The Best Parents in Breeding French Hybrid Grapes

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The establishment of a number of French hybrid grape varieties and the use of some of these in grape breeding at various experiment stations has caused an interest in their genetic background and certain breeding aspects. Among those features which are of interest to breeders and other students of the grape is the apparent breeding value of certain clones for use as parents in further crossing. Unfortunately, there is a general lack of information about the selections or varieties in this large group of grape varieties that have been good parents in the production of valuable offspring. It has been shown by other workers that certain grape varieties produce a higher percentage of meritorious seedlings when used as parents than do other varieties. This principle has been confirmed with other fruit bearing plants as well, and there is no reason to assume that the French hybrid grapes are exceptions.

In this country the data used to determine the best parents have been obtained largely from breeding work and progeny evaluations performed in the various public supported experiment stations, and the results published in various scientific journals.

One of the most satisfactory and simple methods of expressing the ability of a given clone to transmit desirable qualities to its offspring has been to determine the number of meritorious seedling selections out of the total of any given progeny having the given clone as one of its parents. In determining the meritorious seedlings of a progeny, the figures are normally derived from those seedlings selected for further observation or test at the first evaluation. This figure is usually expressed as a percentage of the total, and may well be considered as the breeding value of that parent in a particular cross. Thus, with a numerical value assigned to each parent-progeny, direct comparisons can be made between values for different parent-progenies or between progenies having a common or recurring parent.

With the French hybrids, a different set of conditions has occurred in their evolution which alters the problem. This group of hybrid grapes was bred and developed largely by private breeders in France, not by public supported experiment stations. A large number of individual breeders have made a contribution to this work at various times during the last three-quarters of a century, but very little or no data have been published on this particular phase of the breeding work. Several specialized journals devoted to the direct producers (French hybrids) have been published in France at various times, and the literature on these hybrids is extensive; but to the author's knowledge no systematic evaluation of varieties has been made as to their breeding value.

Fortunately the specific parentage is known for the majority of the French hybrids save a few in which (1) the male parent in unknown; (2) the parents are given only as a species without noting specific clones; and (3) the originator does not divulge the specific parentage to the public. In these last cases, resort must be made to botanical analyses of morphological characters

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of the clone in question and its seedlings, plus its breeding behavior and peculiarities in test progenies.

With the lack of comparable data for progeny totals and number of selections per progeny for the French hybrids, which could be used to compute a breeding value for any particular clone, recourse must be made to other methods. It is proposed that part or all of at least the following two points be taken into consideration in establishing the best parents: (1) Clones which have been used in further breeding and have produced meritorious offspring; (2) number of known seedlings selected or placed in commercial test.

It should be noted that this proposal does not mean to imply that other factors should be excluded from consideration, or that these points are necessarily listed in order of relative importance. Indeed, this technique is open to criticism for more than one reason. It is not possible to assign precise numerical values to a parent-progeny, and the information on parentage and offspring was assembled from a large number of sources, some of which are not in agreement. Also, as was pointed out earlier, the fact that the parentage of a few varieties has not been divulged by the originator, and that parentage can only be estimated, is another objection. Despite this, every effort was made to study this problem in detail. The author's conclusions are offered only as one point of view, in an attempt at solving a problem of interest to other breeders.

To appreciate the extremely difficult breeding problems which confronted the French grape breeders, a brief idea of their objectives is helpful. As originally conceived, these objectives were to develop grapes with the wine quality and production capacity of the vinifera wine grapes of France, and resistance to all of the serious fungus diseases attacking those wine grapes, as well as resistance to the root louse, phylloxera. In practical vineyard terms, this meant developing wine grapes which would not have to be sprayed to control downy mildew and would not have to be grafted in order to be grown in soils infested with phylloxera (i.e. a direct producer).

