

"SCREENING" THE AMERICAN CHESTNUT FOR FLIGHT RESISTANCE

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The search for resistance to blight in the American chestnut has never ceased, but the chances of success in finding such resistance appeared to be so remote that the U. S. Department of Agriculture early directed its efforts toward the introduction of resistant Asiatic chestnuts and the production of hybrids between them and our native chestnut. Between 1910 and 1930 introductions by seed and scionwood brought to America nearly every species of chestnut in the world, as well as representatives of the closely related chinkapins. In addition to this, since 1928 the Department (in cooperation with the Connecticut Agriculture Experiment Station) produced several thousand controlled hybrids of the Javanese, Chinese, and American chestnut. From 1947 to 1955 inclusive, 15 hybrid chestnut test plots were established under forest conditions in 13 eastern states. These are being maintained and kept under close observation.

We now have approximately 25 years of field testing experience with many kinds of exotic chestnuts in plantations established throughout the eastern United States. Although most of them show a remarkably high resistance to the chestnut blight fungus, their rate of growth and form appear to be generally inferior to that of our native chestnut. Another serious limiting factor is their more exacting site requirements. It has also been observed that practically all of the Japanese, Seguin, and several of the Chinese chestnuts, as well as the Henry Chinkapin, have not been winter hardy in many of the test plots. The limited observations of the hybrid chestnuts, over a period of less than ten years, already indicate some very promising crosses that equal or excell the good qualities of our native chestnut, and thus far have been resistant to the blight. They cannot be evaluated, however, with any degree of reliability until they have satisfactorily withstood at least 25 years of field testing in the established plots.

Despite the fact that during the past 50 years the blight has virtually annihilated our American chestnut over its entire natural range, each year we still receive reports of surviving American chestnuts from widely separated localities. Many of these prove to be sprouts that are only 10 to 20 feet in height, which may still be susceptible to blight. Occasionally, however, very large living trees are reported. Some of these old American chestnut trees may have large, dead, cankered branches scattered throughout a living crown, but the living branches appear to be healthy, bear yearly crops of burs and nut's, and may have old blight lesions that have completely healed over.

In an attempt to determine if any of these large old surviving American chestnut trees may be genetically resistant to the blight, the cooperation of federal and state foresters was solicited to collect scionwood for grafting on to American and Asiatic chestnut root stocks. In February 1955, scionwood collections from 28 old American chestnut trees were received from Connecticut, Maryland, Massachusetts, Missouri, New York, and Virginia. Some of all the material received was used locally. But to make certain that any resulting American chestnut grafts would be adequately "screened", most of the scionwood was forwarded to federal and state foresters in 11 eastern states, from Pennsylvania to South Carolina and Georgia, westward to Arkansas, Missouri and Illinois. There is still an abundant production of chestnut blight spores in most of these localities, which will insure natural infection in any of the American chestnut grafts susceptible to the blight.

Over 200 American chestnut grafts were made by cooperating federal and state foresters last spring. Most of them used the "girdle-graft" method, with a scion bridge over a complete girdle on the rootstock. Chinese chestnut trees, in a plantation established three or four years earlier, generally served as rootstocks. Field reports from about half of our cooperators indicate that about 25 percent of the attempted grafts were successful by midsummer. How many of these will survive the winter still remains to be seen.

From our very limited grafting experience, it appears that undisturbed rootstocks, i.e. trees growing in nursery rows or in plantations, are more likely to produce successful grafts than root stocks that are bench grafted and out-planted, or that are growing in containers. Other factors that appear to be important in the success of the girdle-graft method are: 1) There should not be too great a difference in diameter between the stock and the scionwood; 2) The scion should receive full sunlight for at least part of the day.

The girdle-graft method also succeeded when scions were placed on branches in the crowns of medium-sized and large, old American and Asiatic chestnut trees. All of the crown grafts made rather slow growth. The most vigorous girdle-grafts resulted when a scion was inserted near the base of a coppice sprout. One of them grew over 5 feet tall in one season.

