Figure 1. A more than 20-year-old Parson Brown tree is maintaining a normal canopy with minimal fruit drop.

The past and potential of Parson Brown

By Gary K. England and Manjul Dutt

The Parson Brown is an early-season sweet orange that was identified in 1875 by J.L. Carney and named the Carney Parson Brown (CPB). In a 1923 article titled 'History of the Parson Brown Orange,' E.L. Carney described how his brother Capt. J.L. Carney sought a sweet orange of acceptable quality for budding onto native sour orange stock growing on a property near Lake Weir in Marion County that he purchased in 1874.

VARIETY HISTORY

J.L. Carney had heard of an excellent tasting sweet orange owned by a Methodist minister named Brown in the Webster, Sumter County area. He selected one of five seedling trees on the Brown property that he described as prolific in growth and of "fine flavor." Rev. Brown indicated that the five seedling sweet orange trees on his property were given to him by someone passing through on their way from Savannah, GA, to settle in the Peace Creek area. He was told the trees originated from an orange carried on a British ship that was unloading goods obtained in China. The E.L. Carney article stressed that his brother studied all five trees extensively and considered each significantly different from the others in quality and maturity.

J.L. Carney purchased rights to cut budwood from what was referred to as the "Carney tree" for $80. He cut budwood for eight years until selling that right to another grower for $100. During this time, other growers collected budwood from the other trees on Rev. Brown's property and, unfortunately, some trees propagated from these were also identified as Parson Brown, not knowing all five trees varied in quality and maturity and were mostly different.

Confusion over what was and was not "true" CPB trees escalated after the devastating 1894–95 freezes when bud lines from other seedling trees on Rev. Brown's property were marketed as Parson Brown versus the Carney tree. J.L. Carney pointed this out in a letter he wrote to Florida Farmer and Fruit Grower in 1896. He cautioned growers who wished to source CPB trees to be careful in identifying the source of the budwood.

By the mid-1920s, the Parson Brown cultivar had become a popular early sweet orange. Eventually, Parson Brown fell out of favor due to seediness, relatively lower yield versus Hamlin, and poor fruit quality

delivered to juice plants from blocks thought to be Parson Brown but were possibly from other budwoods.

During the 1950s–1960s, there were approximately 15 different clones of Parson Brown registered with the Florida Department of Agriculture and Consumer Services (FDACS) Citrus Budwood Program. It is difficult to say if all these clones are related to CPB or not. Of these 15, only one remains in the budwood program, F-56-2. Two others, Parson Brown 3-37-6 and Parson Brown 3-40-2, were collected from the Carney block in the Orange Island area of Lake Weir in December 1983 and are quite likely related to the original CPB.

Parson Brown trees always had better canopy density with much lower dieback than Hamlin.

Another clone is the Parson Brown SPB-1-2-3, entered by Lena B. Hughes. It is from a nucellar citrus block 5 miles northeast of Plymouth, Florida. This clone was dropped by the Division of Plant Industry (DPI) as acid levels tapered off early in the season and ratios were not met. In addition to the F-56-2 clone available at DPI, two other clones, the Carney Orange DPI 229-2 (CO2) and 229-3 (CO3), were introduced relatively recently in the fall of 2015 to the FDACS-DPI Citrus Parent Tree Program.

HLB TOLERANCE

As citrus groves throughout Florida are in serious decline from the effects of huanglongbing (HLB), growers mentioned certain rootstock and/or cultivars that seemed to exhibit varying levels of tolerance to HLB. One mentioned often was the Parson Brown sweet orange (Figure 1, page 14). These trees had normal-sized fruit and very little fruit drop even under endemic HLB conditions (Figure 2, page 16).

Research confirmed the enhanced growth and fruit-keeping quality on

Figure 2. Mature fruit hangs on a Parson brown tree. The inset shows a cluster of normal-sized immature fruit despite being from an HLB-infected tree.

the Parson Brown trees from four locations. Interestingly, there were no significant differences in the *C*Las titer between the Parson Brown trees when compared to rapidly declining Hamlin trees in the same or adjacent blocks. Parson Brown trees always had better canopy density with much lower dieback than Hamlin.

To better understand the effect of HLB on these trees, RNA was isolated from them to evaluate the gene expression patterns. Efforts were focused on the systemic acquired resistance (SAR) process and identification of the upregulation of the PR1 gene in all Parson Brown trees that were evaluated. Many of these trees also had the other SAR marker (PR2) in an enhanced state. These initial results are interesting since they potentially indicate that the Parson Brown trees have some sort of internal mechanism that allows them to better protect against infection when compared to Hamlin. Hamlin is very susceptible to HLB and does not upregulate the PR1 gene at the same rate as the Parson Brown following infection.

WHY SAR IS IMPORTANT

The plant defends itself from biotic attack by two primary methods. The first is a physical level defense through the production of barriers such as trichomes that restrict pathogen infection. The second is a systemic plant defense mechanism. This defense mechanism results through the movement of long-distance signals to and from the rootstocks to the scion through the graft union.

Long-distance signals potentially involve mRNAs, small RNAs and proteins. Some of the proteins involved in this long-distance signal transport are the defense-related pathogenesis-related (PR) proteins and phytohormones, particularly salicylic acid (SA) and jasmonic acid (JA). SA helps activate plant defense mechanisms against biotrophic and hemibiotrophic pathogens, whereas JA is usually involved in defense pathways against necrotrophic pathogens and herbivorous insects.

IMPLICATIONS

What does this all mean for the long-term management of Parson Brown? Much remains to be understood before we can fully elucidate the mechanism of HLB tolerance in Parson Brown oranges. In addition to the enhanced PR expression, there could be other factors that play an important role in this process. It is also possible that there is active communication between the Parson Brown scion and the rootstock as part of this SAR mechanism, which may result in less damage to the root system and loss in fibrous root density. This would in turn help maintain a normal canopy and crop load through proper nutrient and water uptake.

Most of the Parson Brown trees that we have observed are 20 to 30 years old. Thus, these trees have managed to survive the onset of HLB in Florida. In this era of endemic HLB, where many small growers have left the industry, and the remaining growers' bottom line is being squeezed from declining sales and low pounds solid, the Parson Brown sweet orange offers hope that genetic tolerance to HLB is perhaps available from a sweet orange cultivar grown in Florida since the late 1800s. Understanding this mechanism could help ensure the survival of Florida's orange juice industry and assist in the development of future citrus-breeding strategies that focus on HLB-tolerant sweet oranges — primarily early-season cultivars.

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