As one studies the literature and geneology of the French hybrids from the beginning until the present day, a definite pattern of evolution presents itself. Certain stages have occurred in their breeding and development which are unusual in fruit bearing plants for both length of time that they have been under intensive breeding, and the remarkable continuity of purpose shared by the various independent breeders. While there is some overlapping of these various stages in time, and whereas few individual breeders have carried out their breeding work long enough to span all these stages, there is a close similarity of technique among contemporaries at any given period.

The stages that are recognizable up to the present time are four in number, and can be designated as follows:

Stage I—Primary crosses or F_1's

Stage II—Secondary crosses or F_2 backcrosses

Stage III—Intercrosses

Stage IV—Modern hybrid x vinifera crosses

It is obvious that no single clone or parent could be superior throughout the entire period of time, because each succeeding generation should, in theory and practice, be an improvement over the ancestral varieties. Accordingly, as the work progressed from stage to stage, a new group of parents was used; and out of each group certain clones appear as the best parents.

From the large number of crosses made and seedlings grown for selection and further breeding a relatively few exhibit not only superior characteristics in themselves, but, more important, have the ability to transmit these superior characteristics to their offspring to a greater degree than the others.

Stage I—The Primary F_1 Crosses

This stage is in many respects the most important of all, because of its influence on the character of succeeding generations. Although several grape species were available which had high resistance to downy mildew, all did not have equally high resistance to other diseases such as powdery mildew, anthracnose, etc., or to phylloxera. Some, otherwise of promise, had certain objectionable fruit qualities or other defects and were eliminated as suitable parental material after trial.

A wide choice of vinifera varieties, all susceptible to phylloxera and downy mildew, was available for breeding; and the choice of parents for this group of parent material undoubtedly involved an element of personal preference to some degree. Wine type vinifera varieties were chosen because wine types and not table grapes were desired. Two general classes of wine type viniferas were available, (1) the local or common wine varieties with relatively good production and cultural features, but of ordinary quality, and (2) the classical or fine wine varieties of high quality, but with relatively low production and less certain cultural values.

In the beginning, a large number of grape species, rootstock selections, vinifera varieties and even American cultivated varieties were employed as parents in the breeding work with various degrees of success. Most of the American varieties used were attenuated hybrids of labrusca, vinifera and, to a lesser extent, riparia, as well as pure labrusca selections. But, with their "foxiness", susceptibility to disease and phylloxera and other undesirable traits, most of these varieties were soon eliminated as parents. Only a very few in this group had sufficient merit to produce offspring of any promise at all. These were Noah, a

TABLE 1.

Best parents	*Progeny used in further breeding or as a commercial variety*
Jaeger 70	Aramon X Rupestris Ganzin 1 = Aramon X Rupestris Ganzin
Rupestris Ganzin	Aramon X Rupestris Ganzin 4 = Aramon X Rupestris Ganzin
Unknown *V. rupestris*	Aramon X Rupestris Ganzin 60 = Aramon X Rupestris Ganzin
Herbemont Touzan	Couderc 28–112 = Emily X Unknown *V. rupestris*
Aramon	Couderc 71–20 = Jaeger 70 X Unknown *V. vinifera*
Emily	Seibel 29 = Jaeger 70 X Unknown *V. vinifera*
Unknown *V. vinifera*	Seibel 1000 = Jaeger 70 X Unknown *V. vinifera*
	Seibel 2003 = Jaeger 70 X Herbemont Touzan
	Seibel 2007 = Jaeger 70 X Aramon

riparia-labrusca hybrid, Herbemont plus its close relative Jacquez, and seedlings such as Herbemont d'Aurelles, Herbemont Touzan, etc.

Grapes of the Herbemont group are not "foxy" as is Noah, and are referred to as *V. Bourquiniana* varieties in this country. In France, however, they are regarded as complex aestivalis-cinerea-vinifera hybrids. Except for this latter group, it is likely that the only reason Noah and a few other labrusca hybrids such as Othello were used as parents was because they were the only grapes then available that had size and production qualities along with a measurable resistance to disease and phylloxera. The other species available had much higher qualities of resistance but small sized fruit. This "short-cut" to achieve berry size later proved to be a costly error, for the "foxiness" introduced in the breeding lines from these labrusca types required several generations of careful selection to diminish its intensity.

