

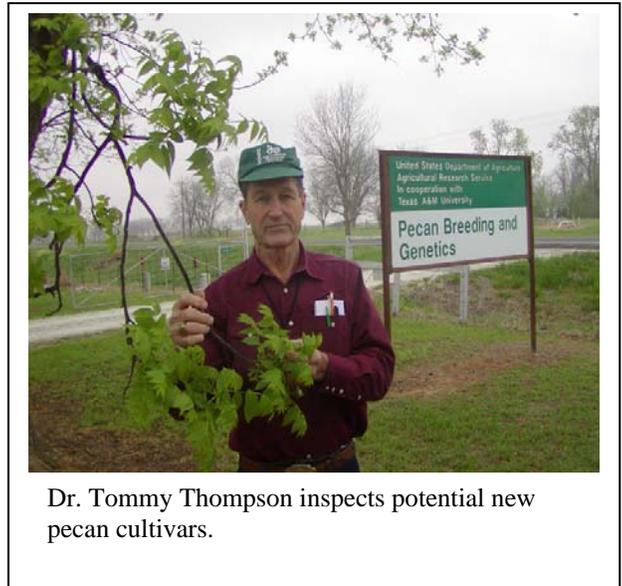
TEXAS A&M PLANT BREEDING Bulletin

April 2011

Last month's Texas A&M University Plant Breeding Bulletin dealt with the USDA Plant Germplasm Collection Program and highlighted the cotton Working Collection headquartered at College Station. By act of Congress, four Plant Introduction Stations, through cooperation of the USDA/ARS and State Agriculture Experiment Stations were established. This was followed by the establishment of several USDA/ARS Working Collection sites where scientists acquire, maintain, regenerate, distribute, document, characterize, and evaluate, among other duties, accessions of specific

seed propagated crops. Eight National Clonal Germplasm Repositories were established to collect and preserve diversity of asexually propagated species such as fruit and nut trees. This month we feature the *Carya* Collection that also is headquartered near and associated with Texas A&M.

The National Clonal Germplasm Repository for Pecans and Hickories (NCGR-*Carya*) was established in 1984, but the work that provided the foundation for the collection began in 1930 when appropriations for pecan research work in Texas were made through the efforts of U.S. Congressman James P. Buchanan, of Brenham, Texas. In 1931, a long-term pecan research orchard was established on Pecan Bayou on land owned by the City of Brownwood. That orchard became the USDA-ARS Pecan Station (now worksite) at Brownwood. In the spring of 1931, Louis Romberg began making controlled crosses of pecans in an effort to improve nut quality and production. Over the years, Romberg collected pecan cultivars for his use in the breeding program, grafting them into trees at the Brownwood Station. It was Romberg's collection that was designated as the National Clonal Germplasm Repository in 1984. In 1987 Texas A&M University invited USDA-ARS to establish an additional pecan worksite on land



Dr. Tommy Thompson inspects potential new pecan cultivars.

owned by the University near College Station, Texas. The Brownwood and College Station worksites are home of the USDA ARS Pecan Breeding & Genetics Program. That program has two major projects: the NCGR-*Carya* and the Pecan Breeding Program.



Dr. L.J. Grauke (left) addresses participants in the joint meeting of the Southern Plains Diagnostic Network (SPDN) and the Great Plains Diagnostic Network (GPDN) at College Station in 2010.

The mandate of the National Clonal Germplasm Repository system is to provide for maximum genetic diversity in each genus by collecting wild species and domestic cultivars from worldwide sources. Pecan is in the *Carya* genus, along with about 16 other species (commonly called “hickories”) that are distributed across the southeastern U.S, Mexico and Asia. The *Carya* Crop Germplasm Committee established a strategy to represent the genus by collecting seed from native trees of all species across their geographic ranges, with the most thorough collections being made from native pecan populations. In 1986, seed and herbarium collections were made from native pecan populations in the U.S., from Texas through Missouri and Illinois. In 1987, seed and herbarium collections were made from native pecan populations in Mexico as far south as Zaachila, Oaxaca. Pecan seedlings growing on their own roots were planted in provenance test orchards at both the Brownwood and College Station worksites, as well as at a sister USDA-ARS

