# Oregon Wine Advisory Board
# Research Progress Report

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## Considerations in Rootstock Selection in Oregon

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In many of the world's vineyards, grafting *Vitis vinifera* scions to phylloxera resistant stocks has been routine for nearly a century. In other areas, the spread or threat of phylloxera is relatively new. In Oregon, it is not now known if phylloxera will become the killer it has been in other areas. Is it a disaster waiting to happen? No one interested in the future of Oregon winegrowing should ignore this possibility and NOW is the time to start trials which will demonstrate the best rootstocks for cohabitation with phylloxera.

There are other reasons for grafting European vines on American rootstocks besides phylloxera that may be of more immediate interest to Oregonians. For one thing, grafting as a process, even homo-grafting, has been shown to have a favorable effect on fruit set. Rootstocks are one of the ways grape growers can better meet an array of vineyard problems relating to climate (short growing season, cold winters, drought) and soil conditions (high pH, salt, phylloxera, nematodes, excessive fertility, low fertility, nutritional imbalances). It is important to prioritize one's needs in a rootstock, because rarely does one rootstock fulfill all the desired requirements equally.

The opportunity to select a rootstock presents itself only once, and therefore requires serious thought. Unlike pruning, spraying, trellising, or even choosing a fruiting variety, there is no possibility of changing or modifying a rootstock once it is planted. It is critical to have production goals in mind: the quantity and quality your site will allow. At the same time, growers must consider strategies for vine spacing and trellising to accommodate anticipated vine size and crop load.

Because the performance of rootstocks is extremely site dependent, the results for a given scion/stock combination are bound to differ from region to region. Growers in areas new to grape growing must extrapolate information generated in foreign sites. Much useful literature is not in English. California literature to date is virtually useless for Oregonians, although there may be some interesting research in upcoming years. New York experiments are more relevant, but information is still quite limited.

European experience has been long and intensive. While it may not point immediately to the best stock for Oregon, it is certainly the place to find some of the fundamental information. Even in France, however, where the majority of today's commercial rootstocks were developed before 1900, there has been a continual evolution in rootstock plantings and recommendations.

### ROLE OF GENOTYPES

Three North American species are the most common parents of grapevine rootstocks: *Vitis rupestris*, *Vitis riparia*, and *Vitis berlandieri*. Each species has evolved in a specific habitat with different environmental conditions.

***Vitis rupestris***

*V. rupestris* grows in dry, sunny sites which have periodic rain. It is a bushy vine with numerous short, upright shoots and many adventitious buds. It is better suited to periodic flushes of growth due to alternating dry and wet conditions than is a climbing vine with a single stem. Its plunging roots help it tap a deep water supply, but are ill suited to shallow soils in drought conditions.

*Rupestris* has a very long vegetative cycle with early bud break and late fruit and wood maturation. Its growth strategy can be described as vigorous during periods of high water and nutrient availability with reduced activity during drier periods. The most common pure *Rupestris* stock is Rupestris St. George; it is totally unsuited to Oregon conditions. On the other hand, hybrids of *V. rupestris* with *V. riparia* such as 3309 C and 101 -14 Mgt may prove very satisfactory in Oregon as they have in many other temperate wine regions.

***Vitis riparia***

In its native habitat of the northern section of eastern North America, *V. riparia* climbs trees in a moist and shady environment. It partitions most of its growth to long-lived, woody stems that allow it to climb towards higher light, producing very long shoots with a large amount of wood. It is unusual among vines in that it produces more shoot material than root material. The roots grow mostly laterally. Its large leaves are well adapted to shade, but not drought.

The vegetative cycle is adapted to cold climates with short seasons. Bud break is early as are fruit and wood maturity. Although a shortened growth span would decrease the total production by the plant each year, it ensures completion of growth, fruit, and wood ripening before the onset of winter cold. It is a conservative strategy oriented to long term survival of upwardly mobile shoots. The only pure *Riparia* commercial stock is Riparia Gloire de Montpellier; it should certainly be part of the trials in Oregon. *Riparia* hybrids are "most likely to succeed" here.

