small seeds similar in size to figs or strawberries are preferred. There exists a great deal of genetic variation for seed size in blackberries and much attention is given to this character in choosing breeding parents and selections. One promising cross, 'Whitford Thornless' X 'Flordagrand', has produced seedlings with numerous, high quality, small-seeded fruit.

FUTURE OUTLOOK

The bramble program in Florida has been unique in that adapted cultivars have been developed mainly for fresh fruit outlets. The newer cultivars have large, attractive fruit that ripen in April and early May, a time when few fresh fruits are available in major market centers. Blackberries have a short shelf life, therefore, these fruits have had greatest success in customer-pick operations and local markets. Characteristics not favorable for processing the present Florida cultivars including trellising, low soluble solids (9-10%) and low yields 1-2 T/acre).

For blackberries to become a major crop in Florida, superior cultivars with higher soluble solids and larger yields must be developed through breeding. Desirable characters such as large, firm fruit with small seed, thornlessness, uprightness and disease resistance can be introduced into selections and recombined until new selections are worthy of being named.

Selections of *Rubus* adapted to growing and fruiting under the climatic conditions of Florida should be tested in sub-tropical areas at 1200 to 1800 m elevation. The only known blackberry cultivation in the subtropics is that of *R. glacus* at somewhat higher elevation (1).

SUMMARY

Seventeen years of *Rubus* breeding in Florida have resulted in two trellising varieties of very low winter-chilling requirements suitable for local markets. Genes for thornlessness, uprightness, higher fruit quality and smaller seed have been introduced into the germplasm at the diploid level. Additional breeding for higher soluble solids, larger yields and adaptation to mechanical harvesting will be necessary to make low-chilling requirement varieties competitive with established producing areas in the United States.

The breeding lines and varieties developed in Florida may be worthy of trial in other sub-tropical areas at suggested elevations of 1200 to 1800 m.

Fifteen or more years are normally required from the initial successful cross to establish the first commercial plantings of a previously static crop. The practical application of genetical tools has produced results rather quickly in adapting the brambles to a subtropical climate.

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BREEDING GRAPES FOR CENTRAL FLORIDA[1]

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The most successful grape growing areas of the world are those in which little rain falls during the ripening period of the fruit. Abundant rains during this period promote disease, cracking and rotting of berries, and watery grapes of inferior quality (39). In Florida the time of ripening for grapes is June to September, which is also the time of most frequent rainfall. Since *Vitis vinifera* L. is highly susceptible to the diseases that accompany summer rainfall, new disease-resistant cultivars are needed with fruiting characters competitive with *V. vinifera*. Sources of such resistance in *Vitis* are found in both subgenera: *Muscadinia* (muscadine type) and *Euvitis* (bunch type) (1).

Three categories will be considered in the breeding of grapes: *Euvitis* breeding, *Muscadinia* breeding, and *Euvitis* x *Muscadinia* breeding. The purpose of this paper is to discuss each as they apply to developing new varieties for central Florida.

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HISTORY OF RESEARCH

Euvitis breeding

The cultivation and selection of seedlings has been practiced for many centuries in the species *Vitis vinifera* L. This has produced a highly variable species with which to breed, including many cultivars of high fruit quality. *V. vinifera* was first introduced into Florida by early Spanish settlers, and many cultivars have been tried since that time. None of them survived long enough to be profitable here because of their susceptibility to diseases (41).

V. labrusca L. cultivars from northern states were later grown in Florida extensively, but longevity and disease resistance were lacking. Greater longevity was obtained from T. V. Munson's hybrids of *V. lincecumi* Buckley x 'Triumph', and as many as 5,000 acres were planted in the 1920's in central Florida (36, 49). Vaile (50) tested 41 of Munson's hybrids in Arkansas, but only 2 could withstand shipment to distant markets: 'Carman' and 'Extra'. The same 2 cultivars were satisfactory market grapes for many years in Florida (49). However, even Munson's hybrids eventually became weak and unproductive from a disease later found to be largely caused by Pierce's disease virus (9, 45, 46).

