

Cold-hardy citrus for North Florida

By Xavier Martini and Peter Andersen

Cold-hardy citrus has a long history in North Florida, Alabama, Louisiana and Georgia. Records show that sweet orange, citron, lemon, lime and pummelo were brought to Saint Augustine, Florida, from Spain in 1565. However, it was not until the late 1700s that the Jesuits introduced satsuma (*Citrus unshiu*) to what is now Louisiana.

SATSUMA HISTORY AND RESURGENCE

The satsuma is believed to have originated in China, but it was first reported in Japan in about 1300. During the late 1800s, the Owari cultivar was introduced from Satsuma, Japan, and was established throughout the lower Gulf Coast states. The acreage of satsumas was virtually eliminated in the states bordering the northern Gulf of Mexico by severe freezes in 1894 and 1899.

However, the satsuma acreage rebounded. By the 1920s, Florida's Jackson County had billed itself as the "Satsuma Capital of the World." There were about 23,000 acres of satsumas at that time (Figure 1), and the fruit was marketed as "Sugar Sweet." The highest yield occurred in 1923, when satsumas were sold in the Northern and Midwestern regions of the United

States, including major cities such as New York and Chicago. The combined effects of freezes, hurricanes and the lack of workforce due to World War II eliminated the satsuma industries on the Gulf Coast until the 1990s.

The relatively mild winter temperatures during the last three decades and the development of microsprinkler irrigation in the early 1990s to reduce the effects of freeze (Figure 2) have led to a resurgence of interest in cold-hardy citrus in North Florida. Satsumas are the most cold-hardy commercial citrus and account for a great majority of the new commercial citrus acreage in North Florida. In 2017, the acreage of citrus by county in North Florida was as follows: Gadsden, 120; Jackson, 31; Jefferson, 30; Taylor, 34; Madison, 30; and Suwannee, 20.

When properly cold acclimated, satsumas are cold hardy down to



Figure 2. A young citrus reset covered in ice from microsprinkler irrigation helps reduce cold injury to the tree.

about 12 to 14 F. They mature and are harvested during a four-week period centered in mid-November. To avoid peel tearing, satsumas must be clipped to be harvested and should be handled with care because they are more prone to bruising than most other types of citrus.

VARIETIES FOR NORTH FLORIDA

Currently, there is an urgent need to diversify fresh-market citrus in North Florida to include varieties that mature from September through December.

At the University of Florida Institute of Food and Agricultural Sciences (UF/IFAS) North Florida Research and Education Center in Quincy, many varieties and numbered selections have been under evaluation for up to 13 years. The coldest temperatures recorded in Quincy for the winters of 2015–2016, 2016–2017 and 2017–2018 were 26, 26 and 20 F, respectively. The last 10 years have experienced temperatures as low as 15 F, and Navel, Minneola Honeybell and Valencia have not experienced damage other than tip burn. Satsuma did not sustain any significant cold injury.

In North Florida, microsprinkler irrigation for cold protection is imperative, especially for the non-satsuma varieties. Nevertheless, low-lying areas that can serve as frost pockets should be avoided, if possible. To reduce wind speed during freeze events, it is highly advisable to select a location that is



Figure 1. Satsuma grove in Milton, Florida (1929)

protected by woodlands or other barriers on the north quadrant of the grove.

The citrus varieties that mature before Christmas have the best chance for success in North Florida since citrus fruit will freeze in response to prolonged temperatures of 25 to 27 F. Researchers are particularly interested in early-maturing mandarins that would be available on the market from November to January. Other important traits include cold hardiness and seedless varieties that are uniformly small to moderate in size, attractive, sweet, and easy to peel.



Figure 3. Owari is a satsuma variety suitable for North Florida production.

Satsumas

Brown Select is the satsuma variety that produces the largest tree and fruit size. It has a higher yield than Owari and matures in early November.

Owari (Figure 3) is the most popular satsuma variety. It produces a consistent crop of small to medium-sized fruit. It reaches optimum maturity in mid-November.

Xie Shan is an early-maturing satsuma variety that matures during late October. In previous years, Xie Shan has produced large, puffy fruit that were not suitable for marketing. In 2016, a heavy crop (300 pounds/tree) of sweet, moderate-sized fruit was produced. In 2017, crop load was light and most fruit were large and puffy. More observations are needed on this variety before a recommendation can be made.

For more details on the performance of satsumas in North Florida, see EDIS publication HS195, "The Satsuma Mandarin," at <http://edis.ifas.ufl.edu>.

