FUTURE "IDEAL" GRAPES

JOSEPH L. FENNELL
Princeton, Florida

HEALTH and resistance to disease are prime requisites in any plant. With the grape they are most important. This fact stands like a tombstone above the grave of that once enthusiastic effort to build the so-called "Direct Producer" vine. This was to have been the ideal hybrid development which would, according to the dreams of former vinyardists, combine in a single plant the fruit quality of the European grape with the healthiness of the more rugged American kinds.

Quality was attained, to be sure, from some of the first breeding attempts. We need but to taste the delicious berries of such kinds as Agawam, Delaware, Lindley, Goethe, etc., to be convinced of that. But few of them even approximate the variety Concord in practical value, despite their superior fruit quality. Aside from certain needless imperfections of vine, flowers, etc., the cause of this appears to be a step-down in resistance to disease.

In most instances the results of the early "Direct Producer" attempts show an inverse ratio as between fruit quality and vine healthiness. The few hybrid sorts which proved sufficiently disease free (hybrids of *Vitis vulpina; V. rupestris;* etc.) bore small, seedy or sour fruit. These initial difficulties in evolving the visionary "Ideal" grape led to the almost complete abandonment of that worthy and once enthusiastically pursued program.

Previous Results Misleading

From the early disappointments there came into being the now-prevalant dogma which says, in effect, that *vinifera* or European parentage in a hybrid grapevine means just that much weakness and susceptibility to disease. Judging solely from these early experiments we cannot deny such a theory. But we do doubt, and in all sincerity, that the matter could have been given the complete and thorough-going investigation which it deserved. When based upon the results of recent experiments this doubt becomes little short of a conviction.

Recent investigations by the writer, which has involved much unusual and hitherto untried material and many new hybrid combinations, has not only indicated the inaccuracy of the theory that all forms of the European grape impart a susceptibility to disease to their hybrids, but has shown that in rare cases such parentage in the hybrid may even contribute toward the resistance to certain fungus or insect attacks. This point is of great significance and may tend to revive the quest for our elusive Direct Producer kinds.

In the author's test vineyard there are a few new F_1 hybrids, having fifty per cent European "blood" in their make-up, which have shown a degree of disease resistance scarcely surpassed in the entire genus *Vitis*. Such are, of course, rare cases and have resulted only from certain hybrid combinations. The full extent of this disease resistance under all and varying conditions, or of the means through which it is instilled in the progeny by a considerably weaker parent, or parents, is not yet fully understood. It seems hardly probable that such uncommon healthiness can be the result of a simple recessive quality inherited from either parent, or that it is the result of hybrid vigor. A more likely solution would be that it is either the result of mutation or has come about through some peculiar conjugation of genes; wherein two negatives form a positive, so to speak. (Investigations conducted by the writer appear to indicate that the unusual resistance to disease shown in certain of these hybrids, is probably brought about through complementary additions from both parents. In the case of *Plasmopara*, resistance to initial infection appears to come from one parent, and resistance to spread of the mycelium through the tissues from the

other. In the parent forms the absence of either complement often renders the other scarcely noticeable, and of little value.) There has been much evidence in support of the latter theory.

In all events the results indicate, in contradiction to the dogma mentioned previously, that both rugged health and a high per cent of *vinifera* parentage can be attained in the same vine.

In view of this latter evidence it would appear interesting to make a re-inspection of the earlier experiments which tell such a different story. Let us see why it was that these first attempts to develop the "Ideal" hybrid grape netted so little encouragement. The American species employed in these former breeding experiments were, in order of their importance, something like this: (1) *Vitis labrusca;* (2) *V. rupestris;* (3) *V. vulpina;* (4) *V. aestivalis;* (5) *V. berlandieri.*

In the case of *Vitis labrusca*, which was the species most extensively employed by American breeders in developing American × *vinifera* hybrids, we have learned by observation, both in the vineyard and in the wild, that *labrusca* is one of the least healthy American kinds, particularly so in regard to phylloxera injury. The large size of its berries won it a place of undeserved favor with the early grape breeders, despite the fact that in many respects it is decidedly inferior to several other native American sorts. The last named kinds are more healthy than is *V. labrusca,* though from the standpoint of fruit size they have little to offer.