Munson's success in using native Texas species as breeding parents stimulated private viticulturists in Florida to begin breeding with native Florida species as parents. In 1927, Demko (Altoona, Florida) began hybridizing American cultivars with Florida native species such as *V. simpsoni* Muns. He developed 3 self-fertile cultivars: 'Dunstan', 'Taylor', and 'Florida Concord' (8), but none have competed commercially. In 1936, Fennell began breeding with *V. rufotomentosa* S., *V. gigas* Fenn., *V. tiliafolia* H. & B., *V. sh ·ttleworthi* House, and *V. smalliana* Bailey as wild parents (22, 24). He developed 'Biscayne', 'Fairchild', 'Marco', 'Tropico', 'Wachula' (6), 'Everglades', 'Largo', 'Masters', and 'Tamiami' (7). 'Tamiami', a tremendous producer, was grown in Florida to some extent during the late 1950's, but eventually succumbed to Pierce's disease. The others were either lost or of no importance commercially.

In 1945 at the Watermelon and Grape Investigations Laboratory, Stover crossed the native 'Pixiola' (*V. simpsoni*) with 'Golden Muscat', which gave rise in the F_1 progeny to 'Lake Emerald' (47). Subsequent breeding by Stover, using *V. smalliana, V. simpsoni,* and *V. shuttleworthi*, led to the release of 3 other bunch grapes: 'Blue Lake' (48), 'Norris' (35), and 'Stover' (34). All 4 new cultivars were resistant to Pierce's disease, and form a basis for expanded bunch grape plantings in Florida, as well as a foundation for further breeding.

Breeding *Euvitis* for warm climates is also under way in Brazil, South Africa, and India. Santos Neto has since 1950 developed several new scion and rootstock cultivars adapted to the subtropics of Brazil (42), using species similar to those used by Fennell. Evans has developed cultivars for the summer rainfall area of the Republic of South Africa (20), using primarily *V. labrusca* and *V. vinifera* as parental species. *Euvitis* cultivars are now produced commercially in tropical regions of India, though the vines do not become dormant there (3). The principal species is *V. vinifera*, with 1 cultivar of *V. labrusca* parentage. By scheduled pruning twice a year, yields of 15 to 20 tons per acre are common (3). Growers in Colombia also produce *V. vinifera* cultivars with 2 crops a year. This suggests that winter chilling is of much less consequence in *V. vinifera* than in other deciduous fruits. In central Florida there is adequate chilling every winter for both subgenera of *Vitis*.

Increased berry size by the production of colchiploids for breeding at the tetraploid level was described (11, 14), but none of the colchiploids grown at Leesburg have been as vigorous or productive as the respective diploids. Diploid and tetraploid inbreds in S_1 and S_2 have been weak in vigor with small leaves and short internodes. Their value has been mainly for inheritance studies rather than cultivar improvement. Florida *Euvitis* cultivars have been evaluated for table quality through taste panels held in connection with the Florida Grape Grower's Association. Evaluations for processing potential have been investigated by the Food Science Dept. (5).

Muscadinia **breeding**

The *Vitis* subgenus *Muscadinia* is distinguished from subgenus *Euvitis* in having closely adherent bark, continuous pith through the nodes, unforked tendrils, and generally greater resistance to diseases, phylloxera, and nematodes than *Euvitis* cultivars. Three species are described in the literature: *V. rotundifolia* Michx. native to the Southeast, *V. munsoniana* Simp. native to central and south Florida, and *V. popenoei* Fenn. (21) from Mexico.

Older cultivars of muscadine originated as female selections of *V. rotundifolia* from the wild. In 1907, the USDA made a cross in a commercial Florida vineyard that gave rise to the first recorded self-fertile muscadine seedling. *V. rotundifolia* cv. 'Eden' was crossed with a native Florida male selection of *V. munsoniana*, and the seedlings were grown in North Carolina (10). 'Tarheel', one of the outstanding self-fertile cultivars used in breeding for larger clusters, was a derivative of this early *rotundifolia-munsoniana* hybrid (32, 52).

Conducting an active breeding program for improvement of muscadines since 1909, the Georgia Agr. Expt. Sta. has released a number of superior cultivars adapted to central Florida. Fry (25) used gamma irradiation to double the chromosome number of *V. rotundifolia* cultivars, obtaining increases in berry size. Phenomenal increases in berry size were obtained at the diploid level by using 'White Male', a diploid non-bearing *V. rotundifolia* selection, in the parentage (27).

Loomis bred muscadines between 1941 and 1965 at the U. S. Horticultural Field Station, Meridian, Mississippi. Two of the most outstanding self-fertile varieties in central Florida originated from his work: 'Southland' and 'Magoon' (31).

