



FamC30-5-1: A Potential Red Wine Selection for Florida

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Adaptability, productivity, and wine quality with nice and stable color are the main challenges of the Florida wine grape industry, due to the hot and humid growing environment that leads to high disease incidence. In the efforts to improve the wine industry in Florida, FAMU's grape breeding program selected a Pierce's disease resistant breeding line, FamC30-5-1. This selection has produced high quality red wine with excellent and stable color. The wine color intensity is outstanding and the aroma is very good. This selection could be a milestone for the future development of red wine grapes for the Florida wine industry.

Grape industries have been important in Florida since this state was the first location in the New World to produce wine. In the 2009–2010 fiscal year, 346,146 gal of wine were produced by 26 wineries in operation in the state, according to the Florida Grape Grower Association (FGGA, www.FGGA.org). These would not only have a multimillion dollar impact on the state economy; grape industries are also responsible for significant jobs creation in Florida today. However, Florida's grape industries have been challenged by the hot and humid environment. The prevalence of Pierce's disease (PD) under Florida's hot and humid climate have limited the production of premium wine grapes such as those produced from *Vitis vinifera*, the traditional wine grapes. Furthermore, the wine quality made from PD tolerant grapes is further challenged by the premium wines made from *Vitis vinifera* grapes; these are especially true with red wine grapes. Red wines made with Florida environment adaptable and PD tolerable grapes such as 'Black Spanish', 'Blue Lake', 'Conquistador', and 'MidSouth', 'Miss Blue', etc., are often poor in red color intensity or/and browning/color instability. This kind of poor red color is not unique to Florida, but it has been a common problem for warm areas (Reisch, 1996). In spite of these challenges, wines made from Florida-grown grapes are always wanted by diverse wine markets; therefore, grapes that are resistant or tolerant to PD while producing premium wines with better color have been highly demanded by Florida grape industries. To accomplish the mission of developing a grape combining PD resistance, premium wine quality, and good color for Florida growers, various sources of germplasm must be evaluated as the first step to develop high quality wine suitable for Florida climate conditions.

Germplasm Sources and Methods

Our wine-orientated germplasm repository of bunch grapes consists of more than 2000 accessions and breeding lines, originated from different parts of the world. We are the co-operators of the National Clonal Germplasm Repository for Fruit and Nut Crops at Davis, CA, and of the National Clonal Germplasm Repository for Fruit and Nut Crops at Geneva, NY. Plants were field screened for PD resistance first; only the vines with good PD tolerance were then used for wine studies.

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The vines were planted at a density of 10 × 12 ft, and were trained as a two-arm cordon system with spur pruning technique and commercial vineyard management. PD resistances were evaluated in the field by leaf marginal necrosis symptoms with a 0 to 5 score system modified from Hopkins criteria (1985): 0 representing no symptoms; 1 = minor symptoms up to 15% of leaves with marginal necrosis (MN); 2 = 16% to 30% of leaves with MN; 3 = 31% to 50% of leaves with MN; 4 = 51% to 75% of leaves with MN; and 5 = over 75% of leaves with MN or vine dead.

The standard procedures of our laboratory were always followed in wine making. Wines were evaluated by taste panels of 20 participants with the California Commercial Wine Taste Standard. The total 20-point scoring system was divided into: appearance 1–3, aroma/bouquet 1–6, taste/texture 1–6, aftertaste 1–3, and overall impression 1–2. Spectrophotometer (Genesys 10uv) measurements of wine color were recorded at A420 nm, A520 nm, and A620 nm with 10-mm crystal cuvettes; samples were diluted 10 times with ddH₂O before measurements. Hue was evaluated as the value of A420/A520, and color intensity was defined as A420 + A520 + A620. 'Conquistador' grapes, the only commercial red wine grape in Florida, grown in the same vineyard, were used as standards both in plant and wine evaluations.

Horticultural Characteristics of FamC30-5-1

FamC30-5-1 is a self-fertile, very vigorous *Euvitis* grape vine. Its 10-year-old vine trunk circle was 28 cm, and some fruiting shoots may be more than 3 m long. The average node length and node diameter of fruiting shoots were 8.1 cm and 0.78 cm, respectively. In contrast, the trunk circumference of 10-year-old 'Conquistador' was 20 cm; its node length and diameter of fruiting shoots were 5.8 cm and 0.58 cm, respectively (Table 1).

The yield of FamC30-5-1 was lower than that of 'Conquistador'. A two-arm cordon vine with planting density of 10 × 12 ft may produce 8.5 kg fruits, while a 'Conquistador' vine may yield more than 13 kg grapes (Table 1). The fewer cluster numbers per spur and fruiting shoot, and smaller clusters (Fig. 1) could be responsible for the lower yield of FamC30-5-1. The clusters per spur and clusters per fruiting shoot of FamC30-5-1 were 4.4 and 2.0, respectively; both were fewer than that of 'Conquistador' (Fig. 1, Table 1). The majority of clusters of FamC30-5-1 weighed about 45–70 gm, and consisted of 35 to 55 fruits. The dark round

Table 1. Horticultural characteristics of 10-year-old FamC30-5-1 and ‘Conquistador’ grape vines.

	Vigor	Trunk circle (cm)	Fruiting shoot		Cluster/ fruiting shoot	Fruit size (g)	Yield (kg/vine)	Fruit rot (%)	Ripen (m/d)	10th yr survival (%)	PD ^z
			Diam (cm)	Node length (cm)							
Conquistador	Moderate	28	0.58	5.8	2.5	2.4	13.5	6.3	7/25	92	2.1
FamC30-5-1	Very vigorous	20	0.78	8.1	2.0	1.6	8.5	2.1	8/10	100	1.3

^zPierce’s disease.



Fig 1. Fruiting shoots of (left) ‘Conquistador’ and (right) FamC30-5-1 during fruit ripening.

fruits weighted 1.6 g, and 1.5 × 1.4 cm in fruit diameters. In the vineyard of Florida A&M University, the vines bloom in early April, fruit veraison starts around 20 June, and less than 10% of fruits remain green by the end of June; in contrast, only a few veraison fruits may be observed in ‘Conquistador’ by the end of June, with fruits ripening around 10 Aug. Fruits are uniform in ripening; unripened berries are rare within harvested clusters. The rot fruit rate of harvested FamC30-5-1 was about 2%, while the rot fruit rate of ‘Conquistador’ could be 6% (Table 1). Rot fruit rate has been an important factor in determining the planting of grapes in Florida; grapes with higher rot fruit rate require more chemical controls than those with lower rot fruit rates.

Unlike ‘Conquistador’, and like most grapes, the flesh of FamC30-5-1 is red (Fig. 2). This red flesh could be responsible for the high A520 nm and A620 nm absorbance with freshly crushed juice of FamC30-5-1 (Table 2), and/or the rich dark red



Fig 2. The flesh of (left) ‘Conquistador’ and (right) FamC30-5-1 of water-rinsed fruits.

Table 2. Fruit characteristics and wine evaluation scores of FamC30-5-1, Florida ‘Conquistador’, and California ‘Cabernet Sauvignon’ and ‘Merlot’.

	SSC (%)	TA (%)	pH	Taste score
Conquistador	15.2	0.78	3.11	12.3
FamC30-5-1	14.5	0.70	3.20	15.7
Cabernet Sauvignon				15.9
Merlot				15.2



Fig 3. Two-year-old wine color of (upper left) ‘Norton’, (upper right) ‘Cabernet Sauvignon’, (bottom left) FamC30-5-1, and (bottom right) ‘Conquistador’.

Table 3. Color intensities of 2-year-old wines among 2008 vintage FamC30-5-1, Florida ‘Conquistador’, and California ‘Cabernet Sauvignon’ and ‘Merlot’.

Wines	Light absorbance (nm)			Hue	Intensity
	420	520	620		
Cabernet Sauvignon	0.198	0.312	0.046	0.62	0.556
Merlot	0.200	0.286	0.052	0.70	0.538
Conquistador	0.097	0.101	0.001	0.96	0.198
FamC30-5-1	0.358	0.730	0.138	0.49	1.226

color in the wine. The wine made from FamC30-5-1 is excellent in taste with attractive and stable red color (Fig. 3, Table 2, and Table 3). The vines showed very minor symptoms of PD on leaves; light anthracnose symptoms have been observed on their shoots, but not with fruits.

Results and Discussion

FamC30-5-1 is a highly PD resistant breeding line. Its PD score for a 10-year average was 1.3, with 0–5 evaluation criteria (Table 1), and no vine was lost during this 10-year observation

Table 4. Color changes during aging between 2010 vintage FamC30-5-1 and 'Conquistador' wines

Wines	Month	Light absorbance (nm)			Hue	Intensity
		420	520	620		
Conquistador	Fresh juice	0.035	0.025	0.006	1.40	0.066
	1	0.063	0.077	0.012	0.82	0.152
	6	0.051	0.056	0.004	0.91	0.111
	9	0.099	0.075	0.000	1.32	0.174
	12	0.070	0.060	0.000	1.17	0.130
FamC30-5-1	Fresh juice	0.250	0.244	0.130	1.02	0.624
	1	0.399	0.634	0.136	0.62	1.169
	6	0.409	0.683	0.246	0.60	1.338
	9	0.503	0.796	0.180	0.63	1.479
	12	0.406	0.645	0.117	0.63	1.168

period. Meanwhile, the PD score of 'Conquistador' was 2.1, and its 10-year survival rate was 92% (Table 1). This suggests this line is able to adapt to hot and humid weather and may grow well in Florida environments

FamC30-5-1 produced premium quality wine. The wine is very rich in dark red color, with pleasant aroma and good taste. It received virtually the same taste score as those commercial California 'Cabernet Sauvignon' and 'Merlot' wines, and significantly higher than Florida commercial 'Conquistador' wine (Table 2).

The wine color is rich and stable. The color intensity of 2-year-old FamC30-5-1 from 2008 vintage was 6 times higher than the Florida 'Conquistador' wine, 2 times higher than the California 'Cabernet Sauvignon' and 'Merlot' premium wines (Table 3). With 2010 vintage wines, FamC30-5-1 showed similar color intensity of about 10 times as high as 'Conquistador' during 1 year aging (Table 4). The rich color of FamC30-5-1 was also recognized by its higher 520 nm absorbance, the maximum absorbance of anthocyanin or red color pigment. Its A520 nm absorbance fresh juices and aging wines from 2010 vintage was about 10 times as high as its counterpart 'Conquistador' (Table 4). Similarly, the A520 nm of 2-year-old FamC30-5-1 wine was about 7 times as high as 'Conquistador', and more than 2 times higher than that of 'Cabernet Sauvignon' and 'Merlot' wines (Table 3).

The hue of new FamC30-5-1 wine ranged 0.60 to 0.63 during 1 year aging, while the hue of 'Conquistador' were 0.82 to 1.37 (Table 4). Among the 2-year-old wines from 2008 vintage, the

hue of FamC30-5-1 was 0.49, while 'Conquistador' was 0.96, which was about 2 times as high as FamC30-5-1. The hue of 2-year-old FamC30-5-1 was not only lower than its counterpart 'Conquistador' wine, it was also lower than that of 'Cabernet Sauvignon' and 'Merlot', the premium wines from California (Table 3). For hue is the ration of A420 nm/A520 nm, while A420 nm is the maximum absorbance of brown pigment, and A520 nm is the maximum absorbance of red pigment. Higher hue would indicate more browning or less anthocyanin content than that of lower hue; therefore, the lower hue of FamC30-5-1 in different aged wines suggests the red pigment of this selection is more stable with less tendency of browning than that of 'Conquistador'.

The selection, besides being highly resistant to PD, is also well adapted to Florida's hot and humid environment. This grape, recognized for producing excellent quality of red wine, may be a milestone for further development of red wine grape cultivars for Florida as well as the southeastern United States.

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