PERFORMANCE TESTING OF STREET TREE CULTIVARS: A MODEL PROJECT[1]

by Henry D. Gerhold

Abstract. A model system for evaluating and comparing street tree cultivars is proposed for any town or city that wishes to use standardized methods. It is a modification of the cooperative STRETEST system proposed several years ago, but not started for lack of financial support. Its methods may be incorporated easily into the regular planting program. The municipal arborist chooses cultivars to be tested and makes periodic measurements and observations as the basis for evaluating their health and growth. Forms and instructions are provided. The results would provide more definitive information for selecting cultivars for stressful planting sites, and thus can improve the health and longevity of city trees. The standardized methods would also permit comparisons to be made with test results from other cities.

Selecting the right tree for a particular urban planning site is one of the most complex tasks for a municipal arborist. Characteristics considered in making selections are many and varied; information on some is more readily available than others. Size, shape, foliage, flowers, and fruits are usually described in nursery catalogs and horticultural books, but information on traits that affect survival and health in cities is limited. Trees vary in tolerance of stresses caused by limited root space, poor soil, pollutants, and other unnatural conditions that may combine to reduce their health and life span. Such characteristics can be more readily determined for cultivars, due to their genetic uniformity, than from trees grown from seed.

An arborist has had to rely mainly on his personal experience in making selections. Because conditions vary greatly from site to site, it is difficult to draw conclusions from informal observations or even published information. Characteristically, when new cultivars are first introduced, very little is known about their susceptibility to pathogens or stresses.

These problems suggest an urgent need for testing cultivars in metropolitan environments to determine which can perform best on various sites. Surveys of arborists and nurserymen have shown that many would be willing to participate in a testing program and that they especially need information about the growth and health of trees under urban conditions (Gerhold *et al.* 1979). The cost of testing can be justified amply by the superior health and longevity of cultivars that will be selected according to test results.

A cooperative performance testing system, called STRETEST, was designed several years ago for evaluating the health and growth of trees in metropolitan regions (Gerhold and Bartoe 1976, Sacksteder and Gerhold 1979). Its design was based on studies of existing plantings in which arborists cooperated. The main objective of the program is to provide the landscape and street tree industry with reliable and meaningful information on cultivar performance at a reasonable cost. When fully operational the program could involve several hundred cities, many nurseries, highway departments, and other federal, state, and local agencies. Most test trees would be established as part of regular plantings and should require little additional cost. Participants would collect performance data at specified intervals, and a coordinator would analyze the data and report results to all participants. The Metropolitan Tree Improvement Alliance made plans to start a Cultivar Testing Project using STRETEST (Karnosky *et al.* 1982), having received some tentative assurance of federal support for financing the coordinator's work. However, when financial support did not materialize, the project was not started because it would have been impossible to promise cooperators that test results would reach them.

Although a comprehensive, multi-city project for testing cultivars does not seem feasible at present, some municipal arborists may want to pro-

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ceed on their own. For those who do, it would be desirable to use standard methods, so that the performance of a cultivar in different cities may be compared. The use of standardized methods would be especially valuable if a regional or national performance testing program were started in the future. Accordingly, the STRETEST methods have been simplified and modified for independant use in towns or cities by arborists who have an understanding of species and cultivar selection.

STRETEST is not intended to replace other methods of evaluating urban trees, but to supplement them. Information from nurseries and demonstration plantings, informal observations by arborists, and controlled laboratory tests all have their place. In commercial nurseries the appearance, ease of propagation, and marketability of potential landscape trees may be observed. But it is not practical to evaluate some characteristics in nursery conditions, particularly those that become evident only after many years or in different environments. Demonstration plantings at arboreta are useful for comparing large numbers of species or cultivars under similar conditions, but here also there are uncertainties in extending the results to the "real world" of cities where environments are very different. Informal observations of trees along streets can detect some of the larger differences and those that occur repeatedly; however, when two cultivars are compared on different sites it is usually impossible to know whether a difference in performance is due to the cultivars or different site conditions.

