of the French National School of Agriculture, Grignon, to visit South Africa. In his report, after visiting the principal wine-farming regions, he stated: "Although the existence of the phylloxera in the vineyards of the colony was not verified officially before the year 1886, the disease is, in my opinion, of much earlier date, and in accordance with Monsieur Peringuey, who has made a special study of the question, I consider that the invasion of this destructive insect should be approximately fixed at about the year 1880."

He further offered speculation that the insect’s spread will be much quicker in South Africa than in Europe due to the mild climate of the Cape, especially winter, that allows the reproduction of the insect for more than four months, while in Europe it is not more than 8 - 10 weeks. The warm summer season also favours the reproduction. From the above it seems that South Africa’s fate was sealed, irrespective of the Cape government’s attempts to remedy the problem. Phylloxera was found in Groot Drakenstein in 1889, in Malmesbury, Tulbagh and Worcester in 1900, the lower Orange River in 1951 and in the Olifants River Valley by 1964.

The first rootstocks

The Cape government desperately tried to obtain rootstock cuttings from Europe where grafting trials were already in progress since the late 1870s (the first consignment of American Vitis species for use in grafting trials with Vitis vinifera arrived in France in 1878). None was however forthcoming and as a result large quantities of seeds of American Vitis species were imported to the Cape from France. Reproduction and multiplication of these seeds gave rise to rootstocks that were specific to South Africa, the most important being Constantia Metallica, Donkie-Rupestris, Mooikelder and Schabort 1 and 2 (all Vitis rupestris seedlings) to name a few. De Waal Bostock was a cross between Vitis vinifera and Vitis labrusca.

Initially Constantia Metallica (a supposedly Vitis rupestris seedling selected by J.P. de Waal at Groot Constantia in 1880) was used on a large scale due to the ease of propagation with the most common cultivar grown at the Cape at the time, Sémillon, as well as the strong vigour it induced. In later years it became evident that its good compatibility with Vitis vinifera types was not universal. It was completely incompatible with Muscat d’Alexandrie and showed poor affinity with Colombar, Ugni blanc, Shiraz, Souzao and Tinta Barocca. It was the most used rootstock between 1900 and 1912. Its popularity did not last however, as the vines grafted to Constantia Metallica showed signs of decline within 8 - 10 years on heavy clay soils, while nematodes destroyed the roots in sandy soils even faster. It performed well in deep, well-drained, loose soils that did not become too dry in summer or too wet in winter. There are differences of opinion about the true qualities of Constantia Metallica, since some vines performed quite well for an extended period. The reason for this phenomenon is probably due to the many different Vitis rupestris species that occur when propagating through seeds, all of them having different rootstocks."
which have different characteristics. At the time the technical knowledge did not exist to differentiate the good from the bad.

Other European bred rootstocks were imported and evaluated at the Cape. Some were planted on a large scale even without proper evaluation. This fact supports the “desperation” of the Cape farmers to find a long term solution to the effects of phylloxera. These rootstocks included:

• 1202 Couderc (Vitis vinifera cv. Mourgèdre x Vitis rupestris made by George Couderc in France in 1883). It was known as 1202 in South Africa.

• Riparia Gloire de Montpellier (Vitis riparia selection by Pierre Viala in France around 1860).

• Rupestris du Lot (Vitis rupestris seedling selected by Robert Sijas in France around 1860).

• Ganzin nr. 1 and 2 (Vitis vinifera cv. Aramon x Vitis rupestris made by Victor Ganzin in 1879 in France). Ganzin nr. 1 is also known as AXR#1 in California.

• 333 Ecole de Montpellier (Vitis Berlandieri x Vitis vinifera cv. Cabernet Sauvignon made by Gustave Foex in France in 1883).

• 420 A (Vitis Berlandieri x Vitis riparia made by Alexis Millardet in France in 1887).

• 1613 Couderc (Vitis labrusca x Vitis riparia x Vitis vinifera made by George Couderc in 1881 in France).

420 A was planted on a large scale before the 1930s. It is a low vigour rootstock and grafted vines took some time to develop. It performed quite well because it showed good drought tolerance and good compatibility with most Vitis vinifera types, including Muscat d’Alexandrie (field grafting). It performed very well in heavy loam and clay soils, but was sensitive to subsoil wetness. The reason for its disappearance is probably due to Jacquez’s better performance on similar soil types, but also because bench grafting results were poor and therefore nurserymen were disinclined to propagate it.