Beginning with early work of Reimer and Detjen (40), the North Carolina Exp. Sta. has conducted breeding and research with *V. rotundifolia.* In the past 25 years, new self-fertile cultivars have been released that have performed well in trials at the Watermelon and Grape Investigations Laboratory (2, 52).

With superior cultivars of *Muscadinia* introduced to Florida from other states, the emphasis of Florida work has been to test these for vigor, yield, suitability for mechanical harvest, quality, disease resistance, and processing potential (2, 5).

Euvitis x *Muscadinia* **breeding**

The 2 subgenera of *Vitis* differ morphologically, in specific gravity of the wood (51), and in chromosome number: 38 in *Euvitis* and 40 in *Muscadinia* (43). The disease susceptibility of most *Euvitis* cultivars in a humid, subtropical environment stands in sharp contrast to the resistance of *Muscadinia* in the same environment. However, crossing the 2 subgenera has led to sterility problems, and the history, begun over 100 years ago, has been reviewed (38). The hybrids had 39 chromosomes (19 *Euvitis* and 20 *Muscadinia*), and were almost completely sterile due to abnormal pairing and irregular distribution of chromosomes (38). This supports Bailey's classification of *Muscadinia* as a separate subgenus from *Euvitis* (1). Patel and Olmo were not able to obtain fertilization when *V. rotundifolia* was used as the female parent, even though *V. vinifera* pollen tubes grew down the style and sometimes into the micropyle of the muscadine pistils. The reciprocal cross was readily made, but the backcross progeny of the hybrids lacked vigor (38).

Dermen (12) restored fertility to sterile *Euvitis* x *Muscadinia* F_1 hybrids by doubling the chromosome number with colchicine. He obtained segregation of characters from both species by intercrossing the doubled F_1 hybrids at the 4x level (13). Crossing 4x *Euvitis* female with 4x *Muscadinia* male was successful, but not the reciprocal (30).

Two diploid hybrids (2n=39) of historical interest originated in North Carolina about 1916. One was N.C. 6-15, a cross between an open-pollinated 'Malaga' seedling (*V. vinifera*) and an hermaphrodite *V. rotundifolia* (15). The other was a cross of a *V. rotundifolia* female with 'Black Morocco' (*V. vinifera*), known as N. C. B4-50 (10). Both hybrids were largely sterile and unpromising, but during the 1950's Dunstan (16) obtained fruit and viable seed from N.C. 6-15 by applying abundant pollen from several *Euvitis* cultivars on the open-pollinated flower clusters. The majority of his seedlings were weak, but some (2n=38) showed marked heterosis and normal ovule fertility. He made further backcrosses of one of these fertile seedlings to both *Euvitis* and *Muscadinia*, obtaining fruitful progeny with segregation of genes at the diploid level (17, 18). The other hybrid, N.C. B4-50, was the grandparent (through open-pollinations) to Farrer 30, which produced fertile diploid seedlings when Fry (26) crossed it with *Muscadinia* female cultivars.

In contrast to the earlier report of sterility (38), several recent F_1 hybrids involving different cultivars of *V. vinifera* as the maternal parent were partially fertile (28). There was a correlation between chromosomal pairing and fertility of the hybrid. Diploid backcrosses of the F_1 hybrids to *V. vinifera* ranged from completely sterile seedlings to others as fertile as standard varieties. Segregation for *V. rotundifolia* characters such as fruit quality, flavor, type of bark, diaphragm, and size of flower clusters was observed in the backcross progeny (29).

PRESENT PROGRAM

Euvitis **breeding**

The following *Euvitis* species are native to Florida: *V. cordifolia* Michx., *V. gigas, V. rufotomentosa, V. shuttleworthi, V. simpsoni,* and *V. smalliana.* Better selections from the last 3 species were the sources of disease resistance used to combine with the desired fruit characters found in *V. vinifera* and *V. labrusca* cultivars. Since the chromosome number is 38 for all the above species, little difficulty has been encountered in crossing them and obtaining fertile progeny.