Several grape species possessed the necessary high resistance to disease and phylloxera, but not all were suitable for breeding because of certain other characteristics. Some would not mature fruit or wood satisfactorily except in southern France. Others had peculiar flavors which, although not "foxy" as in the labrusca types, were disagreeable when fermented for wine.

Many rootstock varieties were also used because of high phylloxera resistance, vigor, etc. These were chiefly selected clones of either resistant species or of inter-specific hybrids. A few, such as Aramon x Rupestris Ganzin–1, were rootstock selections having a vinifera variety as one of the parents. Also used was a species hybrid of American origin which was produced by an American breeder, H. Jaeger, for use as a wine grape. This selection, Jaeger–70, was a lincecumi-rupestris hybrid of good size and quality for a grape without vinifera ancestry; and it ultimately proved to be one of the outstanding first stage parents among the French hybrids. It is found in the lineage of virtually all present day French hybrids at least once, and usually several times; and may be justly considered as the foundation variety of this race of grapes.

Aside from Jaeger–70, which is in itself a rupestris hybrid, it is *V. rupestris* more than any other species which was used as the source of resistance to both phylloxera and the fungus diseases. The vinifera varieties used as parents were chiefly the local or common wine types such as Aramon, Alicante Bouschet, Bourrisquou, Columbeau, Carignan and the like, and to a lesser extent the fine wine varieties such as the various Pinot and Gamay types. A summary of the best parents in Stage I is presented in Table 1.

It should be noted that Rupestris Ganzin is a *V. rupestris* rootstock selection made by Victor Ganzin, of Toulon, France, and that Emily was a pure vinifera variety produced by Peter Raabe of Philadelphia, Pennsylvania. *(To be continued.)*

Hardiness of Red Raspberries

The variety Sumner, recently introduced by the Washington Agricultural Experiment Station, was the only variety not injured by low winter temperatures at Prosser Washington during 1955. The varieties Washington and Willamette were injured badly, and Puyallup, Newburgh, Latham, Early Red and Canby were killed back to the ground.

At Vancouver, Washington, the varieties Sumner, Canby showed the most resistance to damage from the November freeze in 1955.

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(PART II)

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Stage II—The Secondary or F_2 Backcrosses

Most of the large number of F_1 seedling selections were eliminated after trials because of low production, insufficient wine quality and small-sized fruit which made harvesting slow and expensive. Only a few F_1's were sufficiently promising to enjoy a period of popularity as commercial varieties. Of these few, the majority were the tri-hybrids derived from Jaeger 70 *(lincecumii* X *rupestris)* X *vinifera,* because they possessed the size and production characters of *vinifera* to a greater degree than the bi-hybrids of *vinifera* X *rupestris* lineage. Despite this it became evident that even the best F_1's were not good enough to solve the problem adequately, and more *vinifera* fruit characters would have to be introduced or intensified in the next generation.

The realization that more of the desirable *vinifera* characters would have to be incorporated in the next generation if fruit quality was to be improved brought a crucial problem before the breeders. The F_1's were intermediate in resistance to phylloxera and most of them could not long survive as ungrafted plants in soils highly favorable to this insect. On the one hand, more *vinifera* characters were needed to increase the fruit quality and production of the F_1's, while on the other hand, the phylloxera resistance of the species parent was needed to increase the insufficient phylloxera resistance of the F_1's. At the very minimum no further decrease in resistance could be absorbed by the addition of more *vinifera* parentage and still meet the original concept of the direct producer.