STRETEST is not unique; in fact, trees have been tested along streets in Illinois, New York, and Ohio; and a Landscape Tree Evaluation program conducted in California in the 1960's also had similarities. STRETEST may be viewed as a process for formalizing and summarizing observations, instead of individuals relying solely on personal experience to recognize the merits and defects of cultivars. The important advantages of STRETEST include:

1. The choice of test trees is made by those who will utilize the results, so cultivars will be tested in proportion to the need for information about them.
2. Test trees are purchased and planted as part of the regular planting program, so the cost of testing is minimized, and results will be realistic. Test sites represent the range of climates, soils, and unnatural conditions encountered in a city.
3. Test designs are practical for normal plantings in cities, yet data can be analyzed statistically.
4. Periodic measurements of the most important and easily observed characteristics are made using standardized procedures, permitting comparisons with other cities.
5. Tests can also serve as demonstration plantings to acquaint interested citizens with characteristics of various trees.

Operation of STRETEST

The basic operation of STRETEST is not complicated. The choice of trees to be tested is made according to requirements for information and the types of planting spaces available. Test trees are purchased and planted as part of the normal plantings along streets or highways, or in parks and other open areas where appropriate space is available. Some restrictions in numbers and arrangements of the trees are necessary to accommodate data analysis. Data are recorded by the arborist in late summer each year. Comparisons and evaluations are made by the arborist, perhaps with the assistance of a specialist in statistical analyses. Trees are evaluated as to survival, growth, health, causes of injuries, maintenance needs, and suitability for various types of sites.

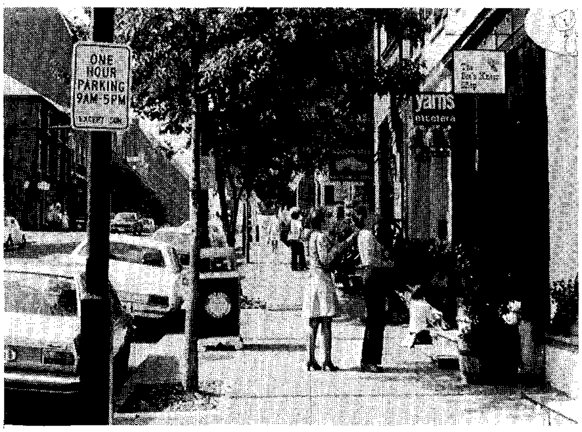

Figure 1. Selecting trees for particular urban sites is difficult due to insufficient information about performance under city conditions.

Planning tests. Test plans are prepared every few years by the municipal arborist; five years is suggested. The plan consists of paired cultivars listed in order of priority for testing, and the year in which each of these tests is to be started.

Test plan form. More detailed instructions for making these plans accompany the Test Plan Form (Appendix I). The plan may be followed loosely, since annual planting can vary unexpectedly, and changes might be necessary when cultivars are unavailable from nurseries. The number and type of tests will depend on local resources, available space, and the type of information needed. For example, a small town with limited funds might plan only one or two tests for the five-year period. Very large cities might plan as many as ten or twenty tests a year.

Choosing test trees. The cultivars selected for testing should reflect the city's need for information about species to be planted in the future, and should also be compatible with current planting requirements. Small trees, flowering trees, columnar trees, and other types should be tested only where they would be appropriate in the landscape.

Two cultivars will be compared in a typical test. One of these should be a standard cultivar (Appendix II), and the other a tree of the same species or growth habit which might be substituted for the standard if its performance is found to be equal or superior. The standard cultivars have been selected from commonly used species of the temperate zone according to two criteria: 1) they are widely available, and 2) they have shown good street tree qualities over reasonably long time periods. Thus, they may be considered safe choices, but not necessarily the best for a particular location. Nurseries where cultivars may be obtained are listed in "Sources of Shade Trees in the United States — 1983" (Sydnor and Holman 1983). Useful information about characteristics of cultivars is given in "Manual of Woody Landscape Plants" (Dirr 1983).

Designing tests. Tests should be designed to optimize efficiency and to separate the influence of non-genetic sources of variation from conclusions about the performances of various cultivars. This is accomplished by planting a number of test trees in a certain arrangement at several locations that are representative of environmental conditions. Environmental and genetic effects are then separated via statistical analysis. A special study of test design (Bartoe 1977) is the basis of recommendations here.