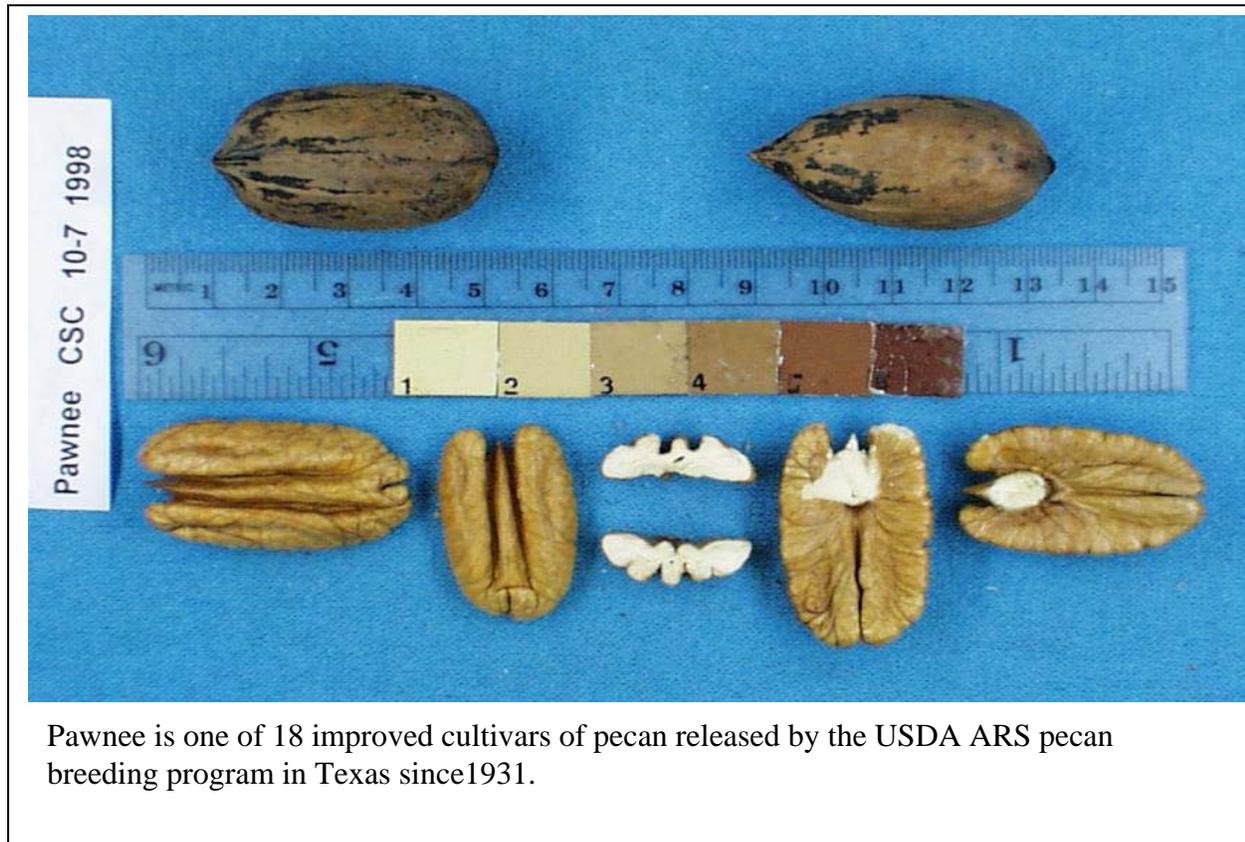
research program at Byron, GA. Those orchards, as well as other collections grown from seed collected in subsequent years, have been the source of valuable information on the influence of geographic origin relative to genetic diversity, phenology, and performance of pecan. Because much of the collection is maintained as seedlings on their own roots rather than as grafted trees, the entire collection is referred to as the National Collection of Genetic Resources for Pecans and Hickories, still carrying the acronym NCGR-*Carya*.