***Vitis berlandieri***

*V. beriandieri* is a species found in calcareous and dry soils in Texas and Mexico. It is a vigorous, climbing vine with strong, fleshy, plunging roots. Of the three species mentioned here, it is the most drought tolerant. *Berlandieri* is adapted to maintain activity during a long, hot growing season and it can also tolerate very low winter temperatures. It is not adapted to cool regions because of its long growing cycle and late wood maturity. Its tolerance of high pH soiIs is extremely valuable to Europeans. Due to poor rooting, there are no pure *Berlandieri* stocks. Hybrids with *rupestris* (1103 P, 110 R, 140 Ru) are common in hot climates. *Berlandieri-vinifera* crosses are used in the high lime soils of Cognac and Champagne (41 B, 333 E.M, Fercal). Common in cool regions and of importance to Oregon are hybrids with *Riparia* (1125 AA, 420 A, 5 BB, SO 4, 161-49).

**WATER AND NUTRIENT UPTAKE**

Rootstocks have morphological and physiological differences that confer differing abilities to take up water and nutrients. Their rooting patterns explore different soil zones. Rootstocks can even influence stornatal characteristics of the leaves on the scion in such a way as to affect drought tolerance.

Absorbency of certain minerals such as N, K, Ca, Mg, and P varies both among rootstocks and among *V. vinifera* scions. For example, rootstocks have a significant effect on N concentration at bloom (a factor in fruit set/shatter), but not a veraison. St. George has been shown to be an "inefficient genotype" for phosphorus absorption while 3309 is efficient. Stocks like SO 4 and 44-53, which take up high amounts of potassium, tend to take up low arnounts of magnesium. This can be problematic with Mg-demanding scions such as Grenache and Cabernet Sauvignon.

Given the complexities and variables involved in the outcome of trials in other places, it is not possible to predict exactly how rootstocks will respond to moisture and nutrition status in various Oregon sites. Experience shows that there will be differences both between stocks and between stock/scion combinations that are significant to both vine performance and fruit composition.

**HORMONES**

The root has been likened to the orchestra conductor controlling the equilibrium between the flower path and the vegetative path. Rootstocks have more influence on the scion during the first part of the vegetative cycle. At veraison, the fruiting variety becomes the dominant influence in regulating source-sink relationships. Research into the role of cytokinins, supplied by the roots at the time of bud burst, shows that flower formation in inflorescence primordia is a cytokinin-controlled process. Fruit set is critical to Oregon growers and rootstocks should be carefully examined here for their influence in this respect.

**VIGOR**

Oregonians may already be aware of the problems associated with excessive vigor: poor set, delayed maturity, increased mildew and rot, increased susceptibility to drought, increased management costs to reduce shading, and intendent fruit imbalances. Although American scientists I have spoken to seem skeptical about the role of rootstocks in affecting relative vegetative vigor, Europeans have observed differences and select stocks accordingly. In his paper delivered at the Second Annual Cool Climate Symposium in New Zealand this January, Robert Drouhin noted "a tendency toward less vigorous vines" in Burgundy. More vigorous rootstocks such as SO 4 are being avoided.

In my limited tour of the Willamette Valley, I concluded that there is a need for a variety of rootstocks. On one hand, in unirrigated, infertile sites with wide spacing, rootstocks that promote vegetative vigor may be recommended. In contrast, on humid or irrigated sites with rich soils and close spacing, stocks which tend toward moderate growth may be appropriate.

**MISTAKEN IDENTITIES**

Errors in rootstock identification can be on an individual level, where the nursery erroneously delivers the wrong material, especially likely during high demandlow supply years. On a national level, such errors happened in Australia when 34 E.M. was incorrectly called 161-49 and in California when the identities of 99 R and 110 R were reversed. If the results of a rootstock trial are way out of line with previous results, it is not unreasonable to question the trueness to type of the stock in question.

Experience has rendered me skeptical as to whether we know what we are using at all times, especially with genotypically and phenotypically similar *riparia-berlandieri* stocks such as S04,5 BB, 5 C, etc. Studies have shown significant differences infield performance, but with the low to nonexistent interest in classical ampelography in the U.S., who's to say which is which?

**INFLUENCE OF COMMERCE**

There is no question that rootstock cultivars which are easy to root and graft are also more economical to produce. Such stocks are far more widely planted than their inherent value warrants. For example, the planting of Rupestris du Lot in dry regions instead of the superior 110 R can be directly attributed to the latter's poor rooting and mediocre grafting qualities.