Since the F_1 hybrids strongly resemble the native parent, better selections are backcrossed to the cultivar with desirable fruit. Where a *V. vinifera* cultivar is the recurrent parent there is a high degree of susceptibility to anthracnose, downy mildew, and Pierce's disease among the progeny. For this reason the double cross, or intercross of selected F_1 hybrids, is often used to maintain disease resistance in the progeny and still obtain segregants with recessive fruit traits such as firm texture and large cluster size. Outstanding segregants that complement each other in desirable traits are frequently intercrossed, especially if their original sources of disease resistance stem from different native species.

In considering the overall strategy of the breeding program it seemed desirable to determine which crosses have produced the highest percentage of outstanding selections. The 20 outstanding crosses between 1945 and 1965 are given in Table 1. At first glance, it might seem desirable to repeat these 20 crosses with larger populations in order to be reasonably sure of obtaining outstanding progeny. However, the breeding objectives at the present time are more advanced and more difficult to attain than they were at the start of the breeding program in 1945.

Our present breeding objectives are as follows: (a) vigorous, long-lived vines, with resistance to diseases of vine and fruit (especially Pierce's disease, anthracnose, black rot, ripe rot, bitter rot, and downy mildew); (b) self-fertile flowers; (c) productivity and adaptability to mechanical harvest; (d) uniformly ripening berries on large clusters that hold well on shelf or in cold storage without pedicel drying or shelling.

Table cultivars should ripen in June, before California grapes are available in sufficient quantities to depress market prices. Seedlessness, crisp texture, attractive appearance, and good eating quality are other desired objectives.

Juice cultivars should have a color and flavor resembling 'Concord' in the processed product. Several varieties that ripen in June, July, and August are desired so that commercial citrus juicing facilities, which are relatively idle at that period of the year, can process grapes over a prolonged harvest season.

None of the 20 crosses in Table 1, even if repeated in larger populations, would yield progenies that produce early, seedless, firm-textured fruit. For early, firm-textured table types with seeds, the following could be repeated: W1521 x 'Perlette', W1521 x 'Alden', C5-49 x 'Exotic', and B3-90 x 'Exotic'. For early, slipskin types: 'Norris' x 'Schuyler' and 'Norris' x 'Alden'. For juice or all-purpose slipskin types resembling 'Concord', the 'Blue Lake' x 'Concord' and 'Norris x 'Concord' could be repeated. Intercrosses involving 'Concord' as grandparent on both sides show considerable promise in juice types. For seedless, firm-textured types, new combinations are being explored using seedless male parents crossed with seeded female parents, the latter having seedless parentage.

A replicated yield test consisting of 6 newer selections (none seedless) is under way at 3 locations in Florida (Table 2). Seedless selections to date are too small in berry size to merit trial.

Muscadinia breeding

For satisfactory commercial production in Florida we need muscadines resistant to Pierce's disease and several fungus diseases. Certain newer cultivars, though improved in self-fertility, berry size, or quality, have greater susceptibility than older ones to specific diseases. Improved resistance to drouth and greater vigor during years of establishment is needed in Florida's well-drained, sandy soils. High labor costs in harvesting demand that newer varieties be suitable for mechanical harvest. Some cultivars shake readily with dry stem scars on the berries, while others are too tenacious when shaken, tearing the berries.

Sixty muscadine entries now under trial at the Watermelon and Grape Investigations Laboratory include 24 named cultivars, 6 USDA selections, 9 Ga. Expt. Sta. selections, 18 N.C. Expt. Sta. selections, and 3 *V. munsoniana* selections. Several of these can be recommended for Florida growers (2).

With active breeding programs elsewhere in the Southeast, relatively few crosses among *Muscadinia* are being made in Florida. Zehnder, a private breeder in South Carolina, saved open pollinated seeds from Fennell's 3-way hybrid [(*V. rotundifolia* x *V. muns.*) x *V. popenoei*], and the seedlings grown in Florida had highly flavored fruit on vigorous vines. *V. munsoniana* cv. 'Marsh', selected from the wild in Central Florida because of its uniform cropping and early bud burst, has been extremely healthy and vigorous. Crosses were made to outstanding self-fertile cultivars of *V. rotundifolia* in order to improve berry size, quality, self-fertility, and suitability for mechanical harvest.

Euvitis x *Muscadinia* breeding

Most *Euvitis* x *Muscadinia* hybrids tested in central Florida are not long-lived, primarily due to susceptibility to Pierce's disease. A notable exception is Dunstan's *V. rotundifolia* backcross hybrid DRX 64-69. It is resistant to Pierce's disease and anthracnose, traits derived from the muscadine parent (Ga. 14-20), and it crosses readily with either *Euvitis* or *Muscadinia*. A number of *Euvitis* cultivars have been crossed with it to incorporate the muscadine-type resistance into the progeny.