Still, it seems that the European experimenters who developed hybrids of these more healthy American kinds with the European grape should have received for their labors something in the way of a better Direct Producer. This would appear especially so in view of more recent findings. That they did not, obviously rests upon the fact that such was not the primary aim. In most cases the real goal of these early breeding attempts by French, Italian and German workers was to produce a healthy graft-stock upon which to graft the tender *vinifera* vine. This fact, in addition to the realization that some of the parent material we now find most promising was not then available, offers us an understanding of why the "Ideal" (American × European) hybrids were never evolved.

Selection of Parent Material Important

Perhaps it would be interesting to discuss something of the mechanics necessary in the building of the more rugged Direct Producers of the future. Since we have ample proof that high quality is easily obtainable in the American × European grape hybrid through a careful selection of parents, our one important problem is to produce this superior fruit on relatively healthy and disease-free vines. Before this can be done we must first know just what are the more important weaknesses and maladies, and how they can best be overcome. The most destructive pests toward which our so-called Ideal grapes must show a high resistance and as follows: Root Louse (*Phylloxera vastatrix*); Downy Mildew (*Plasmopara viticola*); Black Rot (*Guignardia bidwellii*); Anthracnose (*Sphaceloma ampelinum*); Ripe Rot (*Glomerella cingulata*); several leaf spot fungi, berry worms, etc. Perhaps there is no American nor European kind which can show complete immunity to all of these troubles. There are, however, several wild American species which register such high resistance as to be practically immune.

When we compare the most healthy forms of several species (*Vitis cinerea, V. vulpina, V. tiliæfolia, V. rufotomentosa, V. champini, V. cordifolia, V. argentifolia, V. æstivalis,* etc.), with the much used *V. labrusca* in the matter of resistance to Phylloxera and certain fungal diseases, the superiority of most any of the former group is apparent. That fruit size can be readily increased though breeding with large berried *vinifera* kinds has been demonstrated.

In the effort to develop a class of more healthy American × European hybrid

THE FAIRCHILD GRAPE

Figure 8

This novel hybrid shows the improvement possible through using the more healthy small-fruited American species. It is an F_1 hybrid of the Central American "uva cimarrona" (*V. ciliacfolia,* See Figure 9) and the European variety Alphonse Lavallee. Though neither sprayed or dusted it has been vigorous and healthy in a region where grape pests are unusually devastating. It is the first improved grape on record to be derived from a tropical wild species, which was introduced some years ago by the U. S. Department of Agriculture.

grapes it is of course very important to find and employ in the breeding work those vinifera varieties which combine and impart to the progeny the best disease resistant factors. In past efforts it appears that very little attention was given to this important phase of the work. As evidence of this we can cite the frequency with which the variety Black Hamburg was used as a breeding parent. It is probable that more than half of the *vinifera* blood now extant in varying degrees in most of our eastern American cultivated kinds, is of this highly Downy Mildew susceptible variety. Since several of the worst diseases of the grape were not common in Europe at the time of the major Direct Producer hybridizing efforts it is doubtful that even there much attention was given toward selecting against such troubles as Downy Mildew, Black Rot, etc.

Certain Resistant Factors in The Vinifera Type

In connection with the author's efforts at grape amelioration a test has been conducted to determine the most disease resistant and generally suitable varieties of the *vinifera* species. Within the past six years something over thirty varieties of the European grape have been sub-

A SIMPLE ARGUMENT FOR THE "DIRECT PRODUCER" GRAPE

Figure 9

The wild parent (*A*), *V. tiliaefolia,* shows dominance in the hybrid (*B*) in: leaf texture, wood texture and color, disease and insect resistance, season of principal growth, berry pulp surrounding seeds. The *vinifera* pollen parent (not shown) shows varying dominance in: leaf margin, budding date, flower self-sterility, berry size, flavor, bloom, sugar content and outer or "skin pulp"; color size and shade of seeds. Other characters are intermediate, — the hybrid being partially evergreen like its seed parent.

jected to harsh comparative vineyard tests. This group included most of the better known commercial kinds. There have also been available for observation a collection of wild and semi-wild sorts from Persia, Haiti and India. These tests have shown a wide variation in disease resistance among the *vinifera* kinds.

