Future Germplasm Reserves in Grapes

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INTRODUCTION

The current trend of tight budgets results in reduced support of man power and effort in areas of research considered to be of least importance, and the limited funds are used for programs yielding maximum results over a short term. Unfortunately, grapes and other deciduous fruits often fall victims of tightened budgets so there is not the continued, long-term effort that is necessary for perennial crops.

Lack of continuity in grape breeding programs has resulted in the loss of valuable germplasm when personnel leave or retire or when projects are terminated. One example was the abandonment of premium *Vitis* germplasm at the University of Illinois in 1968 upon the departure of Dr. Herbert Barrett from Urbana. Fortunately, some of the material was saved before the vineyards were destroyed and was placed in collections at Geneva, New York and Beltsville, Maryland.

Valuable species and cultivar germplasm have been lost from the T. V. Munson collection (5), the Joseph Fennell collection (1), and collections of other private grape breeders. Many of the pioneer breeders had clones of native species that would be difficult to replace by domestic exploration in the present day.

A workable scheme for maintaining *Vitis* germplasm for future generations is greatly needed, and it is hoped that such a program will be implemented soon to prevent any further loss of valuable germplasm.

PRESENT SITUATION

Presently there are two large collections of *Vitis* germplasm in the United States: Department of Viticulture, University of California, Davis, and Department of Pomology and Viticulture, Cornell University Agricultural Experiment Station, Geneva, New York.

Medium-sized collections include those at Clarksville, Arkansas (The Fruit Substation, Department of Horticulture and Forestry, University of Arkansas), Beltsville, Maryland (Agricultural Research Service, USDA), Vineland, Ontario (Horticultural Research Institute of Ontario, Vineland Station), Raleigh, North Carolina (Department of Horticultural Science, North Carolina State University), and Fresno, California (Agricultural Research Service, USDA). Other publicly owned collections of *Vitis* are listed in Table 1.

In addition, there are more than a dozen privately owned collections of *Vitis* such as the *Vitis rotundifolia* collection at Gay, Georgia (Owen's Vineyard and Nursery), and the French hybrid collection at Riderwood, Maryland (Boordy Vineyards).

Most of these collections are of limited acreage and face the problems of mounting costs of maintenance and scarcity of good, trained help. Even the largest collection at Davis, California does not face a bright future

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insofar as their outlook for continued support.

FUTURE NEEDS

Since grapes rank first both nationally and worldwide among deciduous fruit crops in tonnage produced we need to continue to maintain pools of germplasm of this important fruit crop.

In colonial days, when America was first settled, the woodlands and countryside were full of native grapevines. As more and more land was cleared for pasture, cultivation, and nonagricultural uses, much *Vitis* germplasm was destroyed. While there are still wild species available, the area open to domestic exploration has greatly decreased. As the trend continues our

Table 1. Principal locations of *Vitis* germplasm in publicly owned institutions in North America.

Type of germplasm	Principal locations[a], with an asterisk by largest collections
French hybrids	Davis*, Geneva*, Vineland, Beltsville, Clarksville, Wooster, Raleigh
American hybrids	
(varieties)	Davis*, Geneva*, Beltsville*, Vineland, Clarksville, Raleigh, Wooster, Mtn. Grove, Clemson
(selections)	Geneva*, Vineland, Clarksville, Raleigh, Beltsville, Leesburg, Experiment, Brookings
Vitis vinifera	
(varieties)	Davis*, Fresno, Beltsville, Clarksville, Raleigh, Geneva
(selections)	Davis*, Fresno, Beltsville
V. rotundifolia	
(varieties)	Raleigh*, Davis*, Experiment, Leesburg, Clarksville
(selections)	Raleigh*, Experiment*, Leesburg
Euvitis x *rotundifolia*	
(selections)	Davis*, Raleigh*, Experiment, Clarksville, Leesburg
Rootstocks	
(varieties)	Davis*, Fresno, Beltsville, Clarksville, Geneva, Raleigh
(selections)	Davis*, Fresno*, Leesburg, Beltsville
Univ. of Ill. collection	Geneva*, Beltsville*, Clarksville
Vitis species	Davis*, Clarksville*, Beltsville, Raleigh, Geneva, Lubbock, Brookings
Other genera *Vitaceae*	Davis*, Beltsville

