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Is The American Chestnut Tree About to Make a Revival?

KEY TAKEAWAY

Chestnut trees are an attractive option for agroforestry operators in the United States. They grow well at varying latitudes and their limited resource requirements + strong commercial yields make for potentially solid returns to stakeholders. But that's not where the story ends when it comes to chestnut trees in the U.S. The American chestnut tree variety used to be a dominating force across eastern U.S. forests, however a blight introduced from Asia in the early 20th century has largely removed the tree's presence from the landscape today. As a result, agroforestry operators have largely gravitated towards other hybrid varieties. Researchers from the American Chestnut Foundation (ACF) and SUNY have been working to create a new American variety that would enable the country to restore this native species to its land. The U.S. government is close to delivering a decision on whether this may take place, however legal challenges could prolong a long-awaited conclusion. Agroforestry operators are wise to consider this backdrop as they make plans into the future.

KEY POINTS

Once a King. The American chestnut tree (*Castanea dentata*) used to dominate the eastern United States, with estimates that it once comprised roughly 30% of all living biomass in eastern American forests. The trees ranged up to 80-120 feet in height and could be eight feet or more in diameter. However, only a very small remnant remain in place today relative to an estimated 4 billion trees that once covered land from Maine all the way to northern Florida. In the early 20th century, the species was virtually wiped out by chestnut blight caused by a fungal pathogen known as *Cryphonectria parasitica*, when the latter was accidentally introduced into the country as people began to import naturally immune Asian species of chestnuts. There is a long-standing plan to bring the American tree back.

Types of Chestnut Species. Aside from the American chestnut species, three other main types of varieties exist: European, Japanese, and Chinese. The American species has largely been known for having smaller nut sizes and higher fat contents. American chestnuts are the most cold-hardy of all four species, with the ability to range down to -50°F (Plant Hardiness Zone 2). The European species (*Castanea sativa*) is sometimes referred to as the "sweet chestnut", with poor winter hardiness and larger nut sizes. Sweet chestnuts are also known for having thick pellicles (the skin material in between the nut and its shell). They are susceptible to chestnut blight similar to American chestnuts. The Japanese species (*Castanea crenata*) is less cold-hardy, as well, while also mirroring the European variety with larger nut sizes and thick pellicles. It tends to produce a starchier nut and has better blight resistance relative to American and European varieties. The Chinese species (*Castanea mollissima*) is sometimes referred to as the "culinary chestnut", with a wide range of nut sizes, a thin pellicle, and consistently high quality and flavor. Culinary chestnuts are cold-hardy (though not as much as the American variety) and are the most resistant to blight disease.

Back to the Throne? Today, most chestnut trees in the U.S. are hybrids between the European, Japanese, and Chinese varieties. European/Japanese hybrids are broadly planted in the western U.S. and Michigan, as they tend to do well in shorter growing seasons. Chinese and hybrid Chinese varieties tend to be planted in the eastern part of the country. However, after battling chestnut blight for more than a century, researchers are using the modern tools of breeding and genetic modification to try to return the American chestnut to its keystone position in U.S. forests. For over 30 years, the American Chestnut Foundation (ACF) has been working with the SUNY College of Environmental Science and Forestry to genetically engineer the American chestnut tree into a variety that will protect it from its deadly fungus-caused blight. Researchers have discovered a gene present in hard winter wheat that produces an enzyme called oxalate oxidase (OxO), which detoxifies the oxalate that the fungal pathogen uses to form deadly cankers on American chestnut stems. The OxO gene has been added to the American chestnut genome, which contains around 40,000 other genes. The new line of tree is called Darling 58, with research teams producing somatic embryos from this line and rooting the shoots to produce transgenic Darling 58 trees.

Required Regulatory Review. When transgenic trees are used in research, they require field test permits from USDA-APHIS (Animal & Plant Health Inspection Services). Additionally, in order for transgenic trees to be distributed to the public and achieve "non-regulated status", approval is required from USDA-APHIS, the EPA, and the FDA. It has been roughly 7 years since ACF and SUNY started the regulatory review process. A final decision is expected this summer. USDA-APHIS, the EPA, and the FDA have been working in concert to review Darling 58, with APHIS taking the lead and expected to release a final decision shortly. If approved, ACF has said that it will quickly make the trees available to the public. However, government approval may not be the final step in this long process. Some legal experts within the American Bar Association anticipate that any regulatory approval could be met with a legal challenge from anti-biotech activists to stop launch and distribution of the trees. The long, arduous road to revival may continue.

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