333 EM was planted in the 1920s as it was easy to propagate and gave good yields with high sugar content, but due to poor phylloxera and nematode resistance, disappeared from the rootstock spectrum. 1613 Couderc (also known as Fairy) was imported to South Africa in 1939 but never gained importance due to its poor phylloxera and nematode resistance.

Various rootstock surveys were conducted throughout the industry between 1912 and 1927, and the feedback provides interesting insight into the performance of some of these rootstocks. The Stellenbosch Wine Institute summarised these in a 1966 report:

• Riparia Gloire de Montpellier: The 1912 survey mentions that the rootstock performs well on deep, fertile alluvial soils, but has poor drought resistance. Jacquez performed better on similar soil types and therefore replaced it.

• Rupestris du Lot: The 1920 and 1925 surveys recommended the use on higher potential “Karoo-type” soils (today this should be similar to Oakleaf soil form, deep and well-drained); it had poor drought tolerance and did not resist subsoil wetness. It required deep, loose soils where its roots could penetrate easily. According to Professor Abraham Perold it was “worthless” on shallow soils.

• 1202 Couderc: It was widely planted in the 1920s and 1930s. It showed high vigour but did not induce high cropping levels due to poor fruit set. The commission did not recommend the use of this rootstock due to inefficient phylloxera, drought and nematode resistance.

• Ganzin no. 1 and 2: In South Africa it was known as the Aramons. After a promising start both failed due to inefficient phylloxera and nematode resistance.

The Aramons were favoured after Constantia Metallica started to decline around 1912. They however did not last long and by the early 1920s it was 1202 that was favoured. It was assumed that 1202’s very high vigour would be able to resist a phylloxera attack, thus resulting in thousands of hectares being established with 1202 during the 1920s and 1930s. However, its roots succumbed even faster to phylloxera than the Aramons and its popularity took a huge blow during the dry summer of 1944/45, when phylloxera caused extensive damage.

Although Jacquez would become the rootstock of choice for the following decades, one should not neglect mentioning the importance of 101-14 and 143 B in the pre-1960s period. Jacquez was not universally adaptable to all soil types. The 1966 rootstock survey report of the Stellenbosch Wine Institute rated these two rootstocks where Jacquez faltered.

101-14 did well on shallow sandy loam to clay loam soils with compact clay between 40 and 70 cm depth. It tolerated the subsoil wetness associated with these soils, and if salinity was present, much better than Jacquez. 101-14 outperformed Jacquez on these soil types in Stellenbosch, Wellington, Robertson and Bonnievale. And post 1960, 101-14 would become one of the main rootstocks to replace Jacquez.

Although 143 B was a “latecomer” (it was only imported in 1930), it soon became popular. It showed better performance than 101-14 and Jacquez where the soils were more compact and dry. 143 B’s strongest attributes were its strong vigour and good tolerance to salinity, subsoil wetness and drought. It outclassed both Jacquez and 101-14, finding application in Paarl, Wellington and especially Ladi-smith. Vines grafted to 143 B did however not age well under these conditions because of its susceptibility to phylloxera and nematodes. It also showed decline within 10 - 12 years and therefore would not become an important rootstock. Only later, when the lower Orange River area started using rootstocks for raisin grapes (during the mid to late 1980s) on deep heavy alluvial soils, did 143 B find a place as rootstock of choice. Here the risks of nematodes and phylloxera are less.

The Jacquez era

Jacquez is a natural crossing of Vitis aestivalis x Vitis cinerea x Vitis vinifera and was imported to South Africa in 1891. It was initially used on the island of Madeira and from there spread to France and the USA where it was used as a self-producer (bearing variety) known as Black Spanish, not as rootstock. A certain J.F. Marais suggested in 1893 that South African farmers should use Jacquez as rootstock. The fact that it outperformed and outlasted all the other rootstocks in use at the time (Schabort 1 and 2, Constantia Metallica, Rupestris du Lot, Riparia Gloire de Montpellier, the Aramons, 333 EM, 420 A and 1202), confirmed its success as the most important rootstock for South Africa for the next 60 years.