The Test Design Form (Appendix III) specifies the spatial arrangement of test trees. Each test of two cultivars is comprised of several plots. A plot is a series of adjacent trees that are usually (1) in the same block, (2) on the same side of the street, (3) the same distance from the street, (4) planted at the same time with the same methods and treatments, and (5) exposed to similar conditions, e.g., rootspace, sunlight, moisture. Plots are located throughout the city, preferably some distance from one another, so that conditions representative of the city will be sampled randomly.

Tests are designed each year by deciding upon the type, size, number, and locations of plots to be established, so the test will fit into available and appropriate spaces.

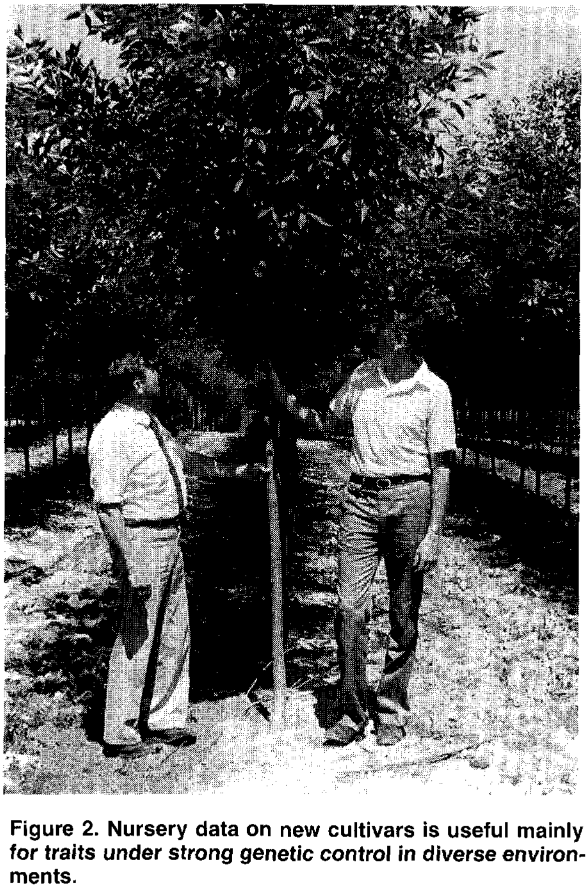

Figure 2. Nursery data on new cultivars is useful mainly *for traits under strong genetic control in diverse environments.*

Plot types. Two types of plots may be used, preferably only one type in a test: mixed plots or pure plots. A mixed plot has trees of both cultivars planted alternately along the street; pure plots consist of only one or the other cultivar. Mixed plots are advantageous because both cultivars are exposed to similar site variation, and should be used whenever possible. However, it may be undesirable for aesthetic reasons to mix different species or cultivars on the same street. Pure plots can then be used, but there may be some sacrifices of precision because site effects cannot be separated as completely from cultivar differences.

An ideal design for comparing two cultivars along streets is 5 mixed plots, with 5 pairs of trees in each 10-tree plot, for a total of fifty trees. This design should be used whenever possible; however variations in the type of plot, plot size, number of plots, and locations of plots can be made to accommodate available spaces.

Plot size. The number of trees in each mixed plot can vary from 2 to 8 pairs (4 to 16 trees), although a uniform number in each test is preferable. Pure plots can have 4 to 8 trees. As plot size decreases, more plots are necessary to bring the total number of trees to approximately 50. A test can have plots of different sizes, but the total number of trees of each cultivar should be approximately equal. For example a test of 5 mixed plots might have 6, 4, 5, 4, and 7 pairs, for a total of 52 trees. Plots near the minimum size (2 pairs for mixed plots, 4 trees in pure plots) should be avoided because mortality is much more likely to render them useless. If there is space for plots larger than 8 pairs (or 8 trees if pure plots are being used) then two small plots would be better than a single large one, especially if the space can be used for two different tests.

