M any of the publications on establishment, management, and utilization of black walnut and other high-value hardwoods are printed in conference proceedings or scientific journals that are not readily available at most public libraries or on the internet. As Chair of the Education Committee of the Walnut Council, I have tried to summarize the findings from the following technical articles or books, especially as they may relate to black walnut or butternut. If available, I have also indicated where to write for reprints or given an address where the articles can be downloaded if on the internet. As an additional service, I have placed copies of these materials in the Walnut Council Library. Members of the Walnut Council can borrow these materials for two weeks by sending a written request or email to the above address.

ORIGIN OF FROST CRACKS IN STEMS OF TREES

This article is a non-technical version of the author's original review and synthesis of the information on the mechanism of frost crack formation in trees originally published in Forest Science. Frost cracks are a concern to walnut growers because the defect is essentially permanent and significantly lowers the value of the butt log. Frost cracks are so named because the crack is most evident when temperatures drop far below freezing and later as a bulging vertical frost rib formed by wound callus initiated to close the wound. Once a crack forms, this is the weakest point around the trunk of a tree so that in subsequent winters the wound is likely to crack again and form additional wound callus. Kubler indicates the primary cause of the stresses leading to frost cracks is associated with movement of water from plant cell walls into the cell lumens under freezing temperatures that causes cell walls to shrink and is not the expansion of freezing water within the cells. The internal drying and thinning of cell walls causes the wood to shrink such that the shrinkage perpendicular to the radius is twice as great as in the radial direction (stem surface to pith). As temperatures decrease the amount of internal drying increases and can lead to tension within the wood that is sufficiently high to break wood causing a V-shaped crack from bark to the pith. Once cracked, as temperatures decrease, the crack widens. When temperatures are above freezing the crack gradually closes and wound callus is initiated. Several other factors can also influence the extent of frost cracking. When temperatures are rapidly falling, the outside of a tree cools rapidly creating greater tension near the outside than the warmer center of the tree. In trees like black walnut where wood shrinkage is nearly equal in both directions (tangentially and radially), temperature differences contribute more to the tension stresses than differential shrinkage. This may explain the observation of growers that frost cracks in black walnut appear to develop following winters in which there was a large temperature drop from above freezing to sub zero over a few days. It also explains why painting the stem white reduces amount of frost cracking. On cold sunny days, dark bark absorbs radiation and warms the stem. At sunset, heat is rapidly lost from the outer wood placing it under increasing tension as the outer wood freeze-shrinks over the warmer wood on the inside of the stem. Bark painted white absorbs less radiation keeping the center cooler and allowing it to freeze-shrink with the wood on the outside of the stem. Kubler believes the reason some trees in a planting have frost cracks while others do not appears to be the “notch” effect resulting from earlier wounds to the stem, branch stubs, epicormic sprouts, or pockets of diseased wood. As a tree calluses over a branch or wound, callus grows mostly from the opposite sites. When the callus meets, it abuts but does not grow together nor does it connect to the damaged wood below the callus. The small radial separation in the new wood is a weak zone where the wood more easily separates under tensions created during freeze-shrinkage.

BLACK WALNUT ON IROQUOIAN LANDSCAPES

Close examination of the natural range map for black walnut prepared by E.L. Little for the Atlas of United States Trees shows almost a dozen small discontinuous walnut populations in New York and surrounding states. The author makes the argument that these populations correlate closely with the locations of the late prehistoric Iroquoian archeological sites. Early historians documented the growing of tree crops including peach, shellbark hickory, and nut trees by the various tribes. Although walnut was documented, it is unclear whether the authors were writing about black walnut, butternut, or, possibly, hickory. At the time of European settlement, walnut trees were found growing in straight lines suggest native Americans had planted and managed tree plantings for their fruit. Early explorers, missionaries, and settlers frequently noted the extensive Native American activities centering on nut food and oil processing including the use of fire to facilitate the harvesting of nuts. There is an excellent record of hammer stones and stone mortars being found in areas where black walnut was plentiful. Apparently, nuts were crushed, boiled in water, and then the nut meat and oil skimmed off to be stored in gourds or ceramic pots. The author discusses the cultural and ecological implications as to the similarity between the soil and moisture requirements of black walnut and maize. Taxonomic evidence indicates that both black walnut and maize originated in Central America with good evidence that the Paleo-Indians are in part responsible for the northward movement of corn and possibly walnut following the last ice age. At some archeological sites, nut shell is more abundant than maize. Other large mast species showing discontinuous populations that correlate well with locations of Iroquoian archaeological sites include pawpaw, mockernut, shellbark hickory, white oak, and bur oak. If you like early American history as viewed through archeological evidence, you’ll find this article on the propagation and spread of walnut in the Northeast to be quite fascinating otherwise just appreciate the fact native Americans are at least in part what we believe to the native range for many of our large edible mast crops.

GROWTH AND NUT PRODUCTION OF BLACK WALNUT IN RELATION TO SITE, TREE TYPE, AND STAND CONDITIONS IN SOUTH-CENTRAL UNITED STATES

Black walnut is frequently used in several agroforestry practices because of its valuable wood, the production of nuts for human and wildlife consumption, and relative thin crowns that allow light to penetrate to crops, forages, or native vegetation. The authors examined dominant height (DH) and diameter at breast height (Continued on page 8)
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lower survival rates for top-pruned seedlings while six studies showed increases from 3 to 42 percent in survival for top-pruned seedlings. In most cases, pruned hardwood seedlings show increased annual height growth and will be taller than or as tall as non-pruned seedlings at the end of two or three growing seasons. Although top-pruning will result in more forked seedlings in the year after field planting, these forks apparently do not persist as there was no studies that showed top-pruning increased the frequency of low forked trees in established hardwood plantations. The author concludes that proper top-pruning of tree seedlings is a beneficial nursery practice to improve seedling uniformity and the root-to-shoot ratio making seedlings easier to handle seedlings in the nursery and when field planting as well as increasing seedling survival on less than ideal sites.

This article can be downloaded from the internet at the following address: http://treesearch.fs.fed.us/pubs/2481

The author asserts that either you love or you hate eastern black walnut, i.e., if you're a craftsman it offers some of the finest wood available and if you're a vegetable gardener it can make your life miserable. The article succinctly summarizes general knowledge about the species in lots of non-technical information as well as perpetuating a number of folktales without supporting documentation.