Also, there is a tendency to favor stocks which produce strong, early growth over those that take longer to get established. This can be a mistake because often the "slow starters" are actually the best producers in the long run.

Growers must be patient when ordering new rootstock-scion combinations and be willing to pay more for rare or difficult to propagate stocks. Nurseries, faced with new rootstock cultivars, need to study ways to increase their percentage of successful grafts; chances are the "new" stock for them is common in another country.

**SOME ANNOTATED ROOTSTOCK SUGGESTIONS FOR TRIAL IN OREGON**

Note: These comments have been gathered from a variety of sources, partially listed in the Selected Bibliography. One of the best descriptions of native American vines and rootstocks is found in Pierre Galet's *Les Vignes Americaines*, published in 1988. These remarks are not "gospel", but should be useful as an introduction to phylloxera resistant rootstocks worthy of trial in Oregon.

*Riparia Gloire:* For fertile, humid soils, tolerates "wet feet". Lowest vigor. Favors fruit set and early ripening. Not drought tolerant, especially in thin soils. Better in high density plantings as the rootstock stays thin relative to the vinifera scion.

*101-14 (riparia-rupestris):* For humid, well drained soils, not dry or compact. Low vigor. More utilized in Loire and Bordeaux than Burgundy. Not found in Germany.

*3309 C (riparia-rupestris):* For humid, fertile soils, not dry or compact. Very popular in non-calcareous soils of Burgundy and Alsace, also the Loire Valley. Recommended for moderate vigor and good winter hardiness in the eastern U.S. Less vigorous than *beriandieri-riparias*, but more than Riparia Gloire and 101-14.

*Schwarzmann (riparia- rupestris):* An eastern European (Czechoslovakia) selection of uncertain origin. Productive, recommended for dry soils. Vigorous in moist, fertile soils. There is not much literature on this stock, but what there is suggests it might be very useful in Oregon's well-drained soils and wet-dry conditions.

*125 AA (beriandieri-riparia):* There is not a lot of literature on this one, but one English author recommended it highly for its favorable effect on early maturity. Worth a try.

*420A (berlandieri- riparia):* For moist, fertile soils, but can tolerate dry conditions as well. The least vigorous of this genotype, called the *riparia* for calcareous soils, it is said to favor fruit set and promote early ripening, although some sources say it has a longer growing cycle than 125 AA. This may be an excellent stock for some Oregon sites, but its poor rooting causes a lower percentage of successful bench grafts.

*SO 4 (beriandieri-riparia):* No longer "ala mode" in Europe's finest vineyards. It has high K and problems with Mg deficiency. It is said to be too vigorous for quality wine. On the other hand, it roots and grafts well and is in most of the research trials of the last 25 years, so it will be a good "standard" vine to relate Oregon results with those of other areas.

*5 BB (berlandieri-riparia):* Very popular in Germany. Good for less fertile soil conditions or for wide spacing and tall trellises. It has been too vigorous (more than SO 4) in the eastern U.S. in clay soils with Merlot and Cabernet Sauvignon and has been blamed for an increase in winter injury.

*5 C (beriandieri-riparia):* Similar to 5 BB, but said to be one of the earliest ripening of this genotype.

*44-53 M (riparia-cordifolia x rupestris):* Said to have similar vigor to 3309, i.e. moderate and promoting early ripening. This is a stock with high drought tolerance. LikeS04, it has fallen out of favor in France because of its high uptake of K and low uptake of Mg. It roots and grafts well and should be tried in Oregon conditions, especially unirrigated sites.

*1616 (riparia-solonis):* A low vigor stock which needs humid conditions and is said to tolerate "wet feet". Not recommended in dry, unirrigated sites. There is not a lot of information about this one, but it has done well in some eastern U.S. trials.

*41 B (beriandieri-vinifera):* The top rootstock in Champagne because of high lime tolerance and phylloxera resistance. Slow starter in Spring helps avoid frost, short cycle, medium vigor, promotes set. It did well in old Swiss trials. Not a favorite with nurseries due to poor rooting.

*110 R (berlandieri-rupestris):* A high vigor, drought tolerant vine. May be useful in unirrigated sites of low fertility or low water capacity. Not recommended in moist, fertile soil because of vigor and long growing cycle.

**SELECTED BIBLIOGRAPHY**

Alley, C. J. and H. P. Olmo. 1981. Letters to the editor. Am. J. Enol. Vitic. 36:last page.