Number of plots. The number of plots recommended for a test depends on the sizes of the

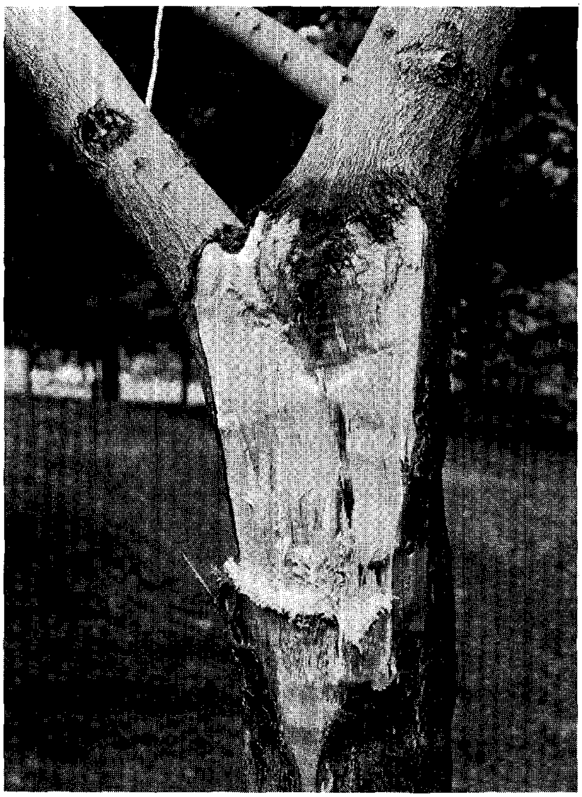

Figure 3. Some characteristics of older trees may become evident when evaluated in arboreta.

Figure 4. Performance tests in urban environments are needed to compare cultivars in survival, growth, health, and maintenance cost.

plots. If each mixed plot in a test had 4 pairs, there should be at least 6 or 7 plots (48 or 56 trees). If the mixed plots all had 8 pairs, only 3 or 4 plots are needed (48 or 64 trees). Similarly, the number and sizes of plots in a pure plot test can vary to bring the total to 50 trees, with approximately the same number of trees from each cultivar.

Plot locations. Plots can be planted on any type of site where the trees might be used in the future. Ideally there should be large variation between plots and little variation within them, although this may be difficult to control. Locations throughout the city in different types of neighborhoods are best, provided the cultivars are appropriate for each site. When pure plots are being used, cultivars must be randomly assigned to plots, i.e., plots of one cultivar should not be designated for one type of site while plots of the other cultivar are assigned to a different type of site. Plot locations for a test should all be listed first, and then cultivars should be assigned without regard to any site classifications.

Conducting tests. *Ordering trees.* Trees may be bought from any nursery. Each pair of cultivars should be similar in size and obtained from the same nursery, if possible. Pairs may be either bare root, B & B or container-grown, but not mixed. Trees may be held or grown in a city nursery provided all trees in a test are treated equally.

Planting. Trees are planted the same way as ordinary trees, but it is very important that every tree in a plot be treated alike. All trees within a plot should be planted the same day by the same crew and they must receive identical treatment, e.g., the same size holes, equal amounts of any soil amendments and water, the same method of staking. However, the several plots of a test may be planted at different times and by different crews.

Recording data. At the time of planting a Plot Establishment Form (Appendix IV) is filled out for each plot. Basic information about the site is recorded, so that subsequently tree performance can be related to site characteristics. An accurate sketch map of the plot is essential, especially for mixed plots of similar looking cultivars, to avoid confused identities. Tags should be removed from trees — they inspire vandals, and do not last long anyway. The arborist periodically returns to the plot with the map and records further data on a Performance Data Form (Appendix V) 1, 2, 3, 6, 9, 12, and 15 growing seasons after planting. Additional data may be collected at the arborist's discretion. Performance data should be recorded in late summer, before leaves begin to change color in the autumn.

Analyzing and interpreting results. Each test of two cultivars is designed for statistical analysis of variance of each trait using plot averages. The principal sources of variation are cultivars and locations. In a test with mixed plots it may be possible to partition location effects into among-location and within-location effects, using data from paired trees. Many arborists may not be familiar with analytical procedures, in which case assistance may be sought at a university.