Other Citrus

Early Pride is a low-seeded Fallglo-like fruit. The fruit-maturing period is

CRDF 2018 Funding Cycle Is in Full Swing

On April 24, the Citrus Research and Development Foundation (CRDF) board of directors approved research priorities for two separate research funding programs. One is for projects that will lead directly to the development of commercial products, tools or recommendations (Commercial Product Development Committee, CPDC-18). The other is for projects with broader, fundamental researchable questions (Research Management Committee, RMC-18). Both of these funding programs have the goal to improve citrus production and mitigate the effects of pests and diseases, mainly HLB.

The priority categories for research were established following extensive consultations with growers, researchers and other citrus industry stakeholders to identify ideas that will provide solutions to HLB and other important citrus diseases and pests, such as citrus black spot (CBS), postbloom fruit drop (PFD) and citrus nematodes. Both CPDC-18 and RMC-18 have research priorities within five categories: bactericide research, Asian citrus psyllid research, plant improvement, horticultural practices and research on other important pests and diseases affecting the citrus industry.

Bactericide project research priorities aim to identify and test bactericides and delivery strategies that improve tree health and fruit quality of young and mature trees. Also included is examination of the dynamics of chemical movement within the vascular system of the tree to improve bactericide efficacy. Psyllid research priorities focus on developing new or improved strategies for psyllid management along with examining the impact of bactericides on the psyllid, effects on transmission of the HLB bacterium and effects of repeated feeding and inoculation on tree health. Plant improvement research priorities focus on testing existing varieties and developing and testing new varieties, including varieties developed using biotechnology. Horticultural practices priorities address the effect of nutritional treatments on mitigating tree decline, including the effect of micronutrients and macronutrients on root health. Plant growth regulators and the effect of other chemicals or horticultural practices on tree health are also included in these research priorities. Other citrus diseases are also covered under the research priorities, including citrus canker, PFD and CBS.

On April 25, a call for preproposals and guidelines for both funding programs went out to researchers. On May 21, preproposals were due for both CPDC-18 and RMC-18. Preproposals are short descriptions of the projects that researchers plan to propose.

In early June, a panel of independent scientific experts, CRDF committees and the CRDF board of directors will review preproposals, and recommendations will be made on which projects should be invited to be developed into full proposals. Full proposals will be due on July 20. They will be reviewed again by a panel of experts, CRDF committees and the board, and recommendations will be given on top projects to be funded.

New research projects will be funded in early October 2018. CRDF is looking forward to seeing new ideas from researchers in this year's funding cycle. To see the complete list of research priorities and for more information, visit the CRDF website (www.citrusrdf.org).

Prepared by the CRDF project management team



Column sponsored by the Citrus Research and Development Foundation

September and October, a time when little other fresh-market citrus is available in North Florida. It produces a high-quality, medium-sized fruit with good flavor that is easy to peel. Early Pride appears to be somewhat resistant to *Alternaria* and citrus scab. It is not cold hardy, and should only be considered for the best sites that are sheltered from north winds. Early Pride should be supplied with microsprinkler irrigation for freeze protection.

Minneola Honeybell: Minneola is an older cultivar that produces an attractive, medium-large, bell-shaped fruit. It appears to be less cold hardy than LB8-9 (Sugar Belle®) and has a later maturation (late December to January). Minneola is very susceptible to *Alternaria* fungus, and a rigorous spray program is required for commercial production.

Navel has performed very well. There have been no reported problems with *Alternaria* or citrus scab. Navel trees seem to be fairly cold hardy and should be under consideration for North Florida. They may be harvested just before Christmas.

Orlando Tangelo is a Dancy tangerine and Duncan grapefruit cross. It produces a medium-sized tangerine-like fruit that is not easy to peel. It produces poorly in solid blocks because it is self-incompatible. Fruit