Jacquez showed ease of propagation and excellent compatibility with all commercial cultivars. It induced good vigour, supported high yields and matured its fruit well. It performed very well on deep, fertile alluvial soils that were well-drained with a good supply of moisture. It had, however, poor tolerance to salinity, drought and nematodes, but showed excellent resistance to Phytophthora cinna-momi, but moderately low tolerance to subsoil wetness. Rootstock surveys done in 1912 and 1927 both confirmed that Jacquez should not be used on shallow, heavy and compacted soils that become dry in summer. Deep, soft and cool soils that never become dry suited Jacquez.

By 1960 Jacquez constituted more than 90% of the vineyards in South Africa. Its popularity, however, declined rapidly during the 1960s and by 1970 it constituted only 36% of overall plantings. It all but disappeared from the rootstock spectrum by the early 1990s,
mostly due to poor phylloxera and nematode resistance (it, however, still constituted 44% of total plantings in Worcester in 1990 – a region where Jacquez was highly successful). With ever increasing plantings being made on sites with more marginal soils, Jacquez quickly lost ground. Replanting of a new vineyard grafted to Jacquez was also impossible if the previous rootstock was Jacquez, because the young vines could not overcome the already high counts of phylloxera and/or nematodes in the soil. Fortunately other rootstocks were available to replace it. Jacquez did not find any application as commercial rootstock outside of South Africa.

Renowned viticulturists warned against the use of Jacquez as rootstock. In 1902, French breeder, Ravaz, stated: “It is only in the cool, deep, fertile sandy soils where Jacquez, if established ungrafted as a direct producer, resists the phylloxera. Everywhere else it has disappeared.” Professor Abraham Perold in 1926 warned against the use of Jacquez on soils that become too dry, and on very heavy loams and clay soils. Desiderius Pongrácz, author of the internationally acclaimed publication Rootstocks for Grape-vines, is extremely critical of the use of Jacquez. He even went as far as stating that Jacquez should never have been used as rootstock in a phylloxera infested country like South Africa (he had similar comments to the Californians about their use of Ganzin nr. 1, also known as ARX#1, for such a long time).

One cannot ignore the fact that Jacquez, even with its *Vitis vinifera* parentage, outlasted the Aramons by 60 years and 1202 by 40 years, thus making a valuable contribution to the South African wine industry in a period where other rootstock options were limited or not available. It can be argued that Jacquez should have been replaced earlier by other phylloxera resistant rootstocks like Richter 99 and Richter 110, but such changes would have been very difficult given the success of Jacquez for so many decades.

The following table lists the percentage distribution of the most important rootstocks grafted by registered nurseries for the 1961/62 and 1964/65 seasons, and the sales figures for the 1979/1980 seasons. Jacquez’s popularity was declining rapidly with 101-14 and Richter 99 that started to gain ground by the mid-1960s. By 1980 these two would constitute 80% of all grafted vine sales.

### Expanding the rootstock spectrum

Slowly but surely other rootstocks were imported from Europe and the USA. These included the commercially well-known Richter 99 and Richter 110 in the late 1920s, Ramsey, Dog Ridge and 143 B in the 1930s and Paulsen 1103, SO 4 and Ruggeri 140 in the 1960s. These and many others were established and evaluated in field trials throughout the industry by the Viticultural and Oenological Research Institute (Nietvoorbij). South African rootstock breeding was initiated under Professor Chris Orffer of the University of Stellenbosch in 1949. Many of his hybrids were included in field trials from 1974 (USVIT crossings of Richter 99 x Jacquez). US 8-7 and US 2-1 showed the most promise.

South Africa has been using rootstocks for more than 120 years. Many years of field trials and commercial use under widely different soil and climatic conditions have provided valuable experience of rootstock suitability for South African conditions. The bulk (91%) of the wine and table grape industries today use only four rootstocks, namely Richter 99, Richter 110, Ramsey and 101-14. Others in commercial use include Paulsen 1103, Ruggeri 140, 143 B, US 8-7 and a very small number of SO 4. It is significant to note that out of all the rootstocks evaluated over the past century the South African industry only uses these nine. The application of the above-mentioned rootstocks in the South African industry will be discussed in following articles.