An alternative is to calculate averages of each

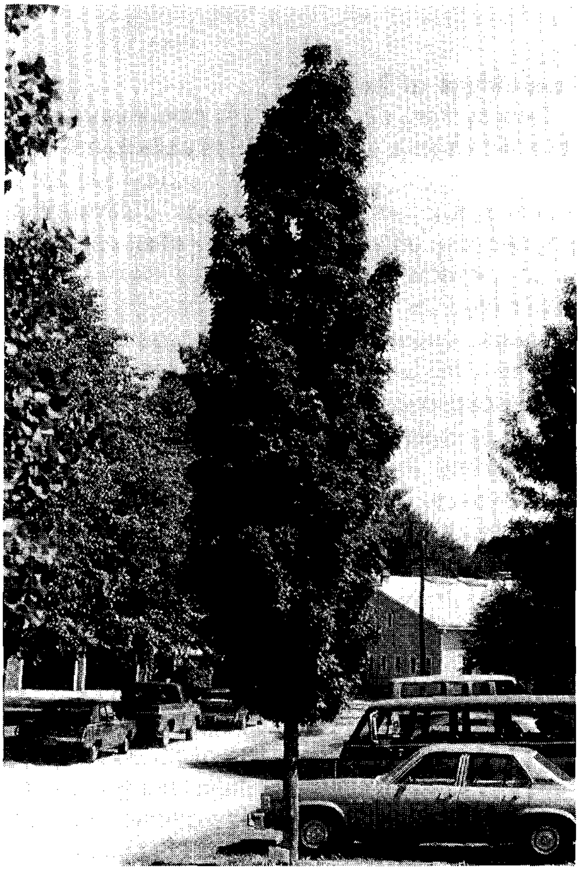

Figure 5. When new cultivars such as 'Goldspire' Sugar Maple first become available, arborists would like to know if they are good enough to replace better known cultivars.

variety using the STRETEST Analysis Form (Appendix VI). These averages may be compared and evaluated, but without statistical analysis it will not be known whether any apparent difference is real or due to random variation. However, even without analyses of variance one may conclude that any small, meaningless difference would indicate that the two varieties are equivalent in this trait. In previous analyses, health ratings and maintenance ratings that differed by less than one unit on the 5-point scale were not considered meaningful.

The Plot Establishment Form should be consulted when interpreting results. If average height or diameter at the time of planting differed between the two cultivars, it could persist for several years. Differences among plots in site conditions also may be useful in explaining performance differences.

Usefulness of Testing

Results from early years will give important information about survival and establishment after planting. In later years more will be learned about ability to withstand city conditions. Cultivars that perform well on various types of sites, especially under adverse conditions, can be identified and substituted for inferior ones in the city planting program. Evaluation of other traits such as branch structure will become possible as trees mature.

Comparisons of cultivars among cities also would be desirable, to strengthen the basis for conclusions. Frequencies of any injuries caused by diseases, insects, pollution, or other agents could be tabulated. Conclusions could be drawn as to the type of site and geographic regions to which each cultivar is well adapted. An arborist can decide then, together with conclusions drawn from his own Test Reports, which trees should be planted in the future, and which sites are appropriate for them. Nurserymen might wish to adjust their production in anticipation of greater demand for trees that performed well and less demand for those that did not. The ultimate beneficiaries of the performance testing program will be city residents. They will enjoy healthier, more beautiful trees that live longer and are less costly to maintain.

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APPENDIX I

Test Plan Form and Instructions

Every five years the Test Plan form should be revised, listing tests and priorities. Each year the form is consulted to determine which test can best fit into the current year's plantings. When a test is started or completed, it is marked on the Test Plan.

1. Consult the list of cultivars suggested as standards for testing (Appendix II) and "Sources of Shade Trees in the United States - 1983" (Sydnor and Holman 1983), marking all trees that you may want to test within the next five years. Limit selections to trees (1) that are likely to be used in future plantings, and (2) for which test results could be useful in deciding if and where the tree should be planted.

