



Application of Molecular Markers in Sugarcane Germplasm Innovation and Breeding: New Germplasm with Cytoplasm from *Saccharum spontaneum*

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All current sugarcane cultivars (*Saccharum* hybrids spp.) are interspecific hybrids of *S. officinarum*, *S. robustum*, and *S. spontaneum* that bear the same cytoplasm of *S. officinarum*. Until the end of twentieth century, *S. spontaneum* was exclusively used as male parents to confer such traits as vigor, ratoon ability, and disease and insect resistance. There was no report on *S. spontaneum* being used as female parents, due to *S. spontaneum* being regulated noxious weeds with substantial self-fertilization and vigorous rhizomes. This situation changed when two series of innovative crosses (*S. spontaneum* × elite cultivars) were made in 1997 and 2001 at the USDA-ARS, SRU. Flowers of *S. spontaneum* were pretreated by trimming off both dehisced and immature florets, immersing in 45 °C (or 50 °C) circulating water bath for 10 (or 5) min, and being placed underneath the flowers of elite varieties. The 1997 cross was made between *S. spontaneum* clone Djatiroto and cultivar LCP 85-384 (Pan et al. 2004). The 2001 crosses were made between ten *S. spontaneum* clones and six elite varieties (Pan et al. 2006). One F₁ progeny from the cross (SES 234A × LCP 85-384) survived a hard frost in March 2003 and was commercially released as an energy cane cultivar Ho 02-113. From the 1997 cross, ten F₁ progenies were selected based on DNA marker and phenotypic evaluations. Their authenticity was further confirmed by SSR fingerprinting. One progeny, US 99-43, produced the largest stalks with the highest Brix values and was chosen for further improvement. Three cycles of backcrossing,

field evaluation, and selection were completed. Five BC₂ progenies were selected in 2008. One BC₂ progeny, Ho 08-9504, produced eight large stalks and a Brix of 23.8. It never flowered in Louisiana, but flowers readily in Florida. A BC₃ backcross (Ho 08-9504 × HoCP 04-852) was made at Canal Point, FL; 216 BC₃ progenies were planted in the field in 2015, of which 36 were advanced to first-line trials in 2016. Seven of the 36 BC₃ progenies were advanced to second-line trials in 2017 that were free of diseases and borers, produced 11–20 stalks with 25–32 mm diameter and 19.6–22.4 Brix. Pedigree indicated that these seven BC₃ progenies may inherit nuclear genes from *S. spontaneum*, *S. robustum*, and *Erianthus*. Availability of these *S. spontaneum* cytoplasm-containing BC₃ progenies may enhance genetic diversity analysis of *Saccharum* germplasm and enable sugarcane breeders to explore the possible contribution of *S. spontaneum* cytoplasm in the development of new sugarcane cultivars.

References

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