Recent tests for resistance to Pierce's disease in 15 *Euvitis* backcrosses [([*Euvitis* x *Muscadinia*] x *Euvitis*) x *Euvitis*] were conducted at Leesburg in cooperation with the Cal. Agr. Expt. Sta. While most were susceptible, 2 selections (Cal. e2-82 and Cal. e5-17) appeared resistant. If so, this is another example of transfer of resistance to Pierce's disease from *Muscadinia* to *Euvitis* type progeny.

Ga. 7-2, an intercross between 2 *Euvitis* backcrosses, was vigorous and resistant to Pierce's disease, though highly susceptible to anthracnose. In this instance it is not clear whether the resistance came from the *V. rotundifolia* parent of N.C. 6-15 or from *Euvitis* male *V. cinerea* Engelm.

FUTURE OUTLOOK

The future expansion of a grape industry in Florida depends on the development of new cultivars adaptable to mechanical harvest. Combining the desirable traits of earliness, seedlessness, firm texture, and disease resistance requires carefully planned crosses and, ideally, large populations.

The most rapid success in developing new cultivars will likely come from breeding at the diploid level within the separate subgenera *Euvitis* and *Muscadinia*. The recombination of the best traits of bunch grapes with those of muscadines is more long range. Based on his backcross progenies at North Carolina and those of Dunstan and Olmo, Nesbitt (personal correspondence, 1970) believes that the use of intersubgeneric hybrids and their backcross progenies at the diploid level has much potential for transferring specific genetic traits from one subgenus to the other in *Vitis*. However, he found that breeding intersubgeneric hybrids at the tetraploid level was less promising, and hexaploid hybrids were too weak to study further.

It appears that elimination of tough skin and pulp are more difficult in breeding *Euvitis* x *Muscadinia* than in *Euvitis* alone, especially if disease resistance is to be preserved. Dunstan (19) reported large blossom clusters in certain F_1 progenies of *Euvitis* x *Muscadinia*, suggesting that a broader base of species and varieties be used in both subgenera in order to exploit horticultural potential. The Muscadine type of resistance to Pierce's disease may be of a higher

Table 1. The 20 best crosses made between 1945 and 1965, based on percentage of outstanding selections.

Parentage of cross	Year made	Outstanding selections	No. progeny grown	% of progeny selected
W1521 x S.V. 12-375	1958	C5-48, C5-50	3	66.7
W1521 x Aurelia	1965	E18-63	4	25.0
W1001 x S.V. 12-375	1957	B3-83, B3-90	16	12.5
W1521 x Alden	1963	E8-48, -52, -70	27	11.1
W1521 x Perlette	1964	F10-18	9	11.1
C5-50 x Exotic	1964	F5-8, 19, 27	28	10.7
W987 x Lake Emerald	1956	Norris	10	10.0
B3-90 x Exotic	1964	F4-11, 16	24	8.3
Norris x Alden	1964	F8-21, 23, 35	37	8.1
Fla. 43-47 x Caco	1950	Blue Lake	14	7.1
Mantey x S.V. 12-309	1956	Stover	17	5.9
C5-49 x Exotic	1964	F4-36, F4-65	37	5.4
Blue Lake x Concord	1961	D5-167	19	5.3
Pixiola x G. Muscat	1945	Lake Emerald	20	5.0
Norris x Stover	1963	E14-29	21	4.8
Norris x Schuyler	1961	D4-176, D5-10, 21, 68, 71	108	4.6
Norris x Concord	1963	E11-40	23	4.3
Dunstan 210 x Mantey	1963	E8-31	39	2.6
Fla. 43-47 x G. Muscat	1948	W716	56	1.7
Fla. 43-47 x Concord	1963	E12-59	59	1.7

Table 2. Characteristics of 6 new selections compared with 4 cultivars previously released.

Selection no.	Date ripe	Color	Texture	% sugar
D4-176	July 10	Purple	Slipskin	19.2
E8-52	July 20	Green	Slipskin	21.2
E11-40	July 12	Purple	Slipskin	19.2
E18-63	July 16	Golden	Slipskin	18.8
F4-16	July 18	Red	Firm	19.2
F4-36	July 8	Red	Firm	20.8
Lake Emerald	July 30	Green	Slipskin	20.5
Blue Lake	July 16	Purple	Slipskin	16.1
Norris	July 24	Purple	Slipskin	17.5
Stover	July 6	Golden	Slipskin	17.5

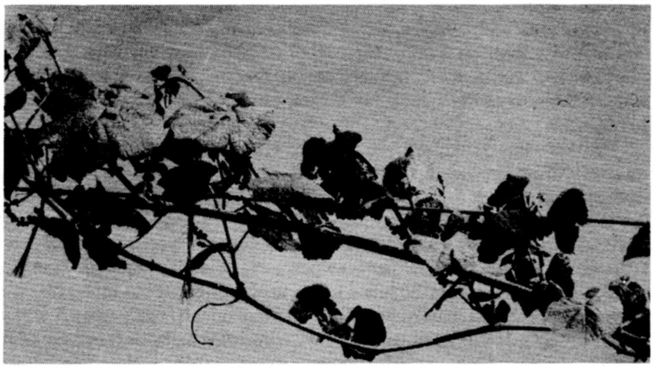

Fig. 1. Healthy spring growth on 'Blue Lake', a cultivar resistant to Pierce's disease.

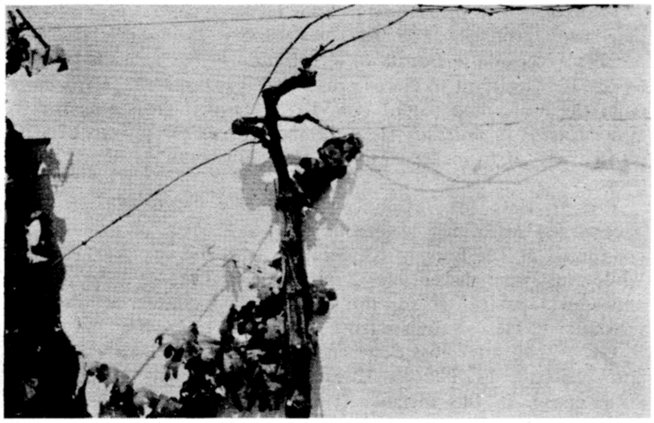

Fig. 2. Pierce's disease symptoms of cane dieback and trunk sprouting on 'Tamiami', a cultivar susceptible to Pierce's disease.

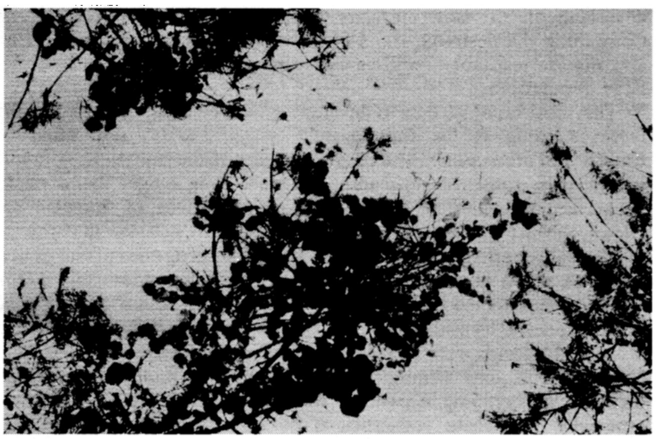

Fig. 3. 'Pixiola', a native selection from Florida woodlands, was used as a source of resistance to Pierce's disease in the program.

Fig. 4. Selection F4-54, a recent selection with apparent resistance to Pierce's disease.

level than that from native *Euvitis*. Combination of both types of resistance should be attempted, as it may give rise to a more permanent type of resistance that is less subject to breakdown under an intensive grape culture in Florida. See Fig. 1-4.

Techniques for testing larger populations from crosses will be needed. Rapid screening tests for resistance to diseases, such as that reported by Barrett (4) for black rot, would be helpful. Many susceptible segregants could thus be eliminated prior to transplanting to the vineyard. As many as 87% of the seedlings in certain crosses may be susceptible to Pierce's disease, even though one parent is resistant (33). Many of them might be eliminated early by a screening test with viruliferous insect vectors or other means. The same might be accomplished for anthracnose resistance.

