

2016 Elm Inoculation Trials

University of Minnesota Elm Selection Program

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Executive Summary

The University of Minnesota Elm Selection Program (UMESP) has been working to discover Minnesota survivor elms with putative tolerance to Dutch elm disease (DED) caused by *Ophiostoma novo-ulmi*. UMESP consistently uses commercially available elm selections during inoculation trials for comparison with newly discovered genotypes. This project continues the screening of potentially resistant Minnesota native elm selections to Dutch elm disease (DED), both in the greenhouse and field and it also supports work to find more rapid methods of propagation and screening.

This joint effort between Professors Robert Blanchette and Gary Johnson and staff from Forest Resources, Plant Pathology and Horticulture at the University of Minnesota is showing great promise in obtaining DED resistant elm cultivars that will thrive in Minnesota and across the northern United States. Dutch elm disease has been in Minnesota since 1961, since that time, the losses have been enormous and disease has killed millions of elm trees. The American elm is an excellent tree for urban areas and is also a very important forest species. The elm tolerates salt, pollution and other stresses better than most other tree species. It also is an important component in the ecology of Minnesota's forests. Continued heavy disease pressure from the aggressive strain of the pathogen, *Ophiostoma novo-ulmi* is continuing to kill large numbers of elms around the state annually. Of great interest are the few trees that remain alive in areas of heavy disease pressure. With the help of arborists, foresters and the public throughout the state, we have been able to identify surviving elms that appear to have disease resistance. However, to determine if these trees are in fact resistant it is necessary to propagate the trees and rigorously test them by

inoculation with the pathogen. Field testing of these trees is also essential and for this long term research to be successful continued support is needed.

Rationale, Benefits to Grounds Managers

In an effort to combat DED and keep American elms in our landscapes, disease-resistant elm selections are being used with increasing frequency in urban areas. This has been a positive trend toward the reestablishment of the American elm, however, the DED pathogen has hybridized in the recent past and *Ophiostoma ulmi* has been displaced by the more virulent strain *Ophiostoma novo-ulmi*. Because the resistance mechanisms in elm are not currently understood, it is not clear how today's resistant varieties will tolerate the pathogen if its' virulence changes in the future. The resistance of particular elms to DED will last only as long as the virulence of the pathogen remains the same or lower. This means it is very important to have a variety of genotypes of resistant elms to protect against losing large populations of trees with similar genetic background. Furthermore, it is exceedingly important that newly-identified trees and putatively-resistant trees are thoroughly tested before they are marketed as "resistant".

Princeton American Elm Inoculation Trials

World War II Memorial, Minnesota State Capitol - Saint Paul, MN

Dutch elm disease inoculation trials at the Minnesota State Capitol will examine different inoculation protocols and techniques and their resulting effects on Princeton American elm. This will involve different branch inoculations, which may prove to be a more "real world" test and allow examination of resistance with more precision. There is little consensus on current disease inoculation protocols and additional research is necessary to examine ways to effectively screen survivor elms for disease tolerance.

Inoculation Protocol

Trees will be injected with a spore suspension of the DED pathogen (*Ophiostoma novo-ulmi*) and evaluated for disease progression every two weeks during the remainder of the growing season. A liquid spore suspension of *Ophiostoma novo-ulmi* will be grown in a shaker for three days and diluted to a concentration of 1.0×10^6 . Thirty microliters of the spore suspension will be injected

into a small (2.5mm) hole drilled into branches or the main stem. Holes will then be covered with laboratory film to prevent drying.

Fungicide Injection

A subsample of the inoculated trees will be selected to test the efficacy of using injectable fungicides to halt disease progression and provide options for those experiencing DED in the disease-resistant elm population. Two trees receiving a main stem injection and two trees receiving a branch inoculation will be treated with a commercially available, injectable fungicide using standard injection protocols.

Observation Protocol

Disease progression following inoculation will consist of a rating scale (0-5) based on the percent wilt in the crown of the trees where 0 = not wilt, 1 = 1-24% wilt, 2 = 25-49% wilt, 3 = 50-74% wilt, 4 = 75-99% wilt and 5 = complete wilt. Trees will also be assessed the following growing season to confirm the outcome of disease progression.

National Elm Trial - Inoculation Trials

Minnesota Landscape Arboretum - Chanhassen, MN

The National Elm Trial, coordinated by Colorado State University, sought to evaluate the growth and performance of commercially available elm varieties in differing climatic zones around the United States. The Minnesota Landscape Arboretum (MLA) was the location for one of the 17 evaluation sites. The trial plot at MLA was established between 2004 and 2007. In total, 16 different commercially available genotypes were planted. All growth and performance data for the National Elm Trial has been collected from this trial plot as of 2015. With the conclusion of the National Elm Trial evaluation period, the trial plot at the MLA presents itself as a good opportunity to test commercially available DED tolerant elm cultivars against a local isolate of *O. novo-ulmi* which is currently used in UMESP inoculation trials. Inoculation with a current local isolate of the DED causing fungus will complement the ten years of growth and performance data already obtained from the trial plot. Furthermore, this inoculation trial will give up-to-date tolerance data for the commercially available elm cultivars to a potentially more virulent strain of the DED causing fungus.

Inoculation Protocol & Observation Protocol

As described above in the Princeton American Elm Inoculation Trials.

Outcomes

The American elm is a critical species not only for Minnesota, but nationwide. Continued testing of known resistant cultivars in addition to putative selections in the landscape is key to fighting this exotic disease. The elms in the national elm plot trial provide an excellent opportunity to field test large known and lesser known DED resistant cultivars. This information is valuable to assess the tolerance or lack thereof in cultivars that have been developed in the past and would supplement the large body of growth data that has been compiled over the last decade in these plots.

Table 1.

Cultivar	Replicates at MLA
<i>U. glabra</i> x <i>U. carpinifolia</i> x <i>U. pumila</i> ‘Homestead’	3
<i>U. pumila</i> x <i>U. japonica</i> x <i>U. wilsoniana</i> ‘Morton Glossy’ (Triumph)	5
<i>U. pumila</i> x <i>U. japonica</i> ‘Morton Plainsman’ (Vanguard)	5
<i>U. japonica</i> x <i>U. wilsoniana</i> ‘Morton Red Tip’ (Danada Charm)	4
<i>U. carpinifolia</i> x <i>U. pumila</i> x <i>U. wilsoniana</i> ‘Morton Stalwart’ (Commendation)	5
<i>U. japonica</i> x <i>U. wilsoniana</i> ‘Morton’ (Accolade)	4
<i>U. pumila</i> x <i>U. japonica</i> ‘New Horizon’	5

<i>U. glabra</i> x <i>U. carpinifolia</i> x <i>U. pumila</i> x <i>U. wilsoniana</i> 'Patriot'	4
<i>U. glabra</i> x <i>U. carpinifolia</i> 'Pioneer'	5
<i>U. wilsoniana</i> 'Prospector'	4
<i>U. americana</i> 'Valley Forge'	4
<i>U. pumila</i> x <i>U. davidiana</i> var. <i>japonica</i> 'Cathedral'	5
<i>U. americana</i> 'Princeton'	4