[a]Key to locations: Beltsville (Dr. J. R. McGrew, ARS, USDA, Beltsville, Md.)
Brookings (Dr. R. M. Peterson, Dept. of Horticulture, South Dakota State Univ., Brookings, S. Dak.)
Clarksville (Dr. J. N. Moore, Dept. of Horticulture, Univ. of Ark., Fayetteville, Ark.)
Clemson (Mr. H. J. Sefick, Horticulture Dept., Clemson Univ., Clemson, S. C.)
Davis (Dr. H. P. Olmo and Dr. L. A. Lider, Dept. of Viticulture and Enology, Univ. of Cal., Davis, Cal.)
Experiment (Dr. R. P. Lane, Dept. of Horticulture, Ga. Agr. Exp. Sta., Experiment, Ga.)
Fresno (ARS, USDA, 2021 South Peach Ave., Fresno, Cal.)
Geneva (Dr. Robert Pool, Dept. of Pomology and Viticulture, N. Y. Agr. Exp. Sta., Geneva , N. Y.)
Leesburg (Dr. J. A. Mortensen, Univ. of Fla. Agr. Res. Center, P. O. Box 388, Leesburg, Fla.)
Lubbock (Dr. M. C. Fuqua, Tex. Agr. Exp. Sta., Lubbock, Tex.)
Mountain Grove (Dr. K. A. Hanson, Mo. Fruit Exp. Sta., Mtn. Grove, Mo.)
Raleigh (Dr. W. B. Nesbitt, Dept. of Horticultural Science, N. C. State Univ., Raleigh, N. C.)
Vineland (Mr. O. A. Bradt, Horticultural Research Institute of Ontario, Vineland, Ontario, Canada)
Wooster (Dr. G. A. Cahoon, O.A.R.D.C., Wooster, Ohio)

future needs for native species germplasm must increasingly be supplied from germplasm collections.

Future needs for foreign plant introductions of *Vitis* will continue strong, both from foreign evplorations and from active foreign grape breeding programs. An example of successful introductions are the French hybrids, which have had a profoundly favorable effect on viticulture in this country.

When a new grape variety is released, it may become important commercially and be maintained by nurseries; or it may not be as popular and tend to disappear from cultivation because the nurseries cannot afford to maintain it. The latter type variety often has a place in germplasm collections because of breeding potential even though it might not have all the qualities necessary for commercial importance (e.g., the Munson varieties).

Certain species have greater genetic vulnerability than others. *Vitis vinifera* L. is susceptible to Pierce's disease, fungus diseases, insects, nematodes, phylloxera, winter injury, etc. Yet most of the grapes produced in this country are cultivars of this species. In contrast to this are native American species, including muscadine grapes, with more or less resistance to each of the problems mentioned above. Future needs for resistance to the above problems and others make germplasm maintenance imperative.

MAINTAINING GERMPLASM

While each grape breeder necessarily maintains a clonal repository, few have adequate time, space, labor, and financial support to maintain a sizable collection of *Vitis* germplasm. Rather than establish additional repositories, we need to strengthen, support, and expand existing repositories. The Uinversity of California, Davis, which has the largest *Vitis* repository, is facing problems in continued maintenance of the extensive and valuable collection comprising 11.5 acres (Table 2). Quoting from Dr. Lloyd Lider (4):

Table 2. Summary of grape germplasm collections maintained at University of California, Davis, as of June, 1974[a].

Type of germplasm	No. of different clones
French hybrids	337
American hybrids	294
Vitis vinifera Table	320
Wine	506
Tetraploids	121
V. rotundifolia cultivars	61
Interspecific hybrids	312
Rootstock cultivars	56
Russian collection (table and wine)	30
Mexican species	61
Vitis species (37 different species)	339
Other genera *Vitaceae*	40
Breeding selections on hold (fluctuates)	704
Total	3181

[a]Information from personal correspondence with Dr. H. P. Olmo, University of California.

"We are currently much concerned about the efforts involved to maintain these collections. Much of the old-line material has virus infections and at this time we are in the midst of making a move to an entirely new vineyard area on the campus and have set a basic ground rule that *no* infected, or non-indexed, vines will be moved to the new planting. To heat therapy even a fraction of this material would be most costly in both time and money."

Similar concern was expressed by Dr. H. P. Olmo (6) that

"We have been sending materials to many states and countries free of charge. It appears that many of our collections will be lost unless (1) we charge a fee for supplying materials or (2) some long term federal support is obtained."

While one-year federal grants have been obtained, there is a need for long term grants for the larger existing collections of *Vitis* in the United States. Funds normally provided by the state are not adequate to meet the mounting maintenance costs, and long-term federal assistance would assure future maintenance of these germplasm reserves.

Valiant efforts by private citizens have been made in recent years in assembling and maintaining many of the T. V. Munson grape varieties. However, few if any of these individuals can afford to maintain a large collection of *Vitis*, and most of the collections they now maintain will probably not survive much longer than the individual responsible. The R. W. Munson Foundation of Denison, Texas, is preparing to establish the T. V. Munson Memorial Vineyard, a more lasting effort comprising 5 to 10 acres.

A computerized grape germplasm resources inventory as suggested by Fogle and Winters (2) offers a possible solution for maintaining current inventories of what is available in the various *Vitis* collections. Classification of the material, where feasible, as to its winter hardiness, resistance to black rot, downy mildew, powdery mildew, anthracnose, bitter rot, ripe rot, fruit cracking, Pierce's disease, phylloxera, nematodes, grape leaf folder, grape leaf hopper, grape leaf skeletonizer, and other pests would be extremely valuable. Rootstock cultivars, in particular, could be rated for their resistance to nematodes, grape root borer, phylloxera, drouth, alkaline soil, salinity, and root rot. Characteristics of fruit and wine would also be helpful. Information from breeders and variety evaluations could be added to the computerized system and greatly increase the amount of information available for each entry.

Maintaining grape seeds at the National Seed Storage Laboratory might be feasible for wild species. However, care should be taken to control the pollinations giving rise to the seed, since *Vitis* species intercross freely.

SPECIAL CONSIDERATIONS

Vitis vinifera L. cultivars are all susceptible to Pierce's disease and to most of the fungus diseases occurring in humid areas. The relatively arid climate of California provides the best locations for maintaining germplasm of this species. *Vitis labrusca* L. cultivars are also susceptible to Pierce's disease and are more at home at northern latitudes such as New York because of their winter hardiness. When it becomes important to maintain either of the above species in a Pierce's disease area such as Florida it is necessary to use screen enclosures to exclude the insect vectors of Pierce's disease or resort to antibiotic drenches on a regular basis (3).

Species native to subtropical and tropical regions (e.g. *Vitis caribaea*) lack the hardiness to survive the win-

ters or to ripen properly at colder latitudes. Special protection such as a greenhouse is necessary where it is considered important to maintain the cold-tender cultivars in cold areas.

Quarantine restrictions on foreign plant introductions rightfully require that material be free of viruses before beign distributed within the country, but sometimes years of delay are involved. The use of heat therapy speeds up the process of getting virus-free germplasm to the breeder, but there is a limit to the number of items that can be handled feasibly.

CONCLUSIONS

In view of the restricted budgets presently limiting the maintenance of germplasm collections, a relatively conservative approach in planning for long term maintenance is more likely to receive funding than an expensive or elaborate plan for which supporting funds may be withheld or delayed in coming. The following needs should be considered:

1) Strong, low-term, federal support to the larger *Vitis* collections now in cultivation.

2) Continued federal foreign plant introduction program for *Vitis* and *Vitis* relatives.

3) Renewed emphasis on domestic exploration, with federal and state supporting funds for those involved in collecting and propagating wild grape species in North America.

4) Until a computerized system is available, we should promote germplasm preservation every two years at the North American Grape Breeders Conference with each breeder bringing updated lists of his germplasm holdings to the conference. A coordinator for *Vitis* germplasm lists should be elected by the group.

5) While the Small Fruit Exchange Committee of the American Pomological Society has promoted free exchange of pollen, cuttings, or plants of *Vitis* germplasm among breeders, few grape breeders make use of this vehicle. Notwithstanding, there has been good cooperation between grape breeders in exchange of materials, and this should continue in the future.

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