

Species-Site Adaptation Study Of Woody Plants For North Dakota

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Abstract

1997 marked the eleventh year of the cooperative woody plant evaluation program at Dickinson. Sixty-one accessions have been planted to date. Forty-eight of these are still under investigation. The test list is comprised mainly of seedling populations of several species, some clonal material plus potential and/or newly named woody plant introductions. Four new accessions were planted in 1997. Sand birch, a lesser known species in the Asian birch group had a 92% survival rate after five years. Data showed significantly greater survival for a seedling population of paper birch produced from seed off native trees growing in the Killdeer Mountains north of Dickinson compared to seedling birch from a Nebraska source. Growth was also greater for the local source, though not significant. Lack of drought and/or cold hardiness resulted in the loss of a clonal accession of American arborvitae, a seedling population of pearfruit corktree and a seedling population of Manchurian viburnum. A clonal accession of a hybrid birch, though performing well in other parts of the state, has had high mortality to date and appears to lack cold hardiness for this locale. Early performance data shows Dakota Pinnacle Birch, a narrow columnar form recently introduced from NDSU, to have good survival and growth potential. A seedling population of Kentucky coffeetree from a Fargo, ND seed source had significantly greater mean growth the first year compared to two seedling populations of the same species grown from Illinois seed sources.

Materials And Methods

The following four additional woody plant accessions were planted on June 17, 1997 at the Dickinson site:

- one clonal accession of European white birch (*Betula pendula*)
- one seedling accession of Kentucky coffeetree (*Gymnocladus dioica*) - