10. Taylor, J. B., and J. N. Joiner. 1959. Vegetative propagation of *Fejoa sellowiana* and *Rhodomyrtis tomentosa* as affected by various combinations of 3-indolebutryic acid, arginine, sucrose and thiamine. Proc. Fla. State Hort. Soc. 72:366-368.
11. Young, M. J. and Julian Sauls. 1979. Propagation of Fruit Crops. Inst. Food and Ag. Sciences. Fla. Coop Ext. Services circ. 456.

Proc. Fla. State Hort. Soc. 94:328-331. 1981.

SYMPOSIUM: GRAPES IN FLORIDA
GRAPE CULTIVAR TRIALS AND RECOMMENDED CULTIVARS FOR FLORIDA VITICULTURE[1]

JOHN A. MORTENSEN
University of Florida, IFAS, Agricultural Research Center, P.O. Box 388, Leesburg, FL 32748

C. P. ANDREWS
University of Florida, IFAS, Agricultural Research Center, Rt. 4, Box 263, Monticello, FL 32344

Additional index words. Breeding, *Vitis.*

Abstract. **Replicated muscadine grape trials at 3 locations (Ft. Pierce, Leesburg, Monticello) were conducted from 1972, 1974, and 1976, respectively, to date. 'Noble' yielded well at all locations . Fresh fruit taste panels held each year placed 'Noble' fairly low, but processing tests indicated good wine and juice potential. 'Sugargate' rated above all other black muscadines in taste, but yields were too low. 'Fry' and 'Summit' also rated well in taste panels, and had acceptable yields.**

Nonreplicated bunch grape trials involving over 1,000 clones indicate that 'Stover', 'Lake Emerald', and 'Blue Lake', along with breeding selections Fla. E12-59, Fla. H15-13, and Fla. L4-33 yielded well among the cultivars resistant to Pierce's disease. 'Delaware' had good quality but lacked yield, and 'Roucaneuf' and 'Black Spanish' yielded well but lacked fruit quality.

Currently recommended cultivars are presented based on the proposed use of the fruit. Cultivars tested but not recommended are also listed.

Grape production in Florida depends heavily on the use of adapted cultivars that are resistant to Pierce's disease (PD) (4, 13). A breeding program to develop such varieties was initiated in 1945 at the Agricultural Research Center, Leesburg, and has been continued to date (5, 13). Resistant cultivars released include 'Lake Emerald' (1954), 'Blue Lake' (1960), 'Norris' (1966), 'Stover' (1968), 'Liberty' (1976), and 'Dixie' (1976, jointly with N. C. State Univ.) (9). 'Welder', a muscadine cultivar originating in Lake County was described in 1977 (8). In addition, grape breeding programs at North Carolina State University, Georgia Agricultural Experiment Station, and U. S. Horticultural Field Station at Meridian, Mississippi have contributed PD-resistant cultivars that perform well in Florida (2, 7).

The purpose of this paper is to present results from replicated cultivar trials in Florida and to update cultivar recommendations over previous reports (1, 2, 3, 6, 7).

Materials and Methods

Beginning with a 16-cultivar planting of muscadine grapes in 1959, and continuing with additional cultivars planted later for observation in nonreplicated plots, over 50 cultivars of muscadine grapes have been evaluated at the Agricultural Research Center, Leesburg. The most promising cultivars were planted in replicated yield trials at Agricultural Research Centers in Fort Pierce, Leesburg, and Monticello. In 1972, a 7-cultivar muscadine planting with 4 single-vine replicates was planted at Ft. Pierce using a vertical trellis. In 1974, a 30-cultivar muscadine planting with 6 single-vine replicates was planted at Leesburg and trained to a modified Geneva Double Curtain (GDC) trellis. In 1976 and later, a 32-cultivar muscadine planting with 6 single-vine replicates was planted at Monticello. Half the replicates were trained to GDC trellis, and the other half to 2-wire vertical trellis. Spacings at Fort Pierce were 16′ in rows 10′ apart, at Leesburg 15.5′ in rows 12′ apart, and at Monticello the GDC were 18′ in rows 12′ apart and the 2-wire vertical were 18′ apart in rows 10′ apart. Harvest was accomplished with a hand-held blueberry harvester, shaking fruit into a catch frame. Yields, date of harvest, percent dry stem scar, percentage ripe, green, and rotted berries were recorded when appropriate at each location. Yield data at Monticello was pooled by year, combining data from both trellis systems on a tons/acre basis.

Bunch grapes were primarily grown in nonreplicated plantings at the 3 locations. The testing of more than 1,000 clones at the Agricultural Research Center, Leesburg, led to only 35 being planted in replicated trials. The 3 replicated bunch grape cultivar trials planted at Leesburg are not yet in full bearing stage, but yields and other data obtained over several years from older nonreplicated trials provide fairly consistent data for the bunch grape cultivars.

Fresh fruit taste panels consisting of 18 to 111 people were conducted between 1963 and 1981 on bunch grape and between 1970 and 1981 on muscadine grapes. The rating system used was excellent = 10, very good = 8, good = 5, fair = 2, and poor = 0 for each cultivar in the taste panel. Normally only 10 cultivars were used per taste panel. Processing tests were performed on the various cultivars by Bates (3).

Results

Muscadine yields at Fort Pierce were recently reported by Stoffella, et al. (12) with 'Cowart', 'Dixie', 'Welder', and 'Noble' outyielding other cultivars. Yields at Leesburg between 1978 and 1981 indicated significant differences among the 24 best cultivars (Table 1). 'Noble' was significantly higher yielding than all other cultivars except 'Regale', 'Redgate', 'Doreen' (N.C. 276-108), and N.C. 77-21. 'Noble' was the most productive entry at Monticello (Table 2). 'Carlos' yielded well initially at Monticello but in 1981 yields declined due to PD. One vine of 'Carlos' died at Leesburg from PD. 'Redgate' yielded well but bunches were excessively compact, causing tearing and rotting of berries; also, taste panel ratings were low (Table 3). The best tasting muscadines were 'Fry', 'Summit', 'Magnolia', 'Watergate' and 'Sugargate'. 'Sugargate' was the only black muscadine that ranked exceptionally high in taste but yields were

[1]Florida Agricultural Experiment Station Journal Series No. 3449.

Table 1. Yields for 24 muscadine cultivars in 6-replicate trials planted in 1974 at the Agricultural Research Center, Leesburg.

Cultivar	Tons per acre					Signif.[z]
	1978	1979	1980	1981	Mean	
Noble	6.6	8.2	7.4	8.5	7.7	a
Regale	5.0	7.6	8.2	8.4	7.3	ab
Redgate	5.0	7.3	6.7	8.2	6.8	abc
Doreen	5.0	6.7	6.9	7.4	6.5	abc
N.C. 77-21	4.2	7.2	7.4	7.0	6.4	abc
Welder	5.2	7.4	6.2	5.8	6.1	bcd
Tarheel	4.2	6.6	6.6	7.0	6.1	bcd
N.C. 80-74	4.5	6.2	7.3	6.0	6.0	bcd
Dixie	4.7	5.4	5.9	6.2	5.5	cde
Magnolia	4.2	4.8	6.7	6.4	5.5	cde
Carlos	4.6	6.2	4.9	6.1	5.4	cde
Jumbo	3.8	4.3	4.7	6.7	4.9	def
Southland	3.3	5.3	5.4	5.2	4.8	def
Cowart	3.7	4.6	4.5	4.6	4.3	efg
Higgins	4.2	5.6	2.4	5.2	4.3	efg
Magoon	2.5	4.6	4.6	4.8	4.2	efg
Fry	2.3	4.9	3.0	5.4	3.9	fgh
Chief	2.5	3.9	5.5	3.7	3.9	fgh
Hunt	2.7	3.5	4.6	3.5	3.6	fgh
Thomas	1.9	3.3	2.2	5.4	3.2	gh
Creek	2.4	2.8	4.6	1.3	2.8	hi
Watergate	1.4	2.4	3.4	3.3	2.6	hi
Dearing	1.5	1.7	2.0	1.4	1.7	i
Sugargate	0.1	0.3	0.2	0.4	0.3	j

[z]Mean separation by Duncan's new multiple range test at the 5% level.

lower than all other cultivars at both Leesburg and Monticello. 'Magnolia' rated high in taste, but uneven ripening and severe fruit rotting exclude it as a recommended cultivar. Five bunch grape cultivars rated higher in fresh fruit taste than 'Stover', whereas 'Norris' and 'Blue Lake' were markedly lower.

Characteristics of the principal muscadine and bunch grape cultivars in Florida are given in Table 4. All the muscadines yielded more than 4.5 tons/acre except for 'Dixieland', 'Fry', and 'Albemarle'. Vines of 'Dixieland' and 'Triumph' were young and not yet in full production. Bunch grapes yielding over 4.5 tons were 'Blue Lake', 'Lake Emerald', 'Stover', Fla. E12-59, and Fla. H15-13. Muscadine bunch weights averaged .04 to .16 lb., depending on cultivar, whereas bunch grape bunches ranged from .21 to .49 lb. Berry sizes were larger among the muscadines. Average ripening dates for bunch grapes ranged from July 7 to Aug. 2 at Leesburg, and muscadines from Aug. 20 to Sept. 10. Cultivars most suitable for mechanical harvest were those with high percentage dry scar such as 'Southland' and 'Summit'.

Discussion

Based on yield, vigor, disease resistance, quality, and other characteristics, certain cultivars were found best suited for certain uses. For example, 'Noble' yielded the highest of all grape cultivars (Table 1 and 2), but rated near the bottom in fresh fruit taste panels (Table 3). Since 'Noble' has small berries but excels as a juice and wine grape it is recommended for the latter purposes only. Similar evaluations were made on all cultivars, and Table 5 summarizes the 16 muscadines and 6 bunch grapes currently recommended, depending on the intended use of the fruit. Three breeding selections—N.C. 80-74, Fla. F4-16, and Fla. L4-33—are still undergoing trial and soon may be recom-

Table 2. Yields of 32 muscadine grape cultivars in replicated trial planted in 1976 or later at the Agricultural Research Center, Monticello.

Cultivar	Tons per acre			
	1979	1980	1981	Mean
Noble	9.8	11.5	9.4	10.2
Carlos	6.3	7.7	7.1	7.0
Southland	5.8	8.7	6.4	7.0
Thomas	—	—	6.6	6.6
Chief	4.6	8.3	5.9	6.3
Higgins	3.4	5.8	9.4	6.2
Dixie	3.2	7.6	7.2	6.0
Redgate	—	6.0	6.0	6.0
Welder	5.5	6.5	5.9	5.9
Summit	—	—	5.8	5.8
Creek	1.6	6.7	8.7	5.7
Magoon	2.9	8.2	5.4	5.5
Watergate	—	1.7	9.4	5.5
Cowart	3.1	5.5	8.0	5.5
Jumbo	3.5	3.3	7.7	4.8
Roanoke	—	5.8	3.9	4.8
Fry	3.0	4.2	4.7	4.0
Albemarle	1.8	3.9	6.0	3.9
Bountiful	2.6	5.2	3.3	3.7
Scuppernong	3.7	4.8	2.4	3.6
Magnolia	4.5	2.8	3.5	3.6
Pride	2.3	3.8	4.5	3.5
Rich	2.5	2.3	5.9	3.5
Hunt	—	2.1	4.5	3.3
Yuga	1.0	3.3	4.8	3.0
Dearing	1.8	3.7	3.4	3.0
Topsail	—	—	2.6	2.6
Dixiered	—	3.1	1.9	2.5[z]
Chowan	—	1.1	3.1	2.1[z]
Dixieland	—	0.9	2.0	1.5[z]
Pink Hunt	—	0.8	1.9	1.4[z]
Sugargate	—	—	1.3	1.3[z]

[z]Cultivars planted later than others (young vines).

Table 3. Taste panel results on fresh fruit for 22 muscadine and 12 bunch grape cultivars.

Bronze muscadines				Black muscadines				Bunch grapes			
Cultivar	No. taste panels	Taste ratings[z] Mean	Mode	Cultivar	No. taste panels	Taste ratings[z] Mean	Mode	Cultivar	No. taste panels	Taste ratings[z] Mean	Mode
Fry	10	7.1	8	Sugargate	1	6.9	8	Fla. E11-40	11	6.5	8
Summit	4	6.5	8	Magoon	9	5.6	5	Fla. 08-31	1	5.5	8
Magnolia	1	6.4	8	Albemarle	9	5.5	5	Fla. L4-33	4	5.4	5
Watergate	1	6.5	5	Hunt	2	5.2	5	Fla. E18-63	5	5.3	5
Dixie	10	6.0	5	Cowart	8	4.9	5	Fla. H15-13	4	5.3	5
Welder	8	5.8	5	Chief	1	4.9	5	Stover	13	5.2	5
Higgins	9	5.5	5	Southland	7	4.8	5	Liberty	6	5.2	5
Carlos	5	5.2	5	Jumbo	9	4.7	5	Lake Emerald	1	5.2	5
Sterling	2	4.3	5	Pride	1	4.1	5	Fla. F4-16	5	4.5	5
Redgate	1	3.8	5	Noble	3	4.1	5	Norris	7	4.0	5
Nevermiss	1	2.9	2	Thomas	2	4.0	5	Roucaneuf	2	4.0	2
								Blue Lake	6	3.5	2

[z]Taste ratings: 0 = poor, 2 = fair, 5 = good, 8 = very good, 10 = excellent.

Table 4. Characteristics of 17 muscadine and 10 bunch grape cultivars adapted to Florida.

Bronze muscadines	Yield (T/acre)	Bunch wt. (g)	Berry wt. (g)	Sol. solids (%)	Approx. ripe date	Dry stem scar (%)	Taste panel rating
Carlos	6.1	26	5	16	8/26	91	5.2
Dixie	6.0	45	5	20	8/23	43	6.0
Dixieland	1.5[y]	42	10	17	8/23	—	—
Doreen	6.5	63	4	19	9/10	56	—
Fry[z]	4.2	73	9	18	8/22	34	7.1
Summit[z]	5.0	66	9	19	8/27	85	6.5
Triumph	—[y]	53	9	15	8/23	—	—
Welder	6.2	32	4	20	8/22	32	5.8
Black muscadines							
Albemarle	3.3	18	6	18	9/2	73	5.5
Chief	5.1	25	4	19	9/8	72	4.9
Cowart	4.9	32	6	16	8/29	45	4.9
Jumbo[z]	4.8	62	10	16	9/1	47	4.7
Noble	9.1	46	3	17	8/27	30	4.1
Regale	7.3	50	5	15	8/22	12	—
Southland	5.8	21	5	19	8/26	93	4.8
Tarheel	6.1	37	3	16	8/24	58	—
N.C. 80-74	6.0	26	4	16	8/23	78	—
Bunch grapes						Color	
Blue Lake	5.9	122	2	16	7/18	Purple	3.5
Lake Emerald	5.1	184	2	20	7/30	Green	5.2
Liberty	3.1	115	3	18	7/21	Red	5.2
Stover	4.6	117	2	18	7/11	Lt. Gn.	5.2
Fla. E11-40	2.1	95	4	18	7/26	Purple	6.5
Fla. E12-59[z]	5.1	126	3	15	7/24	Purple	—
Fla. E18-63	4.0	220	3	19	7/19	Lt. Gn.	5.3
Fla. F4-16	1.9	201	4	18	8/2	Pink	4.5
Fla. H15-13	5.0	113	3	16	7/7	Lt. Gn.	5.3
Fla. L4-33	4.4	118	3	17	7/18	Purple	5.4

[z]Female cultivars requiring a self-fertile cultivar nearby for fruit set.
[y]Vines not fruiting long enough for reliable yields.

mended for release. Unless they are released they will not be available to growers. 'Stover' is the best of the available released bunch grape cultivars for table (14) and wine (3). Only 3 muscadines and 'Stover' bunch grape are recommended for fresh market.

Muscadine cultivars that were tested but are not recommended include 10 black-fruited cultivars and 18 bronze-fruited ones (Table 6). Reasons for not recommending include low yields, susceptibility to Pierce's disease, uneven ripening, low sugar content, small berries, wet stem scars, or weak vine growth. Newer cultivars that need further evaluation are 'Georgia Red', 'Dixiered', 'Dixieland', 'Triumph', and 'Senoia'.

Among bunch grape cultivars, all *Vitis vinifera* cultivars lacked adequate resistance to PD to be grown here successfully (4, 10). A large number of French hybrids are on trial at Leesburg, but only 'Roucaneuf' has exhibited adequate resistance to PD to date. However, the quality of 'Roucaneuf' is low for both wine and fresh fruit, so it is not now recommended to Florida growers. Still other PD-resistant bunch grape cultivars are not recommended, and Table 6 lists them and the reasons each is not recommended. 'Black Spanish' has been grown in Florida for decades, and some growers have made wine with it. However, the wine is not of competitive quality and fresh fruit quality is also poor. 'Delaware' had good fruit quality, but yields were too low for its recommendation in Florida.

Two new blue bunch grape cultivars from Mississippi, 'MissBlue' and 'MidSouth', have been released as PD-resistant bunch grapes (11). Tests at Leesburg indicate good adaptability, but their yields, quality, and resistance to PD under Florida conditions await further evaluation before recommendations can be made.

Table 5. Grape cultivar recommendations for Florida based on proposed use of the fruit.

For pick-your-own sales:
- Bronze muscadines—Triumph, Summit,[z] Fry,[z] Dixieland[y]
- Black muscadines—Jumbo[z]
- Bunch grapes—Stover

For grower harvest to market fresh:
- Bronze muscadines—Summit
- Black muscadines—Southland, Albemarle[x]
- Bunch grapes—Stover

For wine production:
- Bronze muscadines—Dixie, Doreen, Welder
- Black muscadines—Noble, Regale, Tarheel, N.C. 80-74 (if released)
- Bunch grapes—Stover, Lake Emerald, Fla. L4-33 (if released)

For juice and jelly production:
- Black muscadines—Noble, Chief,[x] Southland
- Bronze muscadines—Welder (to blend with Noble)
- Bunch grapes—Blue Lake

For home garden use:
- Bronze muscadines—Triumph, Dixie, Dixieland[y]
- Black muscadines—Southland, Cowart, Albemarle[x]
- Bunch grapes—Stover, Blue Lake, Liberty,[x] Fla. F4-16 (if released)

[z]Female cultivars requiring a self-fertile cultivar nearby for fruit set.
[y]Promising new cultivars that need further testing in Florida.
[x]Not recommended for South Florida.

Literature Cited

1. Balerdi, C. F. and J. A. Mortensen. 1969. Performance of muscadine grapes in central Florida. HortScience 4:252-253.
2. ———— and ————. 1973. Suitability for mechanical harvest in cultivars of muscadine grape (*Vitis rotundifolia* Michx.). Proc. Fla. State Hort. Soc. 86:342-344.
3. Bates, R. P., J. A. Mortensen, and T. E. Crocker. 1980. Florida grapes: the next decade. Proc. Fla. State Hort. Soc. 93:120-124.
4. Mortensen, J. A. 1966. Comparative growth and yield of ten grape varieties sprayed intensively for insect and disease control. Proc.

Table 6. Muscadine and bunch grape cultivars tested but not recommended for new plantings in Florida.

Black muscadine grapes	Reason not recommended
Bountiful	Fruit falls to ground early
Creek	Low sugar; high acid; female
Dulcet	Low yield; very wet scar; female
Duplin	Lacks quality and yield
Hunt	Low yield; dry calyptras; female
Magoon	Fruit too small; vines weak; some PD
Pride	Susceptible to PD
Scott Imperial	Female; berries too small
Sugargate	Very low yield; some PD; dry calyptras
Thomas	Lacks flavor; female
Bronze muscadine grapes	
Carlos	Susceptible to PD
Chowan	Low yield
Dearing	Low yield
Higgins	Fruit rots; ripens unevenly; female
Lucida	Susceptible to PD
Magnolia	Fruit rots; ripens unevenly
Nevermiss	Low yield; female; lacks quality
Pamlico	Low yield
Pink Hunt	Lacks quality; mediocre; female
Redgate	Tight bunch; wet scar; low taste rating
Rich	Low yield
Roanoke	Low yield
Scuppernong	Low yield; some PD; female
Sterling	Weak vine growth; unadapted
Stuckey	Low yield; female
Topsail	Low yield; female
Watergate	Low to medium yield; female
Yuga	Small berry; tenacious; female
P.D.-resistant bunch grapes	
Black Spanish (Lenoir)	Lacks fruit quality
Delaware	Lacks vine vigor and yield
Herbemont	Lacks fruit quality
Norris	Subject to fruit crack & anthracnose
Roucaneuf	Lacks fruit quality; some PD
Seminole	Lacks fruit quality
Stover Tetraploid	Lacks vine vigor and yield
Tropico	Adherent pulp; lacks quality
Valhallah	Lacks fruit quality

Fla. State Hort. Soc. 79:390-395.
5. ———. 1971. Breeding grapes for central Florida. HortScience 6:149-153.
6. ———. 1978. Grape varieties recommended for Florida. Leesburg ARC Research Rept. WG 78-1.
7. ——— and C. F. Balerdi. 1973. Muscadine grapes for Florida: yields and other characteristics of 48 cultivars. Proc. Fla. State Hort. Soc. 86:338-341.
8. ———, and N. C. Hayslip. 1977. 'Welder' muscadine grape. HortScience 12:267-268.
9. ———, W. B. Nesbitt, and V. H. Underwood. 1976. Dixie, a bronze muscadine grape variety. Fla. Agr. Exp. Sta. Circ. S-244.
10. ———, L. H. Stover, and C. F. Balerdi. 1977. Sources of resistance to Pierce's disease in *Vitis*. J. Amer. Soc. Hort. Sci. 102:695-697.
11. Overcash, J. P., C. P. Hegwood, Jr., and B. J. Stojanovic. 1981. Mid-South and MissBlue, two new bunch grape cultivars. Fruit South 5(2):6-11.
12. Stofella, P. J., J. A. Mortensen, N. C. Hayslip, and J. B. Brolmann. 1981. Muscadine grape cultivar yield trials at Fort Pierce, Florida. Ft. Pierce ARC Research Rept. RL 1981-5.
13. Stover, L. H. 1960. Progress in the development of grape varieties for Florida. Proc. Fla. State Hort. Soc. 73:320-323.
14. ———, J. M. Crall, and J. A. Mortensen. 1977. Marketing Florida bunch grapes as fresh fruit. Proc. Fla. State Hort. Soc. 90:228-230.

Proc. Fla. State Hort. Soc. 94:331-336. 1981.

GRAPE INSECTS AND DISEASES IN FLORIDA[1]

W. C. Adlerz and D. L. Hopkins
University of Florida, IFAS, Agricultural Research Center, P.O. Box 388, Leesburg, FL 32748

Additional index words. Grape seed chalcid, grape leafhopper, grape flea beetle, grape root borer, Pierce's disease, black rot, bitter rot, downy mildew, *Isariopsis*.

Abstract. **Insects having the greatest potential for reducing yields of grapes or of killing grapevines have received most attention in studies of ecology, biology, and control. These include grape seed chalcid,** Prodecatoma cooki **(Howard), grape flea beetle,** Altica chalybea **Illiger, grape leafhopper,** Erythroneura comes **(Say), grape root borer,** Vitacea polistiformis **(Harris), and two vectors of Pierce's disease (PD) bacterium** Oncometopia nigricans **(Walker) and** Homaladoisca coagulata **(Say). In this paper control methods are reviewed for grape flea beetle and grape seed chalcid and newly described for grape leafhopper, while recent ecological studies needed to schedule control efforts are described for grape root borer. Ecology and epidemiology of PD bacterium relative to two leafhopper species are discussed. Presently resistance to the bacterium, derived from wild grape species, is the only control for PD.**

Anthracnose development in the spring was delayed and greatly reduced by dormant or early bud-break application of liquid lime sulfur, benomyl, captafol, or captan. Benomyl, maneb + zinc, folpet, and captan all provided some control of the grape foliage diseases. For overall disease control, combinations or alternate applications of these materials have been most effective.

Many insects affect production of Florida grapes, especially bunch grapes. They include both incidental pests such as grape phylloxera, various leaf galling insects, and grapevine aphids, and more common but easily controlled minor pests, such as the grape leaf skeletonizer and grape leaf folder. These have received little attention in our research program.

Research emphasis has been placed on the grape leaf-

[1]Florida Agricultural Experiment Station Journal Series No. 3403.