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THE IMPACT OF TRAINING/TRELLIS SYSTEM AND CANOPY MANAGEMENT ON PRODUCTION EFFICIENCY AND FRUIT QUALITY OF FLORIDA GRAPES

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Abstract. **Florida's major limitation in grape growing is the outstanding fact that the fruit grows and ripen during the rainy season. It is known that plants are more susceptible to many diseases during the fruiting season and also during moist and hot weather. This constraint is faced by all grape growers in Florida, and requires the utmost ingenuity in viticultural skill and science to overcome. Training/trellis systems and canopy management are an integral part of vineyard management because of their impact on the canopy microclimate and therefore efficient pest and disease control of grapevines. Florida grape growers are aware of the importance of canopy management in grape production but lack of specific knowledge to create the desired microclimate for their grapevines and in most cases try to adapt practices that have been developed specifically for temperate and cool climates growing conditions. The current study at Florida A & M University was designed to provide essential information on the use of the most suitable training/trellis system and canopy management practices for Florida grapes. Preliminary results from the evaluation of several training/trellis systems and vineyard management practices show that production efficiency of selected Florida grape varieties can be improved to enhance their economic competitiveness.**

The outstanding restrain of growing grapes in Florida is that the fruit grows and ripen during the rainy season. This must be taken into consideration at all stages of grape production: locating the vineyard, choosing the soil, determining varieties to be grown, planting the vines, pruning and training, trellis choice, cultivation and fertilization, disease prevention, handling and marketing of the crop. Indeed, everything connected to the grape industry in Florida depends upon the fact that Florida is an exception to the general rule that grapes grow and ripen in dry weather. It is known that plants are more susceptible to many diseases during the fruiting season and also during moist, hot weather. This constraint is faced by all grape growers in Florida, and requires the utmost ingenuity in viticultural skill and science to overcome.

The essence of viticulture is manipulating the grapevine by the choice of training/trellis system, pruning, heading, and managing the canopy to maintain fruitfulness and fruit quality (Reynolds, 2000). For *vinifera* and *labrusca* grapes and American-French hybrids, there is a sufficient amount of educational material accumulated from research-based information, to assist and guide grape growers (Bravdo et al., 1985; Intrieri and Fillippetti, 2000; Kliewer and Dokoozlian, 2000; Lane, 2002; Reynolds et al., 1989; 1995; Smart et al., 1982; Smart and Robinson, 2001). Unfortunately, there is very little, if any, research-based information available to help Florida grape growers.

Training/trellis systems and canopy management are an integral part of vineyard management because of their impact on the canopy microclimate and therefore pest and disease control. It is extremely important to understand the factors influencing management, because proper canopy management improves vine vigor and enhances fruit quality and wine quality of grapes. Field studies have shown that unmanaged vines with vigorous growth have dense and crowded canopies and produce low yield and low quality grapes (Smart and Robinson, 2001). Proper canopy management reduces incidence of diseases in the vineyard and minimizes unnecessary vegetative growth.

Training is the design and development of a grapevine's framework. A *trellis* is the structure that supports the framework. Pruning is removing a portion of the annual vegetative growth to maintain a desired number and spacing of nodes per vine, targeting maximum yield of high quality grapes. Training is strategic and pruning is tactical for achieving a particular vine arrangement. The need for specific research-based information on canopy management practices is critical, particularly for the commercial grape growers who are starting out or planning to expand their vineyards. A comprehensive research project was initiated in the 2003-2004 growing seasons at Florida A& M University, Center for Viticulture, to provide essential information on the use of most suitable training/trellis systems and canopy management practices for Florida grapes.

The general objective of this study is to evaluate several training/trellis systems and vineyard management practices for selected Florida grape varieties, aiming to improve production efficiency and economic competitiveness that will lead to a sustainable grape industry in Florida.