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<td><strong>Total</strong></td>
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* Included 1202, Riparia Gloire de Montpellier, 333 EM, 420 A, Teleki and Ramsey for 1961/62 and 1964/65 seasons. Included Constanitia Metallica (2.3%), Richter 110 (4.2%) and Ramsey (0.8%) for the 1979/80 seasons.
The role of nurserymen

The role of nurserymen in the historical use of rootstocks should not be underestimated. In the early days there were no official programmes of plant improvement and therefore nurserymen themselves were responsible for sourcing of rootstock and scion cultivars for grafting. Quality standards were completely in the hands of the nurserymen. Rootstock suckers randomly harvested from commercial vineyards were the main source of rootstock cuttings for nurseries (it was also grown on the edges of drainage ditches and boundary fences). Conventional rootstock mother plantations were very uncommon and it was estimated that more than 70% of Jaquez rootstock material was harvested from suckers in commercial vineyards. The rootstock choices available to growers were therefore dependent on the availability of rootstock suckers collected by nurserymen from their own or other vineyards. It was not considered necessary to establish rootstock mother blocks as ample suckers were available. Since Jaquez was by far the dominant rootstock at the time, rootstock suckers collected were mostly of Jaquez origin, and as a consequence most vines supplied to growers were grafted to Jaquez. Nurserymen in different regions did, however, graft their vines to rootstocks that were generally used in the region.

101-14 and to a lesser extent 143 B were the only other rootstocks used in substantial amounts in the pre-1960s era. Rootstocks that gave poor nursery success (like 420 A), or were not readily available, quickly disappeared. Grapevine nurseries were present in almost all grape growing regions, from Malmesbury, Wellington, Stellenbosch, Worcester and Robertson to Montagu. Nurserymen sold their grafted vines at auctions held in the different regions without having any official standards for physical and/or phytosanitary quality, let alone guarantees of true to type.

Plant improvement

The quality of plant material was in a deplorable state by the end of the 1950s. Vineyards contained many vines that performed poorly and mixing of cultivars were common in both scion and rootstock material. Investigation into the mixing of rootstock materials done in 1966 confirmed large scale mixing in rootstock mother blocks. Only half of the Jaquez, 101-14, 143 B and Richter 99 mother blocks were pure. Nurseries were also evaluated and here the situation was even worse. Less than 30% of nurseries investigated were without mixing. No mass or clonal selections of scion or rootstock material were available and no attention was given to the virus/disease status or the viticultural performance (vigour, yield potential and quality) of material.

The Wellington Nursery Association was established in 1963 and did away with the auction system. They endeavoured to provide better quality material to growers, such as selections of scion cultivars and minimum vine quality standards. They called their selections by name of the nurserymen who selected it, for example “Johan Malan Steen”. This selection process was started early in the 1960s. At about the same time the Department of Agriculture initiated the first official attempts at the selection of improved grapevine plant material. The process of selection started with the identification of better performing vines of scion cultivars across the industry and the establishment of these in test plots of KWV in Robertson and Paarl in 1963.

Rootstock selections were made in a similar fashion. 122 selections (clones) were made of seven rootstock cultivars and established on KWV’s La Bonne Vigne farm in Robertson in 1966 (it included Richter 99, Richter 110, 101-14, Ramsey and Jaquez). These selections were indexed for the presence of harmful viruses and evaluated for grafting success, rooting ability and cane production. The first rootstock material from this selection and evaluation process was made available to nurserymen for the establishment of rootstock mother plantations in 1972, under the control of the Department of Agriculture.

This process of plant improvement received legal backing with the introduction of the Plant Improvement Act of 1976. Its main goal was to ensure stricter control over the production and distribution of grapevine plant material. The grower now had a guarantee that nursery vines he/she purchased from a registered nursery complied with a certain set of minimum standards. These included the phytosanitary status/quality, physical quality of the vine (root development, strength of the graft union and scion growth) and trueness to type of the rootstock and scion cultivar. No plant material could be sold without adhering to these minimum standards. The South African Plant Certification Scheme for Wine Grapes and the South African Plant Certification Scheme for Deciduous Fruit (which included table and raisin grapes) were instituted in 1992 and 1993 respectively, and were a further refinement of the quality standards of the 1976 Plant Improvement Act. All certified vines should comply with the standards set out in the above-mentioned two schemes.