This is the fourth article in the series on the history of rootstocks in South Africa and focuses on the application and adaptations of the commercial rootstocks Richter 99 and Richter 110 in the South African grape industries. Detailed attention is given to the most suitable soils and the regions where they have been planted extensively and also where they have disappeared over time and the reasons why. Comments are also made on the future of each rootstock.

Commercial rootstocks in South Africa

The following table lists the commercial rootstocks used in South Africa, their parentage and the year of selection/breeding.

<table>
<thead>
<tr>
<th>Rootstock</th>
<th>Parentage</th>
<th>Breeder and year</th>
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<tr>
<td>Richter 99</td>
<td>V Berlandieri x V rupestris</td>
<td>Richter, 1889</td>
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<tr>
<td>Richter 110</td>
<td>V Berlandieri x V rupestris</td>
<td>Richter, 1889</td>
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<tr>
<td>101-14</td>
<td>V riparia x V rupestris</td>
<td>Millardet and de Grasset, 1882</td>
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<tr>
<td>Ramsey</td>
<td>V Champinii</td>
<td>Munson, 1900</td>
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<td>Paulsen 1103</td>
<td>V Berlandieri x V rupestris</td>
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<td>Ruggeri 140</td>
<td>V Berlandieri x V rupestris</td>
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<td>SO 4</td>
<td>V Berlandieri x V riparia</td>
<td>Teleki, 1896</td>
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<tr>
<td>US 8-7</td>
<td>V Berlandieri x V rupestris x Jacquez</td>
<td>Orffer, 1956</td>
</tr>
<tr>
<td>143 B</td>
<td>V vinifera cv Aramon x V riparia</td>
<td>Millardet and de Grasset, 1882</td>
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The following sections give an account of the characteristics and performance of the above rootstocks in the South African wine, table and raisin grape industries. Extensive experience of the performance of these rootstocks is available due to the fact that most of them have been used commercially for many decades, and some even for more than 100 years.

The grape growing regions of South Africa are diverse in terms of soil and climatic conditions. Rootstock performance and adaptation between regions can differ drastically. The extrapolation of rootstock performance between regions without experience, and even more so from overseas sources, is dangerous because conditions differ so much. This is evident from research results and the information in frequently found “rootstock characteristics charts” available in literature.

The use of a specific rootstock that gives good and consistent results to a farmer becomes a “way of life” and will be very difficult to change. One can therefore speculate that rootstock preference can become traditional, although better options could be available. Any new rootstock needs to perform well over an extended period (a minimum of 20 years) and should at least perform better than the one presently in use before being accepted and incorporated. South African grape farmers are well organised in farmer’s associations and study groups where knowledge and experience are frequently exchanged and research results presented. Since the early days of rootstock use, trial plots have been established in grape growing regions, on the land of commercial farmers. These had great value, since rootstock performance could be evaluated under commercial conditions.

The following discussions on the use of rootstocks in South Africa is not a literature study, but a practical summary of experience gained from working as a technician in the field over the past 19 years. Inputs from viticulturists and farmers with 30 and 40 years of experience gave valuable insight into the use of rootstocks, many of which have mostly disappeared from use in South Africa. Although more than 100 different rootstock selections have been tested and trialled in South Africa’s grape growing history, today only nine remain in commercial use. This is a positive development if compared to the rootstock choices found in other countries, especially Europe and the USA. Having fewer choices available makes the decision of which rootstock to use less difficult. It also makes the establishment and maintenance of a wide range of rootstock cultivar mother block plantations easier and more cost effective to manage.

Richter 99

Richter 99 was developed in France by Franz Richter in 1889 and imported to South Africa in 1927. New clones were also later imported from Italy, France and the USA. It is a cross between *Vitis Berlandieri* and *Vitis rupestris*. Richter 99 has some of the best compatibility with commercial *Vitis vinifera* wine grape cultivars. It is not considered to be a good rootstock for table grapes because of the poor fruit set it induces.

Richter 99 has high vigour (vigour potential is considered as high out of 5) and is considered a very good rootstock under dry-land conditions on a range of soils, from shallow and compact to deep loamy sands. The strong vigour and deep well-branched root system is able to search for moisture in the deepest soil layers, with some roots penetrating below the depth of soil preparation. The limit of rainfall (mostly in winter) for wine grape production in South Africa is around 400 mm, which is common in certain sectors of the Swartland. Richter 99 has been and still is the main rootstock for this region because it is able to withstand the harsh warm and dry summer conditions without irrigation. Strong vigour is an important characteristic for dry land viticulture, especially in warm climates. Vines are mostly grown as bush vines with average yields of 6 - 10 tons/ha. Agter-Paarl around the Paardeberg (soils of granite, shale and greywacke origin) and the slopes of the Drakenstein Mountains where parent material is mostly granite (Glenrosa soil form) are all areas where Richter 99 finds application. Soils here compact easily and require a strong rootstock. Soil types suitable for its use include Swartland, Klapmuts, Glenrosa, Oakleaf, Clovelly and Hutton.