We solicit the interest and cooperation, particularly of foresters, to locate and forward scionwood of still other large, old living American chestnut trees, so that they may also be included in the screening test for blight resistance. The scionwood should be collected in February, only of current year's growth, and from branches that were fully exposed to sunlight. The diameter of the scionwood should be about that of a lead pencil. The collection of scionwood should contain 15 to 20 scions about 8 inches in length. They should be tied in a net bundle, properly labeled, giving size of the tree and condition with reference to previous blight infection, then wrapped in moist newspaper to prevent drying out and mailed to the writer at: The Northeastern Forest Experiment Station, U. S. Forest Service, Laurel, Maryland.

DISCUSSION

Bramble In the resistant American chestnuts are you correlating difference in resistance with tannin content in the bark or any other physiological differences that might account for these trees showing resistance?

Diller Yes, we had some rather extensive ash analysis of Asiatic chestnut leaves made by chemists at Peltsville, Md., several years ago. The leaves were collected from trees growing in several states. Some of the trees were being blighted and other trees of the same kind, age, and on comparable sites were entirely free of blight, in the several locations represented. The spectographic analysis of the ash from the blighted and non-blighted tree leaves failed to yield any consistent differences either in chemical elements present or absent, or in any quantitative differences.

Bramble I understood that somebody in Connecticut, Nienstaedt, found striking chemical differences in the kinds of tannin in the bark between Chinese, Japanese and American.

Diller Nienstaedt, in 1953, in his study of tannins in American and Asiatic chestnut found that the bark of the Chinese and Japanese contain anti-biotic substances in sufficient quantity to cause reduced growth of the fungus. He concluded that the relative resistance of the three species, at least in part, is due to "the differential solubility and qualitative difference among the tannin in the three species studied."

Bramble However, you have no explanation for these resistant trees.

Diller No, we wish someone would tell us.

Buckingham There is a plantation of chestnut, apparently Asiatic, in the Chesapeake flay area that seems to be growing fairly well. As far as I know, no one has told us what kind they are but they seem to be growing fairly well. Are you interested in looking over this plantation?

Diller We have not lost interest in the Chinese chestnut, or in any other chestnuts that show promise of being blight resistant, make rapid growth, and have good form, i.e. either Asiatic chestnuts or controlled hybrids. But for the present we again want to have another look at our native American chestnut. We want to explore if there is a possibility that somewhere in the eastern United States, during the past 50 years, an American chestnut may have developed sufficient natural resistance against the chestnut-blight fungus to warrant our propagating it vegetatively. In the "screening" tests we propose to make, however, we do not want to include volunteer sprouts that are only 2- or 3-inches d.b.h. and 18 to 20 feet in height. We would like to use scionwood only from trees of American chestnuts that are very large, like the several examples we showed you on the screen.

Heimbürger These chestnuts that have been banded, as you call it, and have died and have sprouted, and you put grafts on the sprouts. Now was this chestnut resistant to blight before it was banded?

Diller Yes, this particular Japanese chestnut tree referred to was approximately 5 inches d.b.h., growing vigorously, and with no evidence of blight anywhere on the stem or branches at the time the metal band was applied near the base of the trunk. I had originally hoped to stimulate heavy fruiting by this technique. Instead, the tree was soon killed by the blight.

Several years ago, in three different states, I applied several kinds of inorganic manures (only one kind to a tree) to stimulate rate of growth, if possible. About a year later I attempted artificial inoculation with chestnut blight fungus on the trees which had received the single application and the check, untreated, trees. My preliminary results showed that there were fewer "takes" on the unfertilized (check) trees than the fertilized trees; and that larger cankers were produced on the latter.

Meyer To what size trees is this method of grafting adaptable?

Ashworth Generally about 1/2 inch. I have used it on stocks up to 4 inches but such large ones need more than one scion to support the top.