2. Make a list (not on the form) of *pairs* of the marked trees by grouping similar trees together (i.e.—small, large, columnar, or lindens, maples, etc.) and picking pairs within each group that will provide the most useful information when tested. For example, suppose an arborist marked the following trees:

Acer platanoides 'Columnare' (a standard)
Acer rubrum 'Armstrong' (a standard)
Acer rubrum 'Columnar'
Acer saccharum 'Columnare'
Gleditsia triacanthos 'Majestic'
Gleditsia triacanthos 'Shademaster'
Gleditsia triacanthos 'Skyline' (a standard)

Among the columnar maples, he might select *Acer rubrum* 'Armstrong' and *Acer platanoides* 'Columnare' for a test, postponing the others initially. If his city plants Shademaster honeylocust widely, he may want to compare it with other popular honeylocusts; thus two more tests might be *Gleditsia triacan-*

thos 'Skyline' with 'Shademaster' and *Gleditsia triacanthos* 'Majestic' with 'Skyline'. Note that a cultivar can appear in more than one test, and that the two trees in a test need not be the same species or genus. The number of tests planned should be the maximum anticipated number of tests that could be planted in the planning period. This allows flexibility in choosing tests to plant each year and gives a starting point for making the next set of Test Plans.

3. Assign each test of two cultivars a priority (i.e. — 1,2,3 etc., where 1 is the highest priority) to indicate the order in which you will try to establish these tests. Take into consideration how important the trees are in your area and how urgently the information is needed.

4. List these tests on the Test Plan Form in order of priority (i.e. — A,B,C, etc.), and estimate in which year the test is likely to begin. It does not matter which tree is placed in the "Variety 1" or the "Variety 2" columns. Use additional forms if you are planning more than 20 tests; number each form in the upper right corner.

STRETEST Test Plan Form

Tests planned for years 19__ to 19__ Number of tests planned ____ Date ______

Plans made by ____________________

List, in order of decreasing priority, the paired tests that will be considered for planting in the next five years. Give the name for each cultivar or species, and the year the test is to begin.

test	year(s) planned	year(s) planted	*Cultivar 1*	*Cultivar 2*
A				
B				
C				
D				
E				
F				
G				
H				
I				
J				
K				
L				
M				
N				
O				
P				
Q				
R				
S				
T				

Use additional forms if necessary

APPENDIX II

Standard Cultivars Suggested for Comparison in Performance Tests with Other Cultivars of the Same Species or Similar Appearance

Acer platanoides 'Columnare', Columnar Norway Maple
Acer platanoides 'Emerald Queen', Emerald Queen Norway Maple
Acer rubrum 'Armstrong', Armstrong Red Maple
Acer rubrum 'Red Sunset', Red Sunset Red Maple
Acer saccharum 'Green Mountain', Green Mountain Sugar Maple
Crataegus viridis 'Winter King', Winter King Hawthorn
Fraxinus americana 'Autumn Purple', Autumn Purple Ash
Fraxinus pennsylvanica 'Summit', Summit Ash
Ginkgo biloba 'Autumn Gold', Autumn Gold Ginkgo
Gleditsia triacanthos 'Skyline', Skyline Honeylocust
Liquidambar styraciflua 'Moraine', Moraine Sweetgum
Malus 'Snowdrift', Snowdrift Crab
Pyrus calleryana 'Bradford', Bradford Callery Pear
Tilia cordata 'Greenspire', Greenspire Little Leaf Linden
Zelkova serrata 'Village Green', Village Green Zelkova

Footnote: "Own-root" plants, i.e. grown from rooted cuttings, are preferred in all species, especially *Acer rubrum*, *Tilia cordata*, and any others where graft incompatibility may occur.

APPENDIX III

Test Design Form and Instructions

A Test Design Form is filled out for every test after it is certain that the test will be conducted, but before any plots are planted. It shows general information about the test, the sizes and locations of all plots, and numbers of trees to be ordered. It serves as a reference when performance data are collected. The varieties in the test, number of plots, and the year plots will be planted must be determined before the form can be filled out. Consult the section on Designing Tests for guidance.

1. **Test Letters,** starting with A, are assigned sequentially as each test is designed. The last Test Design form that was completed should be consulted to see what letter comes next.

2. **Total Number of Plots in Test** is determined by the design.

3. **Plot Type** can be "Mixed Plot" or "Pure Plot." Mixed plots should be used whenever it is possible to plant the two varieties together. A test should not have both mixed and pure plots.

4. **Test Trees** should correspond to the Variety 1 and Variety 2 listed for one of the tests on your current Test Plan form.

5. **Nursery Source(s)** from which trees have been ordered should be listed. Preferably the two cultivars should come from the same nursery, though this is not always possible.