Seed and herbarium collections have been made also from native populations of hickories. All *Carya* species in the U.S. are represented. The most recent (2009) concentrated collection effort was from sympatric Florida populations of two tetraploid ($2n=4x=64$) species: *Carya floridana* and *C. glabra*. Interspecific hybridization was observed to contribute to genetic distinctions between geographic populations, as is common between sympatric species of the same ploidy level in the genus. Pecan, a diploid ($2n=2x=32$), has been found to form natural hybrids with other diploids in the genus also (*C. aquatica*, *C. cordiformis*, *C. ovata*, and *C. laciniosa*). Controlled crosses have produced hybrids between pecan and two other diploids, *C. cathayensis* and *C. myristiciformis*. Collections of the Mexican *Carya* species, *C. palmeri*, *C. myristiciformis* and *C. ovate*, were included in 1987 and in 2001. In 1990, collections were made from *Annamocarya sinensis* (formerly *Carya sinensis*) and *C. tonkinensis* in Vietnam, while *C. cathayensis* and *C. hunanensis* were collected from Zhejiang and Hunan, China, respectively.

Genetic resources of the *Carya* genus are distributed worldwide through the NCGR-*Carya*, as mandated by the U.S. Congress. Most requests, both domestic and international, are for pecan cultivars that have been productive in commercial orchards most comparable to the environmental constraints at the intended site. The maintenance of verified inventories of grafted cultivars is an important prerequisite to the fulfillment of such requests. Modern molecular techniques such as microsatellite markers have been developed that allow verification of cultivar identity and even confirm parentage of controlled crosses. The NCGR-*Carya* maintains over 300 pecan cultivars as grafted trees in its Texas worksites and also maintains extensive documentation on their origination and evaluation.

The USDA ARS Pecan Breeding & Genetics Program benefits from its proximity and association with the NCGR-*Carya* repository and has developed successful breeding strategies to utilize the genetic raw material housed in the repository. The joint effort to characterize the diversity of

native populations across their geographic ranges has contributed to the recognition of the role of interspecific hybridization in regional diversity. This understanding of the genetic role of interspecific hybridization has contributed greatly to the USDA ARS Pecan Breeding Program. The strategy of utilizing wild related species for the development of selected traits such as early nut maturation is being pursued within the Breeding Program.



Pawnee is one of 18 improved cultivars of pecan released by the USDA ARS pecan breeding program in Texas since 1931.

It is necessary to conserve, maintain and characterize the genetic diversity of this valuable genus of trees, in order to continue the process of improvement. It is ironic that the Pecan Breeding Program, by providing improved pecan cultivars that are rewarding economically, has provided the motivation to remove diverse, adapted and uncharacterized native stands and replace them with grafted orchards. The genetic diversity of these replaced native stands of pecan may be lost through this process and the use of improved grafted pecan cultivars in close association with native hickory populations of Mexico and China may impact the future development of wild hickory populations. Long term goals of the NCGR-*Carya* include the designation of

appropriate, regionally diverse *in situ* reserves on conserved lands, where the very raw materials of diversity can be preserved and observed uninterrupted.

Effective strategies to conserve and develop this important group of trees will benefit from global participation. To encourage that effort, the USDA ARS Pecan Breeding & Genetics Program, in conjunction with Texas A&M University, the Texas Pecan Growers Association and the International Society for Horticultural Sciences will sponsor the first International Workshop on Pecans and Other *Carya* in Indigenous and Managed Systems at College Station, Texas, July 17-20, 2013.

Additional information concerning *Carya* and its collection and preservation can be found in the following:

Grauke et al., Geographic patterns of genetic variation in native pecans. *Tree Genetics and Genomes*. Online First, 25 March 2011; Sagaram et al., Variation in anatomical characteristics in leaves of pecan seedstocks from Mexico and the United States. *J. Amer. Soc. Hort. Sci.* 136:103-108. March 2011).

Lu et al., Juglandaceae In: *Flora of China* pp. 278-285. Science Press and MO Bot. Gard. 2001.

Other News

Reminder: The 2011 NAPB annual meeting will be held at College Station, Texas on the campus of Texas A&M University in 23 – 25 May 2011. Reminders and additional information on the 2011 meeting will be noted in future Plant Breeding Bulletins.

Please direct comments concerning this bulletin to Wayne Smith, cwsmith@tamu.edu or 979.845.3450.

AND FINALLY, a special thanks to Dr. L.J. Grauke for the vast majority of the information in this month's Texas A&M Plant Breeding Bulletin.