A few sorts, including Feher Szagos, Perle de Csaba, Gros Colman, Cabernet Sauvignon and Malaga have indicated considerable resistance to *Plasmopara* and to certain leaf-spot troubles which badly attack some American varieties. Among those varieties seriously susceptible to *Plasmopara* a difference in the manner of attack was also noted.

Upon kinds most affected by the disease, which included such well known sorts as Sultanina, Black Monukka, Black Hamburg, Flame Tokay, Rose of Peru, etc., the mildew took the form of solid patches of luxuriant growth which spread progressively in all directions until the entire organ was affected. The few points of infection which enlarged vigorously despite frequent applications of Bordeaux (applied after infection) indicated an almost complete lack of resistance to spread of mycelium through the tissues. In this case the only protection against the malady was a slight resistance against first infection.

With certain other susceptible, though less injured, kinds which included Alphonse Lavallee; Red Hanepoot, Muscat of Alexandria, etc., the manner of attack was obviously different. Here there appeared at one and the same time innumerable points of infection, each of which made little or no enlargement in size though they occurred in such great numbers as to produce much the same effect. Investigation appeared to indicate that in this case resistance was almost wholly a matter of physical or chemical obstruc-

tion to the spread of mycelium through the tissues.

Both types of resistance to *Plasmopara*, or lack of it, as observed in the *vinifera* species have likewise been found in the American wild kinds. There is indication, also, of a probable difference in the optimum conditions for infection as between certain species and varieties. This is probably directly correlated with the size, shape and/or number of the stomata openings and their response to influences of temperature and moisture.

In breeding experiments conducted by the writer these various factors of disease resistance have been combined in many ways. Some crosses have produced very susceptible progeny, and others extremely resistant. Secondary crosses have brought out these resistant factors in interesting recombinations.

Working Plans for The Better Hybrid Sorts

From a methodical evaluation of the various weaknesses to be overcome, as compared to their best relative values of resistance in the extensive breeding material available, we conclude that there is scarcely a problem in our quest for the superior Direct Producer vine which is impossible of solution. By a judicious selection and proportionment of basic parent material, combined with a rigorous campaign of selection for desired qualities in the progeny, we find that, theoretically at least, our better hybrid sorts have conquered all major obstacles. In the mind's eye we see a good sized high quality fruit, approaching *vinifera* in character, borne on vigorous, productive and self-fertile vines which are satisfactorily resistant to most all diseases and insects, including *Phylloxera*. Results so far obtained by the writer have unquestionably indicated that this ideal is well within the range of possibility, even though it has not yet been embodied completely in a single plant.

With a clear understanding of the material, knowledge and results connected with the Direct Producer attempts of former years, as compared to their equivalent today, there is much encouragement. Will the dream of the "Ideal" grape ever dawn into full reality? That question, of course, no one can answer. But there is promise in the conviction that it is yet an open question, and that there is so much which points to the affirmative.

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Biological Symposia

MORE than 160 of the nation's leading scientists and scholars, including thirty-two distinguished men and women who will be awarded honorary degrees, will report basic achievements and advances in learning in a five-day series of symposia sponsored by the University of Chicago. The learned gatherings will be held on the Midway Quadrangles the week climaxing the celebration of the University's Fiftieth Anniversary, beginning September 22.

Thirty-nine universities, including six in foreign nations, and fifteen museums, research organizations, and government agencies will be represented in the symposia. They will deal with newest fundamental advances in the biological, physical, and social sciences, the humanities, law, business, religion, and social service, in keeping with the theme of the University's celebration, "New Frontiers in Education and Research."

Symposia subjects include: aviation medicine, cancer of the lungs, the problem of overabundant evidence in historical research, cosmic rays, oil geology, social implications of vitamins, transformations in atomic nuclei, and the relations of government, the individual, and large-scale enterprise in the economy of the future.

The following are among the subjects and speakers in the symposia:

"Growth and Differentiation in Plants"—Charles E. Allen, University of Wisconsin; Edmund W. Sinnott, Yale University; John W. Mitchell, U. S. Department of Agriculture; John M. Beal, University of Chicago.

"Visual Mechanisms"—Selig Hecht, Columbia University; Ernst Gellhorn, University of Illinois; Samuel H. Bartley, Washington University; Karl S. Lashley, Harvard University, and Arlington C. Krause, Heinrich Kluver, Theodore J. Case, and Stephen Polyak, University of Chicago (Sept. 24).