6. **Plot Location** must be described so that all of the plots can be identified and re-located in the future. Ordinarily the street name and range of addresses or block number is sufficient.

7. **Numbers of Trees** in each plot should be given. If it is uncertain for plots to be planted later, record your best estimate.

8. **Planting Dates.** Give the month and year for each plot. If the date is uncertain for plots to be planted in later years, record your best estimate.

STRETEST Test Design Form

Test designed by ____________ Planting Date, month/year ______

Test letter ___ Number of plots in test: ___ Type of plots: ___ Mixed ___ Pure

Test trees: Genus, species, variety.

Cultivar 1. ____________

Cultivar 2. ____________

Nursery source(s):

Cultivar 1. ____________

Cultivar 2. ____________

Plot information:

plot number	number of trees	plot location, e.g. street and block
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		

APPENDIX IV

Plot Establishment Form and Instructions

A Plot Establishment Form is filled out for each plot immediately after it is planted. The information will be used in locating the plot and each tree for future measurements, and for reference when interpreting results. Care should be taken in recording the data, and especially in preparing the map, which may be used by someone who has never seen the plot.

1. The test letter, plot number, total number of trees in plot, plot location, and cultivars in test must agree with the Test Design Form. The other items on the first page should be self-explanatory.

2. **Map:** The map should show sufficient detail so that each tree can be relocated later, even if the first one or two trees have died and have been removed. If some trees in the plot are removed subsequently, the map should be marked accordingly.

3. **Tree Data:** Start recording data at one end of the plot, entering the tree number on the map as you go. The tree number for the last tree in the plot must equal the number of trees in the plot or else a mistake has been made, and must be corrected.

Distance from building: Record the distance in feet from the center of the tree to the closest building; estimate if greater than 10 feet.

Planting space: The planting space is the uninterrupted, unpaved surface immediately adjacent to the tree, usually a strip between the curb and sidewalk, or a hole in the sidewalk. The space may have grass, gravel, bricks, gratings or other pervious surfaces, but is considered to end where concrete,

STRETEST Plot Establishment Form A

Data recorded by ____________ Today's date ______

Test letter ___ Plot number ___ Date plot was planted ______

Total number of trees in plot ___ Av. distance between trees ___ feet

Plot location ____________

Cultivars in test: 1. ____________ Identity verified: Yes ___ No ___
2. ____________ Identity verified: Yes ___ No ___

Nursery Source(s) Cultivar 1. ____________ Delivery date ______
Cultivar 2. ____________ Delivery date ______

Type of stock: ___ bareroot ___ B & B ___ container Own-root? yes or no

Type of planting space (check one):

___ strip along curb ___ island or median ___ open area

___ hole in sidewalk ___ container other ______

Dimensions or space in feet: ___ width ___ length ___ depth of container

Covering over planting spaces (check one or more):

___ vegetation ___ bare soil ___ mulch ___ gratings ___ gravel ___ bricks

other ____________

Soils characteristics (check one or more): ___ well drained ___ poorly drained

___ natural soil ___ man-made rubble ___ replaced with top soil

___ organic matter added other ______

Treatments to trees at time of planting:

___ watered ___ fertilized ___ staked ___ pruned other ______

Site class (check appropriate items):

___ dense residential ___ commercial ___ park ___ parking lot ___ highway

___ light residential ___ industrial ___ mall other ______

Traffic volume: ___ heavy ___ moderate ___ light

STRETEST Plot Establishment Form B

Map: Sketch street, nearest intersecting street, trees by number (1-16) and by cultivar (1 or 2), sidewalk, north arrow, and any permanent features that will help locate each tree in the future.

tree no.	cultivar (1 or 2)	distance from building (feet)	distance from curb (feet)	planting space width (feet)	planting space length (feet)	trunk diameter (tenth inches	total height (feet)
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							

asphalt, or another relatively impervious surface begins. If the space is a hole in the sidewalk its dimensions are simply the dimensions of the hole, measured to the nearest foot. The width is always measured perpendicular to the curb, and the length parallel to the curb. If the planting space is a strip, then the length is the distance between the two closest obstructions (end of strip, driveway, crosswalk, etc.) on either side of the tree. The width is the distance from the curb to the sidewalk. If the planting space is a container, record the diameter of the container as the planting space width, and the depth of the container instead of length; write "container" above the columns. If the tree is planted in the open, and there are no obstructions within 50 feet of the tree, record "open."