Ambrosi, H. and H. Becker (eds.). 1978. Der deutche wein. Grafe und Unzer Verlag, Munchen. 364 pp.

Boulay, H. 1982. Absorption differenciee des cepages et des porte-greffes en Languedoc. Prog. Ag. Vit. 99:431-434.

Branas, J. 1974. Viticulture. Dehan, Montpellier. 990 PIJ.

Carbonneau,A 1985. The early selection of grapevine rootstocks for resistance to drought. Am. J. Enol. Vitic. 36:195-198

Champagnol, F. 1984. Elements de la physiologie de la vigne et de viticulture generale. Champagnol, Montpellier.

Egger, E., M. Borgo, and P. Antoniazzi. 1985. Tolleranza de portainnesti della vite ad alcune malattie virali o virus-simili. Riv. Viti. Enol. 38:302-307.

Ferris, H. 1979. Quantitative aspects of the development of Meloidogyne arenaria larvae in grape vine varieties and rootstocks. J. Nematol. 11: 168-174.

Freeman, B. M. and R. E. Smart. 1976. Research note: A root observation laboratory for studies with grapevines. Am. J. Enol. Vitic. 27:36-39.

Galet, P. 1979. A practical ampelography. L. T. Morton (trans.). Cornell University Press, Ithaca. 248 pp.

Galet, P. 1983. Precis de viticulture. Dehan, Montpellier. 584 pp.

Galet, P. 1988. Les vignes Americaines. Dehan, Montpellier.

Goss, 0. and 1. J. Cameron. 1981. Rootstocks beat nematodes in grapevines. J. Ag. West. Aust. 22:34-35.

Harmon, F. N. and E. Snyder. 1934. Grape root distribution studies. Am. Soc. Hort. Sci. 32:370-373.

Lefort, P. L. 1977. Les relations quantitatives entre porte-greffesetgreffons. **In:** Grapevine Genetics and Breeding, Ileme Symposium International sur I'Ameliorationdela Vigne. Institut National dela Recherche Agronomique, Paris. pp. 303-308.

Lider, L., N. L. Ferrari, and K. W. Bowers. 1978. A study of longevity of graft combinations in California vineyards. Am. J. Enol. Vitic. 29:18-24.

Morton, L. T. 1979. The myth of the universal rootstock Wines & Vines. April: 24-26.

Mullins, M. G. 1980. Growth regulators and the genetic improvement of grapevines. **In:** Proceedings of the University of California, Davis, Grape and Wine Centennial Symposium. A. D. Webb (ed.). University of California Press, Berkeley. pp. 143-147.

Munson, T. V. 1909. Foundations of American grape culture. T. V. Munson & Son, Denison, Texas. 252 pp.

Pongracz, D. P. 1983. Rootstocks for grapevines. David Philip, Cape Town. 150 pp.

Pool, R. M. 1987. Rootstock and winter hardiness. Vineyard and Winery Management. July/August: 40.

Ravas, L. 1902. Lesvignes Americaines: Porte-greff es et prod ucteu rs-di rects. Coulet et Fils, Montpellier. 376 pp.

Rives, L. 1925. Recherches sur les deperissements de certains hybrides greffes. Revue de Viticulture. LXII1603:221-227.

Rives, M. 1971. Genetique etamelioration de lavigne. **In:** Sciences et Techniques de la Vigne. J. RiberauGayon and E. Peynaud (eds.). Dunod, Paris. pp. 171-219.

Scienza, A. and M. Boselli. 1981. Frequence et carateristiques biometriques des stomates de certains porte-greffes de vigne. Vitis. 20:281-292.

Smart, R. E. and S. M. Smith. 1988. Canopy management: Identifying the problems and practical solutions. Proc. Second Intl. Symp. Cool Climate Vit. and Oenology. Auckland, New Zealand. p. 109-115.

Viala, P. 1889. Une mission viticole en Amerique. Camille Coulet, Montpellier. 387 pp.

Whiting, J. R. and W. J. Hardie. 1981. Yield and compositional differences between selections of grapevine cv. Cabernet Sauvignon. Am. J. Enol. Vitic. 32:212-218.

X. Les Porte-Greffes de [a vigne dans le Bordelais et le Bergeracois. Cambre d'Agriculture de la Gironde, Bordeaux. 25 pp.