Richter 99 is very well adapted to free lime in the soil (17% active lime), but Richter 99 also showed good adaptability under low pH soil conditions as is commonly found in the coastal regions of the Western Cape (soil pH < 4.5 is common). Although soils need to be ameliorated with lime, the effect is limited to the top 60 cm of the soil.
profile. Richter 99 has very good drought tolerance in dry regions, and although it is rated less drought tolerant than Richter 110, it definitely outperforms the latter in warmer regions with “tougher” conditions [high temperatures in summer, compacted soils, lower relative humidity (RH)]. Richter 99, in contrast, has less proficiency as a dry land rootstock on similar soils under “softer” conditions. Richter 99 has almost completely disappeared from the deep red soils of Stellenbosch. Here Richter 110 performs much better, probably due to the fact that Richter 99 depletes the available soil moisture too quickly under the less stressful conditions (higher rainfall, higher soil potential and lower summer temperatures). Richter 99 shows drought symptoms earlier than Richter 110 under these conditions.

Richter 99 is also used under irrigation in the traditionally intensively irrigation regions of the Klein Karoo, Worcester/Rawsonville, Olifants River, Berg River and Orange River Valleys. Richter 99’s high vigour and potential for supporting large crop loads (25+ tons/ha) together with good nematode resistance makes it a very popular rootstock. These soils are normally of a sandy loam texture with good fertility and are very well drained. In contrast, Richter 99 was never a popular rootstock in the Robertson/Bonnievale region due to the fast deterioration of the vines caused by subsoil wetness and salinity. Richter 99 has very good resistance to root knot nematodes but only moderate resistance to dagger and root lesion nematodes.

The salinity resistance of Richter 99 is considered to be medium to low. This resistance level should be seen on a relative scale, as the effects of salinity is very dependent on the availability of irrigation, soil type (well-drained sandy loam versus heavy clay with slow drainage) and type of salinity. On well-drained soils under irrigation, Richter 99 performs very well under slightly saline conditions because salts and sodium can be leached and soil amelioration with gypsum can be applied. When the soil becomes heavier, the combination of prolonged subsoil wetness with salinity can become deadly. High summer temperatures, low RH in combination with sodium based soil salinity will not be suited to Richter 99 under dry land conditions. Of all the Vitis x Berlandieria x rupestris hybrids Richter 110 has the best salinity resistance by far.

Richter 99 is sensitive to the soil borne root fungus Phytophthora cinnamomi, associated with wet, poorly drained soils. This fungus occurs as a natural soil fungus in the acid soils of mountain slopes covered with fynbos, even though the soils are well drained. Richter 99 does not have an extended lifespan under conditions with wet sub-soils associated with Estcourt, Katspruit, Longlands and Westleigh soil types. Vine deterioration starts at a relative early age when used under these soil conditions. The sudden death of individual vines in a vineyard grafted to Richter 99 was commonly known as skielike doodgaan-siekte (sudden vine mortality) at a time when the sensitivity of the rootstock to subsoil wetness was not yet understood. In most cases Phytophthora cinnamomi was isolated from dead vines.

The popularity of Richter 99 under intensive irrigation has, however, declined substantially over the past decade. One can only speculate about the reasons, but it seems that the prolonged wetness of the root zone due to a high frequency of irrigation causes the vine to decline. This characteristic of Richter 99 has been well known since its introduction. Other rootstocks like Ramsey and Richter 110 and, to a lesser extent US 8-7, have replaced Richter 99 under these conditions.

Richter 99 only started making inroads into the wine industry during the 1960s with the decline of Jacquez. In field trials it performed exceptionally well under dry-land and irrigated conditions and on a wide range of soil types. In those days the wine industry was dominated by high yielding cultivars like Palomino, Cinsaut, Chenin blanc and Hanepoot. Richter 99 was definitely the best suited to replace Jacquez at the time. The changes in the wine industry over the past 15 years has seen the establishment of red and white cultivars with lower yields and higher quality requirements for which other rootstocks are better suited. Richter 99 is still the best suited rootstock under the dry-land conditions of the Swartland and Agter-Paarl, but has mostly been replaced by Ramsey for maintaining consistently high yields under intensive irrigation on sandy loam soils. Economic factors over the past decade have seen the plantings decrease, especially in regions without irrigation, and together with the replacement of Richter 99 by Ramsey and US 8-7 in the irrigated regions, Richter 99 became of less importance.

At the time of the rootstock survey by the Stellenbosch Wine Institute in 1966, the following information already existed for Richter 99 in South Africa: By 1939 Richter 99 already showed promising results on a wide range of soil types; broader application than Richter 110. It showed good drought, phylloxera and nematode resistance, but low tolerance to wet soil conditions.