The French breeders soon realized that the original concept of the problem would have to be modified and the breeding effort concentrated on one of the two objectives, either disease resistance or phylloxera resistance, if any one of these problems were to be solved in enough time to aid a desperate industry. Grapes could be sprayed for the fungus diseases and grafted to avert phylloxera injury, but of these two preventive measures, spraying was more expensive, far less satisfactory as a control measure, and on susceptible *vinifera* varieties required a large number of applications each year if any crop was to be harvested. Once a vine susceptible to phylloxera attack was grafted on a resistant rootstock, no further attention or expense was involved from phylloxera.

At this stage the emphasis on the breeding work was placed almost entirely on disease resistance, chiefly downy mildew resistance, and phylloxera resistance was temporarily relegated to the background. Backcrossing to the susceptible *vinifera* varieties definitely lowered the mildew resistance, while the fruit qualities of the *vinifera* parent were greatly accentuated. Very few of these ¾ *vinifera* hybrids were resistant enough to mildew to enjoy commercial usage, but their factor for quality and size plus a measurable mildew resistance proved

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very useful in the intercrosses to follow in the next stage of breeding. Stage II may be summarized as follows:

TABLE 2.

Best parents	*Progeny used in further breeding or as a commercial variety*
Aramon X Rupestris Ganzin 4	
Aramon X Rupestris Ganzin 60	Clairette dorce Ganzin = Aramon X Rupestris Ganzin 60 X Grosse Clairette
Couderc 28–112	Seibel 14 = (Jaeger 70 X Unknown Vinifera) X Unknown vinifera
Seibel 29	Seibel 752 = Sicilien X Clairette dorce Ganzin
Alicante Bouschet	Seibel 2510 = Alicante Ganzin X Picquepoul
Danugue	Seibel 2653 = Couderc 28–112 X Dattier
Dattier	Seibel 4643 = Seibel 29 X Danugue
Grosse Clairette	
Unknown vinifera	

Alicante Bouschet, Danugue, Dattier, Grosse Clairette, Picquipoul, and Sicilien are pure *vinifera* varieties. Seibel 752 and 2510 are actually 7/8 *vinifera* and F_3 backcrosses, because they have the genetic constitution *((vinifera* x *rupestris)* x *vinifera)* x *vinifera.*

Stage III—Intercrosses

This stage—the longest carried on in point of time, the most intensive with respect to numbers of parents, crosses, and seedlings raised—is the stage of the breeding work in which most of the breeders, past and present, have made their contributions. This stage may be regarded as the most important in its effect on the grape industry of France and in the achievement in a large measure of the breeding objectives set forth in the early 1880's. The objective of high phylloxera resistance was only partially or imperfectly solved, and while many of these hybrids could be grown ungrafted on soils relatively unfavorable to phylloxera, only a few approached the ideal direct producer and were able to grow ungrafted on strongly phylloxerated soils. Incorporation of downy mildew resistance into these hybrids progressed to such a degree that most modern day hybrids are able to produce an economic crop without spraying under ordinary weather conditions. It should be noted that, in actual practice, a spray is given as a precaution if weather conditions are exceptionally favorable for mildew, or to insure a wine with the maximum degree of alcohol content should autumn mildew infections decrease the efficiency of the leaves in producing fruit with a high sugar content.

The F_2 backcross varieties were crossed with the F_1 selections; the F_1's were crossed with each other; and the resulting seedlings were further crossed among themselves until the parentage became a very complex genealogy in which many of the early foundation clones such as Jaeger 70, Aramon X Rupestris Ganzin 1, etc., were found several times as an ancestor in a given

hybrid. Very little "outside blood" was introduced into the lines during this long continued stage, and in this respect it strongly resembled the close type of breeding with restricted blood lines used so successfully by animal breeders in developing the various breeds of cattle and other domestic livestock.