Shortening the time between generations is another worthwhile objective. The usual period from pollination until nursery seedlings are large enough for vineyard setting is 18 months. An additional 18 or 30 months in the field may be required before seedlings come into bearing. New techniques that take advantage of the long growing season and mild winters of Florida should be developed. The use of budding (44), partial shade, black polyethylene mulch, and liquid fertilizers may hasten the time from seed to fruit. Exchange of pollen among grape breeders, pollen storage (37), and timed grafting of pollen source (23) also may expedite the breeding program.

Better objective tests for measuring suitability for mechanical harvest, seedlessness, and size of cluster and berry should also be developed.

Obtaining grape cultivars adapted to humid subtropical climate, resistant to diseases, and of competitive quality and appearance is a challenging endeavor that has begun to bear fruit. The future should bring marked improv e ments in grape cultivars.

SUMMARY

Since requirement for winter chilling is not as critical in *Vitis* as in other deciduous fruits, the principal emphasis in breeding grapes for central Florida has been on the incorporation of disease resistance into commercially acceptable types of *Euvitis*. Florida native *Euvitis* species, especially *V. simpsoni, V. smalliana,* and *V. shuttleworthi,* have been superior to others as sources of disease resistance.

Early ripening, seedlessness, firm texture of fruits, and resistance to the diseases prevalent in Florida have been difficult to combine. Intercrossing selected F_1's that complement each other in desirable traits, or that carry masked recessives of desired traits, has been better than backcrossing to pure *V. vinifera* in most cases.

Methods of expediting the breeding program by growing larger populations, earlier screening for disease resistance, shortening the time between generations, and by free interchange of pollen and wood among breeders were discussed.

Recent *Euvitis* x *Muscadinia* backcross progenies of DRX 64-69 to *Euvitis* show promise of recovering *Muscadinia* levels of resistance to Pierce's disease and possibly to anthracnose in *Euvitis* cultivars. This source of resistance may supplement or be superior to that from native *Euvitis* in future progenies.

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BREEDING PEACHES FOR WARM CLIMATES

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The peach as an item of commerce has developed primarily in the temperate regions of the world, the equatorial boundaries being limited by minimum accumulated chilling temperatures and the polar boundaries by minimum winter temperatures. Native temperate climate peaches contained combinations of desirable characteristics with which suitable cultivars could be developed with relative ease. Among such characteristics large fruit size, suitable acid-sugar ratio and flesh firmness are particularly important in commercial varieties.

Peaches adapted to relatively mild winters in their wild state were distributed to various world areas just as were the types more suited to temperate climates (10). But, because the mild-winter peach types produced small, poorly shaped, soft fruit with a honey-sweet flavor, they have been unsuited for commercial production. During the last 2 decades interest in commercial peach cultivars for mild-winter areas has increased because fruit produced in these areas can be marketed before that produced in the temperate regions (Table 1). Also, interest in producing high-quality peaches is increasing in some countries that do not receive adequate accumulations of chilling temperatures to grow traditional temperate-region cultivars. Among areas having mild winters where peaches are grown include Brazil, Egypt, Hawaii, India, Paraguay, Venezuela, Columbia, Ecuador, Guatemala, South China, Argentina, Australia, Italy, South Africa, Mexico, and the United States (22). A number of programs have been established to combine low-chilling requirement with the desirable fruit and tree characteristics of the temperate-region cultivars.

Table 1. Comparative bloom and harvest dates of some Florida peach cultivars at Rialitos, Texas, a 400-hr chilling area.

Cultivar	Avg 1st bloom date	Harvest date
Flordasun	January 23-31	April 21-30
Sunred	January 23-31	May 1-7
Early Amber	February 5-10	May 10-20

HISTORY OF BREEDING AND PRESENT PROGRAMS

Two principle kinds of peaches, 'Honey' and 'Peen-to', have been used in breeding to obtain adaptability to mild winters, the former being far more extensively used as a breeding parent. Both types originated in South China. The 'Honey' peach was first introduced into the U.S. in 1850 as seed imported by Charles Downing of Augusta, Georgia. It is characterized by soft-melting, white flesh, a honey-sweet flavor, and oval fruit with a pronounced, recurved apex. The 'Peen-to' fruit is highly compressed in its longitudinal axis, being much shorter on this axis than on the transverse axis. Both are described in detail by Hedrick (10).