The specific objectives were:

- To evaluate and compare the productive capacity of the various training/trellis system for selected Florida grape varieties.
- To evaluate the impact of the various planting density and spacing requirements for optimum crop size and fruit quality for selected Florida grape varieties.
- To evaluate canopy management needs of various training/trellis systems and their impact on crop size and fruit quality for selected Florida grape varieties.

This paper presents some preliminary data accumulated in the course of this study regarding employed efficient practices for intensive training of the new plantings resulting in an earlier canopy formation and fruit set of the vines, within one year.

Materials and Methods

A 4.2-acre experimental vineyard was established during the 2003-2004 seasons at Florida A& M University, Center for Viticulture & Small Fruit Research to evaluate the various experimental factors of the project. A randomized block design was used. Four

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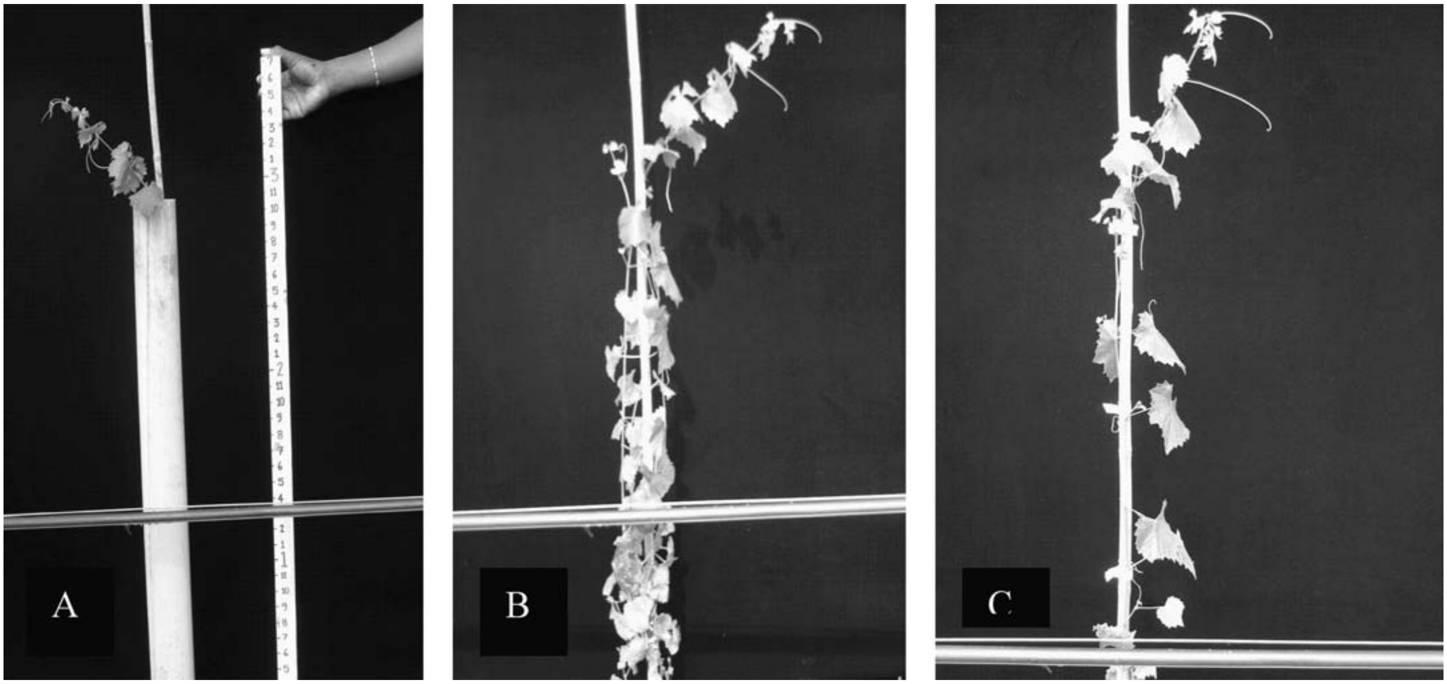

Fig. 1. Initial lateral shoots' removal, Carlos var.: A) plant ready for treatment; B) plant before shoot thinning; C) plant after treatment.

vines per variety are planted as sampling units. Each set of experiments has two replications and the following factors: variety, training/ trellis system and spacing (planting density).

Two muscadine grape varieties were evaluated in this particular study: (1) 'Carlos' which is a standard bronze variety used mainly for wine and juice. It has perfect-flowers, and is vigorous with moderate susceptibility to powdery mildew, angular leaf spots and bitter rot. (2) 'Noble' was released by the North Caroline breeding program as a purple muscadine for juice and wine production. It has perfect flowers and is high yielding, vigorous, and winter hardy. It is susceptible to powdery mildew, angular leaf spots and bitter rot.

The following training/trellis systems were used: (1) cordon training, spur pruning, top single wire; and (2) cordon training, spur pruning, Munson narrow T-trellis. Three vine spacings were used: (1) 10 ft by 12 ft; (2) 10 ft by 14 ft; and (3) 10 ft by 16 ft. The total dormant growth per plant was measured as maximum plant length in linear *m* at the end of the first growing cycle (November 2003). The number of new shoots that developed per plant and the number of fruiting shoots per plant were counted as those shoots coming out directly from the first season's dormant wood on previously formed fruiting cordons. Evaluation of these two variable was done at phenophase "fruit set" in June 2004. Index of fruitfulness was calculated as the ratio of the total number of fruiting

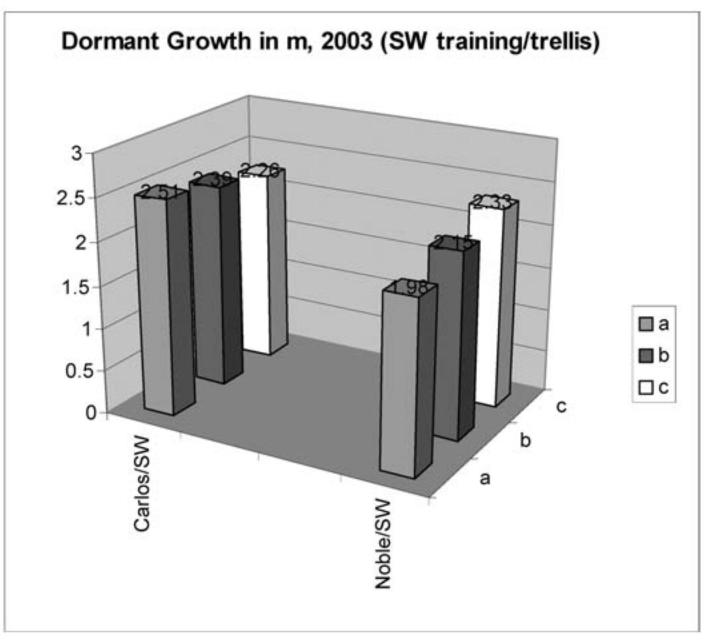

Fig. 2. Dormant Growth in m, 2003(SW training/trellis): a) 10 × 12 planting density; b) 10 × 14 planting density; c) 10 × 16 planting density.

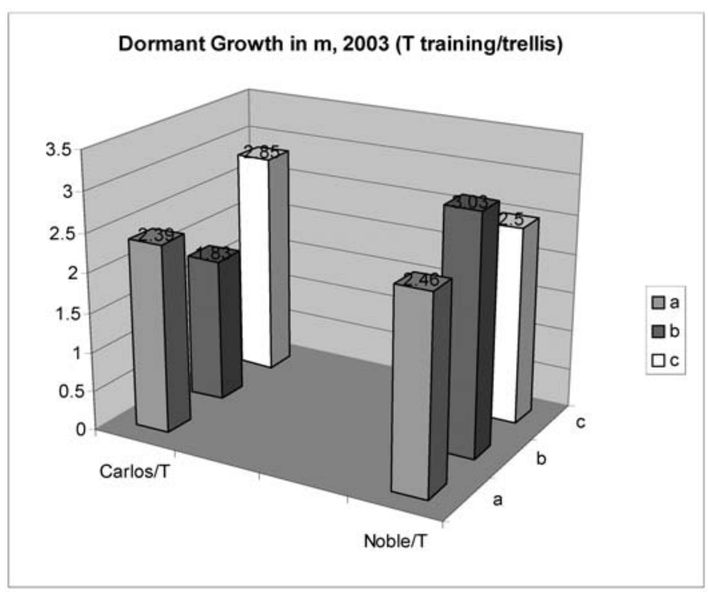

Fig. 3. Dormant Growth in m, 2003(T training/trellis): a) 10 × 12 planting density; b) 10 × 14 planting density; c) 10 × 16 planting density.

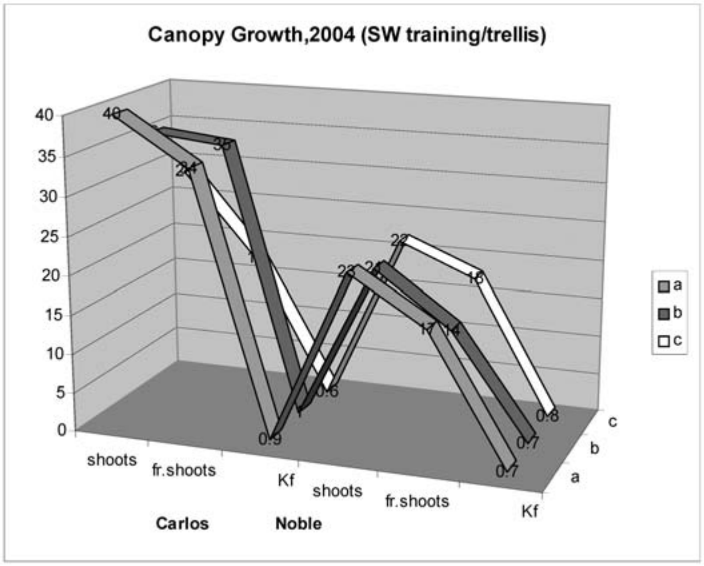

Fig. 4. Canopy Growth, 2004 (single wire training/trellis system): a) 10 × 12 planting density; b) 10 × 14 planting density; c) 10 × 16 planting density.

shoots to the total number of shoots per plant with a maximum value of 1.

All measured and derived variables were analyzed with ANOVA to determine the differences in response to treatments. The treatment means were separated by Least Significant Difference test (LSD) with 5% significance.

Results and Discussion

In the available grape growers' guides the suitable planting time for muscadine grape is any time during the growing season when containerized plants are used (D. Himelrick, 1996, 2001). Considering the specific environmental conditions in our North Florida experiment, containerized 'Carlos'

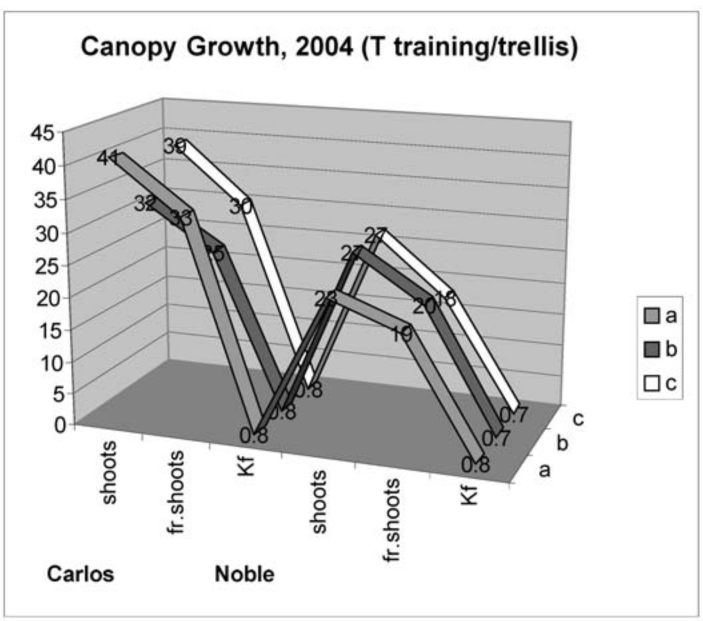

Fig. 5. Canopy Growth, 2004 (Munson Narrow T training/trellis system): a) 10 × 12 planting density; b) 10 × 14 planting density; c) 10 × 16 planting density.

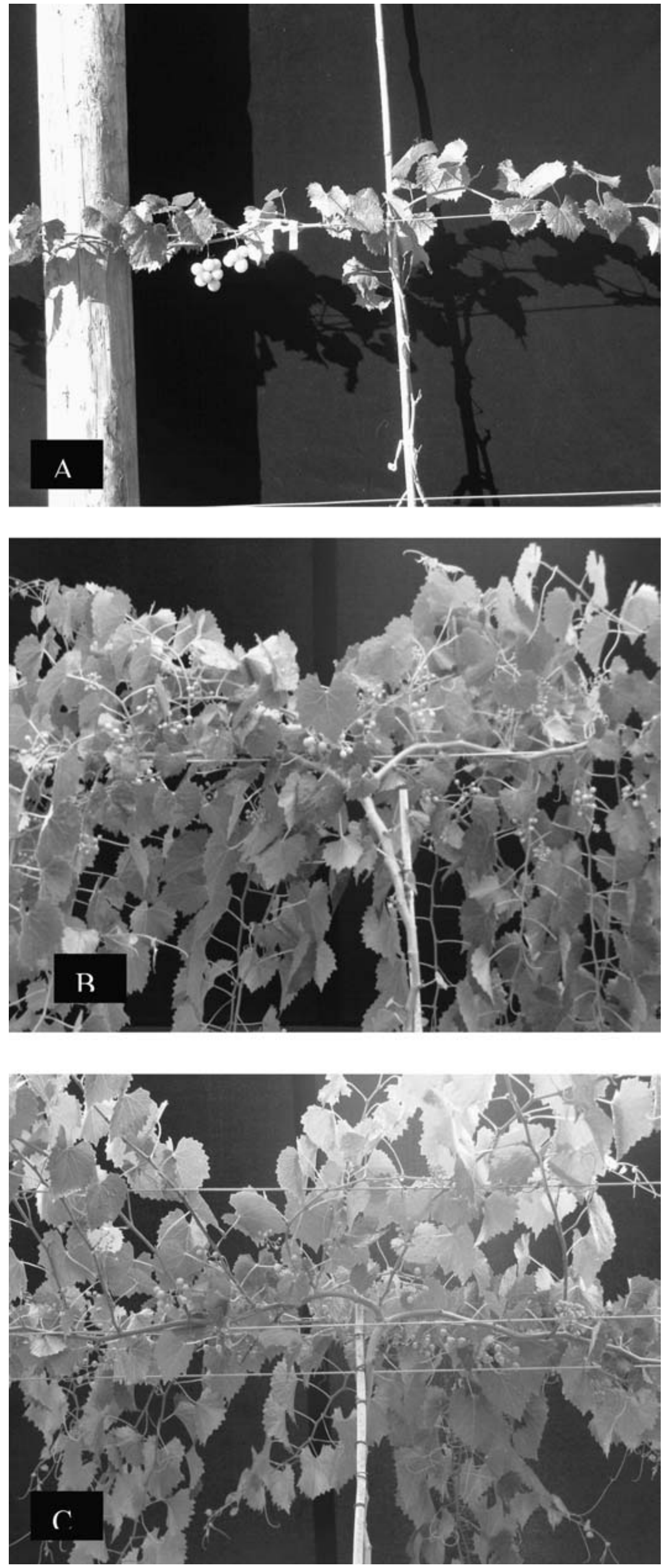

Fig. 6. Early training of the canopy: A) 1st growing cycle; B) 2nd year "fruit set", single wire trellis; C) 2nd year "fruit set" T- trellis.