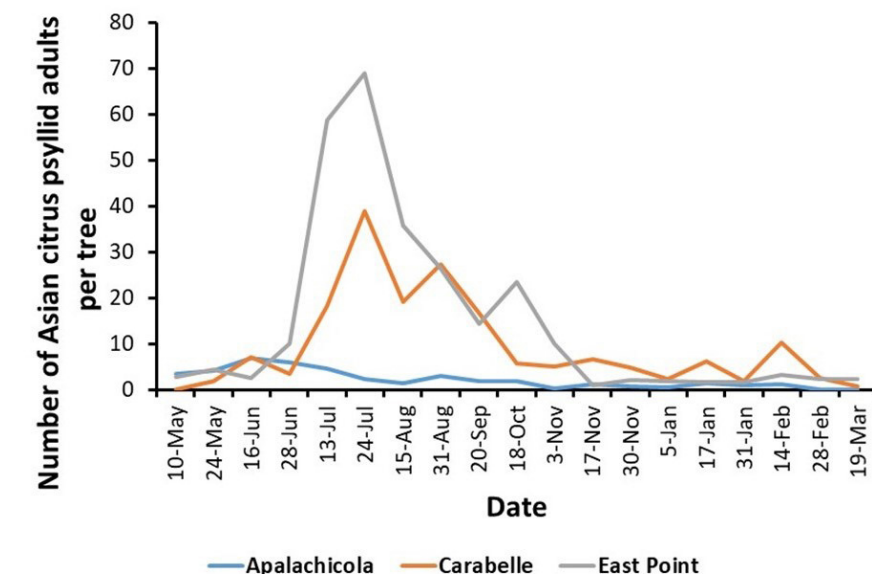


Figure 5. Population dynamic of the Asian citrus psyllid in Franklin County, Florida, during summer 2017 and winter 2018.

contain many seeds when grown in a mixed block. It appears to be moderately cold hardy and matures from November through January.

Sugar Belle® (Figure 4) was derived from a Clementine and Minneola Honeybell cross. This mandarin hybrid is perhaps the cold hardiest of all non-satsumas in the Quincy trial. It produces a very attractive, medium-sized fruit that is

bell-shaped and high in sugar. Fruit can have quite a few seeds when grown in a mixed block with citrus that can serve as pollinizers, and it can be higher in acid than is optimal. Sugar Belle® is not easy to peel. It matures in November through December. Sugar Belle® has good potential for North Florida.

Tango is a seedless Murcott. Tango produces a small but sweet fruit with an average Brix of about 12. It is attractive and easy to peel. Cold tolerance is moderate. It is extremely susceptibility to citrus scab and *Alternaria*. It matures from mid-December through January. Tango may be considered for North Florida, especially if fruit consistently mature before Christmas.

Valencia gave good crops the last two years in the variety evaluation trial, but it is a risky crop for North Florida because of a late (January through March) maturation date. Early Valencia (EV1 and EV2) that can mature by mid-December offer some potential, but have not been evaluated yet in North Florida.



Figure 4. Sugar Belle® is one of the cold hardiest non-satsuma citrus varieties.

PEST AND DISEASE STATUS

The two major arthropod pests in North Florida are the citrus leafminer and rust mites. Leafminer population has two peaks occurring during the two major flushing seasons in May and September. Rust mite scouting should

start in early summer to avoid damage on fruits in the fall. Injury caused by rust mite, including sharkskin and bronzing, is mainly cosmetic but of particular concern in North Florida, as most of the production is directed toward the fresh market.

Other occasional pests include the leaffooted bug, cottony cushion scale and eastern lubber grasshopper. Aphids can be quite abundant in fall and include the spirea aphid, melon aphid and black citrus aphids. The brown citrus aphid, the vector of citrus tristeza closterovirus, has not been found yet in North Florida. Citrus whitefly is also present but is usually naturally controlled by the entomopathogenic fungus *Aschersonia aleyrodis* and *A. webberi* (red and brown fungus, respectively) and a complex of parasitoids.

Contrary to South and Central Florida, Asian citrus psyllid (ACP) and huanglongbing (HLB) have not been reported in commercial groves in North Florida. However, ACP and HLB have been found in dooryard citrus in cities along the coast from Mobile, Alabama, to Carrabelle, Florida. The first cases of citrus greening were recorded on the Gulf Coast in Franklin County, Florida, and in coastal Alabama last year. ACP was found to survive in Franklin County in the winter of 2018, when exposed to minimum temperatures of 23 to 25 F (Figure 4, page 18). Therefore, it is likely that ACP will remain in close proximity to satsuma citrus groves. Consequently, regular monitoring of citrus groves is needed to avoid future infestations.

The two major fungal diseases in North Florida are Alternaria brown spot (*Alternaria alternaria*) and citrus scab (*Elsinoe fawcetti*). The most susceptible citrus variety to citrus scab is Tango, but tangelos and satsuma are also susceptible. Early-season fungicide sprays are required for both Alternaria and scab. Citrus canker (*Xanthomonas citri*) has not yet been reported in commercial citrus groves in North Florida. 🍊

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