These intercrosses can be looked upon as the segregating generations of a wide range of characters, desirable as well as undesirable; and recombinations appeared which gave a wide variety of aberrant or variable seedlings for selection. The choice of parentage, in so far as the records would indicate, appears to have been more or less haphazard in the beginning, and with varying results. Gradually the clones which gave rise to seedlings with the most desirable fruit and wine qualities, increased resistance, etc. began to appear. These best parental types were then used with greater frequency until at the present time six hybrids, all produced by A. Seibel, account for the parentage of the majority of the best and most widely utilized modern day hybrids. These six varieties are Seibel Nos. 880, 5163, 5455, 6468, 6905, and 7053 of which two, Seibel Nos. 5455 and 7053, are widely grown and appreciated at the present. These varieties, their parentage and the present day hybrids in which these six are represented as one of the immediate parents, are tabulated in Table 3. The parentage of all Seyve-Villard hybrids has not been made public by the originator and the parents listed for them are estimations, in part by Galibert*, and in part by the author using botanical analyses and breeding behavior observations.

Stage IV—Modern Hybrid X Vinifera Crosses

This stage, the most recent in point of time, began largely after the complex intercross hybrids had been improved to a high degree in disease resistance and fruit qualities. Many of these modern hybrid x *vinifera* crosses are virtually indistinguishable from pure *vinifera* varieties in fruit characters, especially those derived from *vinifera* table type parentage. This stage is especially notable for the use of *vinifera* table varieties as parents to produce table type grapes. Prior to this only a very few *vinifera* table varieties were used as parents in breeding, and consequently only a few strictly table or dessert types were produced, most of these probably unintentionally. With an increasing demand for table grapes the breeders have responded with several interesting varieties.

Their resistance to phylloxera and downy mildew undoubtedly is not equal to the better complex hybrids because of the proportion of *vinifera* ancestry, but it is considerably better than that of their *vinifera* parents. Not all of these hybrids are offspring of *vinifera* table varieties, for several of the fine wine varieties of *vinifera* have been also used with promising results. A few of these wine type hybrids, especially Ravat 6, have shown that their wine qualities are the equal of the best *vinifera* wine varieties in many competitions. Stage IV should perhaps be looked upon as concurrent with and supplemental to Stage III and not necessarily as a successor. If past history is a significant indication, then Stage IV is the beginning phase of another cycle of adding more *vinifera*-like qualities to this race of grapes, very analogous to Stage II. The major difference between them is that, in general, the level of both resistance and quality is higher in the non-*vinifera* parents used in Stage IV than

*Galibert, A., 1946. Monographie des Hybrides Producteurs et Porte-Greffes.

TABLE 3.

Best parent	*Parentage*	*Remarks*	*Commercial varieties having this clone as one of its parents*
Seibel 880	C.28–112 X S.2003		Seibel Nos. 7052, 7053, 8712, 8716, 8718, 8745, 8748, 9249, etc.
Seibel 5163	S.2510 X Gaillard 2	Gaillard 2 = (Rup-Othello) X Noah	Seibel Nos. 6086, 7052, 7053, 7162, 7226, 8616, 8712, 8716, 8718, 8745, 8748, 8916, 9045, 9249, 10076, 10096, 10868, 10878, 11342, etc.; various Burdin Nos.
Seibel 5455	S.4461 X Berl. Jacquez	S.4461 = Clairette dorce Ganzin X S.2003	Seibel Nos. 7157, 7162, 8355, 8357, 9110, 10076, 10096, 10173, 13663, 13666, 13669, 13680, 13694, 13695, 14117, 14164, 14189, 14404, 14596, 14638, 14639, 15051, etc.; Landot Nos. 244, 2281, 2282, 2283, 2291, 3381; various Burdin Nos.
Seibel 6468	S.4614 X S.30 11	S.4614 = S.752 X S.2003-Berl. S.3011 = C.28–112 X Dattier	Seibel Nos. 13663, 13666, 13669, 13680, 13694, 13695, 14164, 14189, 14514, 14596, 14638, 14639, 14994, 15062, etc.; Joannes-Seyve Nos. 9149, 11–369, 14–924, 15–875, 14–982, 16–150, 23–284, 24–610, 24–614, 25–874, etc.; Seyve-Villard Nos. 12–303, 12–308, 12–309, 12–327, 12–328, 12–331, 12–347, 12–358, 12–364, 12–375, 12–390, 12–395, 12–397, 12–401, 12–413, 12–417, etc.
Seibel 6905	S.4595 X S.4199	S.4595 = S.452 X S.405 S.452 = Alicante Ganzin X S.1 S.405 = S.14 X Aramon X Rupestris Ganzin 1 S.4199 = S.85 X Couderc 132–11 S.85 = S.2 X Aramon X Rupestris Ganzin 1 C.132–11 = Vinifera X Rupestris parentage	Bertille-Seyve Nos. 4825, 5563; Galibert Nos. 114–10, 114–12, 115–22, 115–24, etc.; Seyve-Villard Nos. 12–303, 12–308, 12–309, 12–327, 12–328, 12–331, 12–347, 12–358, 12–364, 12–375, 12–390, 12–395, 12–397, 12–401, 12–413, 12–417, etc.; various Burdin Nos.; Joannes-Seyve No. 16–150
Seibel 7053	S.5163 X S.880		Joannes-Seyve Nos. 11–369, 15–875, 23–284, 23–416, 24–397, 24–610, 24–614, 26–205, etc.; various Perbos Nos.; Seyve-Villard Nos. 18–283, 18–315, 23–18, 23–501, etc.