and 'Noble' vines were planted at the end of April 2003, in order to eliminate any risk of late spring frost. During the first growing season (2003-2004) our primary consideration was to optimize planting and growing conditions in order to maximize growth and development of the vines. The standardized planting technique with application of slow release fertilizer (19-6-2) in each planting whole and increased planting debt were applied for the purpose of providing rapid and uniform growth and development of the new vineyard. As a result a very high rate of survival was achieved averaging 93% for Carlos and 97% for Noble respectively (data are not shown).

Grapevines are a perennial crop with a juvenile stage and form inflorescences in the latent buds on shoots of the current season which are growing from at least one year old dormant wood (Mullins et al., 2000). There is a prevailing opinion that it usually takes 3 years to get the first yield in a vineyard. Base upon our previous experience from intensive training and early fruit set of *vinifera* seedlings for the purpose of grape breeding, it was decided to apply some of these principles of "early vine training" in our present work with the muscadine grapes. An intensive green pruning technique was used after the young vines reached 1 meter (m) in height (Fig. 1) and twice a month thereafter until late September. The main objective was to ensure maximum vine elongation on each plant prior to dormancy and advance the formation of the fruiting arms. As a result, about 80% (data not shown) of the muscadine vines had well-developed fruiting cordons at the end of the first year and intensive fruit set during the second growing season (Fig. 6). Analysis of the preliminary data for dormant growth (Figs. 2 and 3) and canopy growth expressed as the number of new shots and fruiting shoots (Figs. 4 and 5) for both varieties showed a tendency for positive correlation. Our preliminary results suggests that carefully designed and selected training/trellis systems are important for optimum growth and production of particular grape varieties under specific environmental conditions.

Literature Cited

Bravdo, B. and Y. Hepner. 1985. Effect of crop level and crop load on growth, yield, must and wine composition and quality of Cabernet Sauvignon. Am. J. Enol. Vitic. 36:125-131.

Intrieri, C. and I. Filippetti. 2000. Planting density and physiological balance: Comparing approaches to European viticulture, p. 296-308. In Proc. Am. Soc. Enol. Vit. ASEV 50th Anniversary, ASEV.

Kliewer, W. M. and N. K. Dokoozlian. 2000. Leaf area/crop weight ratios of grapevine influence on fruit composition and wine quality, p. 285-295. In Proc. Am. Soc. Enol. Vit. ASEV 50th Anniversary, ASEV.

Lane, R. 2002. Trellising, training and pruning, p. 153-168. In Muscadine Grapes, F. M. Basiouny and D. G. Himelrick (eds.), ASHS press, Alexandria, VA.

Mullins, M., A., Bouquet, and L. Williams. 1992. Biology of the Grapevine. Cambridge University Press, London, 239 pp.

Reynolds, A. G., D. A. Wardle, and A. P. Naylor. 1995. Impact of training system and vine spacing on vine performance and berry composition of Chancelor. Am. J. Enol. Vitic. 46:88-97.

Reynolds, A. G. and D. A. Wardle. 1989. Impact of training system and vine spacing on vine performance and berry composition of Seyval blanc. Am. J. Enol. Vitic. 45:444-451.

Reynolds, A. G. 2000. Impact of trellis/training system and cultural practices on production efficiency, fruit composition and vine balance, p. 309-317. In Proc. Am. Soc. Enol. Vit. ASEV 50th Anniversary, ASEV.

Smart, R. E., N. J., Shaulis, and E. R. Lemon. 1982. The effect of Concord vineyard microclimate on yield. I. The effects of pruning, training, and shoot positioning on radiation microclimate. Am. J. Enol. Vitic. 33:99-102.

Smart, R. E. and M. Robinson. 2001. Sunlight into vine: A handbook for grapevine canopy management. Winetitles, Adelaide, Australia, p. 88.