Trunk diameter: Measure to the nearest tenth inch with calipers or a tree tape at a point exactly 4½ feet above the ground. If necessary, you can measure the circumference and divide by 3.14.

Height: Measure the total height of the tree to the nearest foot, using a pole calibrated in feet. For taller trees place the pole next to the trunk and estimate the height.

APPENDIX V

Performance Data Form and Instructions

Measurements should be taken 1, 2, 3, 6, 9, 12 and 15 years *after a plot is planted. It is important that the data be recorded* accurately, so this task should be done by the person most familiar with STRETEST and most experienced with the trees and their pests.

1. Before recording any data, inspect the plot and locate all the test trees, checking the map on the Plot Establishment form. If a tree is missing, cross out its tree number and the spaces for its data on the Performance Data Form. Missing trees should also be marked on the Plot Establishment Form. Enter the number of trees planted and number surviving.

2. Inspect each tree individually, recording the 9 variables in the space provided.

Trunk diameter is measured to the nearest tenth inch at exactly 4½ feet above ground.

Total height is measured to the nearest foot, or estimated.

Foliage and branch health ratings are determined by estimating the percent of injury, damage or affected tissue, according to the following scale:

Rating	*Percent injury*	
	65-100	1
	45-60	2
	25-40	3
	5-20	4
	no injuries	5

The foliage health rating refers to all leaves and any symptoms (wilt, chlorosis, death, etc.) caused by any fungus, insect, climatic stress, or mechanical damage. The branch health rating refers to the twigs, buds and branches, and any type of injury, dieback or symptoms.

Trunk health rating is determined from this scale:

1 = tree dead
2 = severe injuries or decay
3 = moderate injuries or decay
4 = slight injuries or decay
5 = no injuries or decay

This rating includes the main stem including forks, and should reflect all injuries such as cankers, decay, bark cracks, bark beetles, vandalism, or auto accidents.

Cause of injury codes are recorded if the health rating is less than 5 and the cause can be determined with reasonable certainty. Do not guess. More than one code can be entered when several factors contribute to a poor health rating. If you can identify the specific pest or cause of injury, record this in the space provided for comments at the bottom of the form.

Cause of injury codes:

A = air pollution	P = parasitic disease
D = drought	S = salt
F = frost cold	U = unknown
H = heat	V = vandalism
I = insects	W = wind
M = *mechanical*	

Maintenance rating code is estimated by considering the relative cost of spraying, pruning, repairing, etc., compared to all trees in your care.

1 = very low cost	3 = medium cost	5 = very high cost
2 = low cost	4 = high cost	

STRETEST Performance Data Form

Test Ltr.__ Plot No.__ Date established ______________ No. trees planted ______
Plot Location ______________________________ No. trees surviving _____
Data collected by ______________________________ Today's Date ___________

tree no. and cultivar 1 or 2		trunk diameter (tenth inches)	total height (feet)	foliage health rating (code)	foliage injury cause (code)	branch health rating (code)	branch injury cause (code)	trunk health rating (code)	trunk injury cause (code)	maintenance rating (code)
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										

Overall quality:

Considering all characteristics, not just those above, rate each variety in this plot on a scale of 0-9, using the following guidelines:

0 - unsuitable for planting on this site
1 or 2 - least desirable of any species or variety that is suitable in appearance and adaptation for this planting site
3 or 4 - inferior to an average variety, with faults that outweigh its merits but are not severe enough to eliminate it from use
5 or 6 - average or reasonably good in appearance and performance, with faulty qualities in balance with favorable qualities
7 or 8 - better than average, but one or more faults make it less than ideal
9 - ideal for this site in adaptation, appearance, and health

Circle ratings of Var. 1: 0 1 2 3 4 5 6 7 8 9 and Var. 2: 0 1 2 3 4 5 6 7 8 9

Comment on the most limiting traits of each variety in the plot, noting any specific insects, diseases, or other problems. Give tree numbers where such problems occur.

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