TABLE 4.

Parent	*Meritorious progeny used as commercial varieties*
Seibel 8724	Ravat 6 = S. 8724 X Pinot Chardonnay
Seibel 11803	Landot 2832 = S. 11803 X Muscat Hamburg
Seyve-Villard 12–375	Galibert 255–10 = S. V. 12–375 X Muscat Hamburg
Muscat Hamburg	Galibert 256–28 = S.V. 12–375 X Muscat Hamburg
Pinot Chardonnay	Galibert 261–13 = S.V. 12–375 X Semillon
Semillon	Seyve-Villard 20–365 = S.V. 12–375 X Unknown vinifera

those used in Stage II. The best parents that have appeared thus far in Stage IV are listed in Table 4.

There are many other varieties in this category such as Galibert numbers 221–31, 221–32, 238–35, 238–36, 261–11, 261–12, 255–43, 255–99; Seyve-Villard numbers 20–347, 20–366, 20–473; Landot numbers 2843, 2860, etc.; Ravat 262 and many other Ravat nos.; most of the Burdin numbers; Seibel 16281, etc.; all of these hybrid x *vinifera* crosses.

New Minnesota Introductions

Several new fruit varieties were introduced in 1958 by the University of Minnesota. They have been described as follows:

Welcome gooseberry: A seedling of Poorman. Medium-sized, dull-red fruit with pink flesh and few small seeds. The almost thornless plants are vigorous, productive, and relatively free from disease.

Centennial apple-crab: A seedling of Dolgo x Wealthy. Ripening in late-August or early September, its fruit is dark yellow with bright to dark red stripes; has excellent eating quality, and is one of the best for canned sauce and jelly. Tree is small to medium in size, compact, hardy, productive, but biennial. Flowers are large, white and showy.

Northland apple crab: A cross of McIntosh x Dolgo crab. Earlier than Centennial, the fruit is small, solid bright red with purplish bloom. Flavor of its dark yellow flesh is quite good for a crab, fine for sauce, jelly and pickling. Tree is medium-sized, hardy, productive and tends to be biennial.

Solana Strawberry

Tests in southern California since 1953 have shown that the strawberry variety Solana appears well adapted to that area of the state. It is vigorous and a prolific runner maker. The fruit is medium to large, bright red, moderately firm, with good dessert quality, and holds up well in storage without darkening. Solana is highly susceptible to verticillium wilt, but more resistant to mildew and cyclamen mite than Lassen. Although not as heavy a producer or as early as Lassen, it may be a successful variety in both commercial and home plantings in southern California because of its superior fruit quality.