Richter 110

Richter 110 was developed in France by Franz Richter in 1889 and was, together with Richter 99, imported to South Africa in 1927. It has the same parents as Richter 99, Vitis x Berlandieria x rupestris. Richter 110 has similar affinity when grafted to Vitis vinifera cultivars, but tends to show poor distribution of roots at the basal end of the rootstock. The application of rooting hormones and the establishment of nurseries under plastic mulch have, however, greatly improved the situation.

Richter 110 was always included with Richter 99 in field trials. It never performed poorly, but was mostly outclassed by Richter 99 for vigour and crop size. Richter 110 has moderately high vigour (3.5 out of 5), less than Richter 99 and Paulsen 1103. Richter 110 is said to be a better “quality” rootstock than Richter 99 due to the slightly less vigour it induces and resultant more balanced growth. Traditionally Richter 110 was never a serious contender for competing with Richter 99, but it does have characteristics that make it a rootstock of high importance and is increasing in popularity.

Richter 110 is suitable as dry-land rootstock in the traditionally moderate climatic regions around the Cape Peninsula where soil potential, rainfall and RH are higher. The deep red Hutton and Oakleaf soils on the slopes of Simonsberg, Helderberg, Constantia and Durbanville are particularly well suited for Richter 110. It is considered to have better drought resistance than Richter 99 internationally,

[Image: Richter 99.](source: Boerdery in Suid-Afrika)
but in South Africa this was never confirmed either in trials or commercially. In the previous discussion of Richter 99 the difference in drought tolerance between Richter 99 and Richter 110 depending on region was mentioned.

Richter 110 is the rootstock of choice in the relatively new wine regions of Grabouw/Elgin and the Hemel-en-Aarde Valley near Hermanus. Conditions in these areas are also “softer” with mild summers and higher rainfall and duplex soils of mostly shale origin. Topsoils are gravelly with subsoil well-weathered shale and good water retention capacity. Richter 99 would induce too much vigour for quality production and could also be sensitive to prolonged sub-soil wetness and late maturation of grapes. Soil types in these regions include Klapmuts, Glenrosa, Estcourt, Clovelly and Oakleaf.

Richter 110 has much better resistance to subsoil wetness than was originally thought. In this sense it has similar wetness resistance as Paulsen 1103, which is considered to have very good wetness tolerance. Richter 110 also resists Phytophthora cinnamomi in the soil much better than Richter 99 which is normally associated with wet soil conditions. Richter 110 prefers soils with higher clay content throughout the soil profile, especially the topsoil. Where Richter 99 can easily handle a 30 - 40 cm deep topsoil of clay content less than 5 % (which is common for soils in the Western Cape), Richter 110 needs at least 10 - 15% clay in the topsoil and 20% in the subsoil. It does not perform well on dry compacted soils since it does not have adequate vigour to penetrate to the deeper soil layers, especially in warmer climates. The natural rooting habit of Richter 110 is less deep and branched than Richter 99. It is therefore not preferable to establish Richter 110 on sandy gravel soils. Having Vitis Berlandieri as one of its parents, resistance to free lime is very good (17% active lime), but also to acidic soil conditions. It actually performed better than Richter 99 at soil pH < 5. R 110 is susceptible to Phytophthora.

Resistance to salinity is also much better than originally anticipated. This characteristic increased the usage of Richter 110 on a much wider range of soils compared to the other Vitis Berlandieri x Vitis rupestris hybrids Richter 99, Paulsen 1103 and Ruggeri 140. This was one of the reasons why it replaced 101-14 on salinity prone duplex soils of the Robertson Valley. Richter 110 has moderately good resistance to root-knot nematodes, but has low tolerance to dagger and root lesion nematodes.

Richter 110’s popularity has increased dramatically over the past decade in the Robertson/Ashton/Bonnievale region. It replaced 101-14 as the rootstock of choice on the heavy red clay soils that drain slowly, soft and hard calcareous soils, as well as alluvial salinity prone soils. Richter 110 induces better vigour and salinity tolerance on these soils than 101-14, the original favourite. The longevity of the vines is also better, especially with high yielding cultivars like Chenin blanc and Colombar. Richter 110 is a stronger rootstock and manages to cope with the stresses of higher yields, wetness and salinity much better than 101-14. Many soils in this region contain free lime (both soft and hard) and are considered most suitable for vines. Richter 110 is the rootstock of choice on these soils as it has good tolerance to free lime and induces moderately high vigour for quality production.

Richter 110 has also found application in the table grape industry. It is recommended for organic material-rich alluvial soils of higher fertility where Ramsey will induce too much vigour and delay ripening. It performs better in the mid to late season regions of Paarl and the Hex River Valley on coloured varieties like Crimson Seedless and Red Globe. It should, however, not be used on sandy or gravelly soils where vigour will drastically be curtailed and sensitivity to nematodes increased.

Richter 110 had not yet been planted commercially at the time of the rootstock survey of the Stellenbosch Wine Institute in 1966.