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Resistant rootstocks for New York vineyards

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The grape industry in New York is interested in establishing new vineyards of both old and new varieties. Because there are not enough choice sites available, some will be replantings of old vineyards, others may be on shallow soils. To assume success in such situations, there is a need for vines grafted upon resistant rootstocks.

For nearly 100 years, viticulturists over the world have shown the benefits from employing rootstocks resistant to phylloxera; recently in California also for their resistance to parasitic nematodes. Research in New York over the past 50 years has shown also that resistant stocks can be used to advantage in vineyards on this Station. Recommendations concerning their use have been offered to growers for many of these years.

DEFINITION OF TERMS

Vine vigor is the seasonal rate of growth of the shoots of a vine.

Vine capacity is the capability for the total growth of the vine. It can be estimated by the weight of cane prunings.

Root parasites are destructive organisms living in or on roots.

Root environment is the nature of the soil, including root parasites, micro-organisms, nutrients, and water surrounding the roots.

Resistant rootstocks are grape varieties whose roots are less injured by the attack of root parasites than are the roots of the scion grafted upon it.

The term resistant rootstock for grapes is relative. Such a stock is simply less injured by root parasites and/or excessive amounts of lime in the soil than is the scion's root system.

CURRENT STATUS

The vineyards in this State are almost entirely of own-rooted vines: (1) because the dominant variety, Concord, appears to have some degree of resistance to root parasites and consequently is high in vigor; (2) because the cool, moist climate and short growing seasons here moderate the effectiveness of these parasites; and (3) because the change in vine capacity from moderate to very high reduces fruitfulness and fruit maturity. For these reasons, Concord has responded to grafting generally only in replant sites. The American hybrids, Delaware and Ives, have shown a greater response to the use of resistant stocks. Varieties of *V. vinifera*, recognized widely for their great susceptibility to phylloxera, have not been successfully grown in the State on their own roots.

Thus, we suggest that at a given site in this State with the same pruning and crop load, differences in vine capacity of different varieties are due primarily to differences in the resistance of the root systems of these varieties to soil borne parasites. The vine capacity of a variety can be increased or decreased by the choice of either a more resistant or less resistant root system to which it is grafted.

The capacity of the scion is closely related to the soundness of the supporting root system. A resistant rootstock affords a sound root system for the scion. This affects the scion just as improvement of the soil's fertility, or its water supply, or as the eradication of root parasites of

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the own-rooted vines. In essence, we are discussing the adequacy of the root system to explore the soil mass and to make available to the scion the necessary amounts of water and nutrients for vine growth.

THREE FACTORS AFFECTING EXTENT OF RESPONSE TO STOCKS

Resistance of the roots of the scion variety to the root environment determines the need for a resistant rootstock.

It is recognized that the root system of the resistant rootstock can be adequate to afford high capacity of the scion, an adequacy most difficult to obtain under replant conditions with own-rooted vines.

In order to assure adequate growth of roots in the root environment, the resistant stock must have resistance both to the prevalent vine root parasites, mainly phylloxera and parasitic nematodes, and to lime-induced chlorosis if the proposed site does have soil with free calcium carbonate in one or more of its horizons.

ARE NEW YORK ROOTSTOCK PROBLEMS UNIQUE?

No, the problems, the solution used, and the response obtained in New York are similar in nature to those in other viticultural areas of the world.

The soil borne pests, phylloxera and parasitic nematodes, are the most serious of the factors causing the need for resistant stocks over the world. Both of these parasites occur in New York vineyards, especially in replant situations. Traditionally, phylloxera is the parasite causing the need for resistant stocks. Resistance to this insect is specific and quite high in many rootstock varieties; trials with stocks in this State have borne this out repeatedly. Information on parasitic nematodes is more obscure. Many species are involved and little is known concerning the relative resistance to nematodes of rootstock varieties of current use over the world. California experience shows the wide range of resistance to nematodes by the phylloxera resistant rootstocks. In New York from field performance, it is evident that some resistance to nematodes does exist among resistant rootstocks. Until the specific nature of this resistance is evaluated, continued use of those stocks which perform well in New York in the presence of high populations of these pests can certainly be recommended.

Lime-induced chlorosis or iron deficiency is the only non-biological factor repeatedly encountered which requires the use of rootstocks. In New York vineyards, this problem is localized.

Often, the most striking response to rootstock is on shallow, low-fertility soils which show moisture deficits during periods of low rainfall. There, vine capacity can be reduced because the own-rooted vine's restricted root system would have proportionately more root parasite injury than on deep, fertile soils. Resistant stocks can prevent

this suppression because more of their roots survive and absorb the necessary water and nutrients.

In California, the range of response to stocks is from their being essential to vine survival where the root parasites are numerous, to no response where root parasites do no harm to own-rooted vines. In New York State, Concord shows a range of response to resistant stocks from none, in trials on deep fertile, new sites, up to a fourfold increase in vine capacity on replant sites.

MANAGEMENT OF A RESPONSE IN SCION VIGOR

The increase in vine capacity of a scion resulting from the sounder root system of the resistant stock is basically no different from that resulting from improvement in the conditions of the soil environment in which own-rooted vines are grown and should be managed similarly. Vineyard management can alter vine capacity and this must be integrated with the use of rootstocks to obtain the vine capacity desired.

Own-rooted ConCORDs and those grafted to the resistant rootstock, Couderc 3309, were planted at the Vineyard

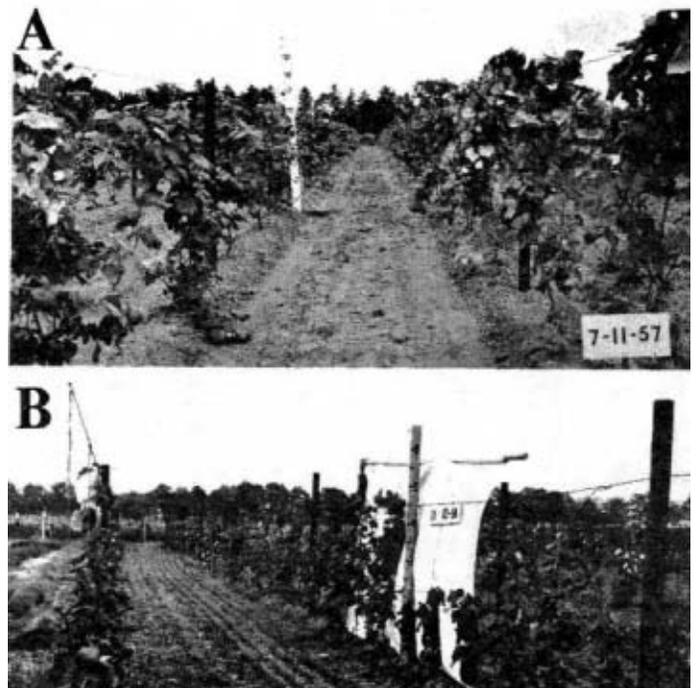


Figure 1.—Response of Concord to use of a resistant rootstock at the Vineyard Laboratory, Fredonia, New York. This soil (Howard) is a very deep gravelly loam. (A) A July 1957 photograph of vines planted in May 1956 in a non-replant site. Left is Concord on 3309; Right is own-rooted Concord. There is no response. (B) An October 1958 photograph of a May 1958 planting. Vines behind the height marker are Concord on 3309; vines in front of height marker are own-rooted Concord. The difference is just as great as in 1958.

Laboratory, Fredonia, N. Y. These vines received a wide range of nitrogen and weed control treatments. Figure 1 shows that the desired capacity indicated by 2 to 2 1/2 pounds of cane prunings per vine (8-foot vine spacing) was obtained by use of 100 pounds of N/acre/year and weed control by cultivation for own-rooted vines; with the resistant rootstock, neither nitrogen nor cultivation was necessary to achieve this capacity on this site.

Here, the effects on Concord of soil management and of this resistant rootstock were additive. When both were used, the vines were excessively vigorous and maturity was delayed. When either was used, vine capacity was effectively regulated and maturity was not delayed. Finally, it was evident that the use of the stock had the same effect on regulating vine capacity as did soil management. Obviously, where the resistant rootstock is essential for vine survival and production, soil management cannot have as important a role in regulating vine capacity.

The use of resistant stocks, on soils with vine root parasites, increases vine capacity over that of own-rooted varieties less resistant to the vine root parasites. That increase in vine capacity is usually desirable, especially where there is adequate space to expose the leaf area. However, if the increased vine capacity exceeds 0.4 pound of cane prunings per foot of row, it would be desirable to afford more space for the large amount of foliage. Such additional space can be provided by using a trellis height of about 6 feet and by dividing the canopy as with Geneva Double Curtain training.

The buds of vines whose size is greater than 0.4 pound of cane prunings per foot of row are more likely to be injured by winter cold than those of smaller vines.

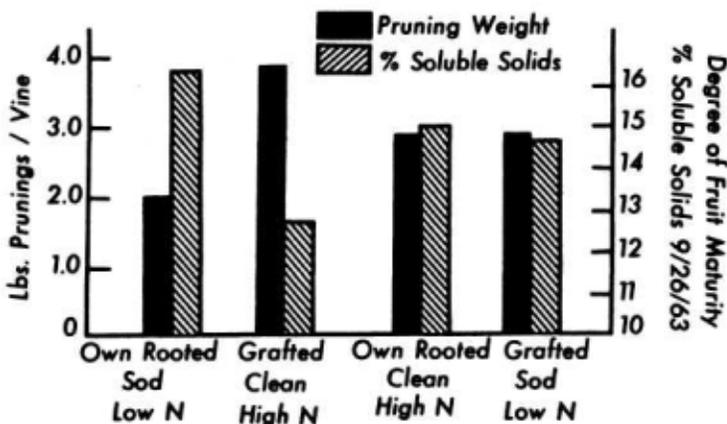


Figure 2.—Soil management and rootstock (C.3309) effects on Concord variety (1962-1963, Fredonia, New York). Crop size equals 5.5-7.5 tons/acre.

SCION VARIETY AND ROOTSTOCK USE

At least six species of *Vitis* enter into the percentage of the American hybrids grown in New York. To root parasites,

such as phylloxera, these range from the highly resistant *V. riparia* to the non-resistant *V. vinifera*. This accounts for the degrees of resistance among the scion varieties listed in Table 1. In this table is also presented a summary of the need for resistant rootstocks. There, a replant site is one in which grapes are replanted within 0 to 2 years of vine removal. With an interval of 3 or more years, the response to a phylloxera resistant rootstock will be reduced.

Table 1.—Grape varieties, resistance, and rootstocks.

Degree of Resistance	Variety (as example)	Need for Phylloxera Resistant Stock	
		New Sites	Replant Sites
Very high	C. 3309	—	—
High	Clinton or Baco noir	None	Low
Moderate	Elvira, Concord or Catawba	None to low	Essential
Low	Delaware or Ives	Mod. to high	Essential
Very low	Vinifera in N. Y.	Essential	Essential
Very low	Vinifera in California coastal valleys	Essential	Essential

In California, benefits from use of resistant stocks come only if they are free from serious virus diseases. The use of vines from certified propagating stock from the virus indexing program operating within the U. S. is absolutely essential to the future of the successful performance of resistant stocks in New York.

In designing the new vineyard, a major decision concerns whether or not to use a resistant rootstock. Of less importance is the choice of rootstock variety.

The variety, Baco noir, a *V. vinifera* x *V. riparia* hybrid, is used occasionally as a resistant rootstock in New York vineyards; recently interest in its use has increased. The phylloxera resistance of Baco noir is well demonstrated. However, it is relatively low in cold hardiness whether used as a scion variety or as a rootstock variety. Its trunks have been more cold-injured than even those of Delaware. Thus, there is concern over the ability of graft combinations using Baco noir as a stock to survive the colder winters of New York's vineyard regions. Of greater concern, is the recent disclosure by pathologists at the New York State Agricultural Experiment Station that Baco noir roots are susceptible to infection by tomato ringspot virus. Because of these two defects, this variety is not recommended as a rootstock for New York vineyards.

Research on many rootstocks is continuing, but Couderc 3309 is currently recommended for use in New York State. It has been an excellent stock in field trials in vineyards on a wide range of soil types and varieties over the State. A supply of virus-tested planting stock of this variety is available.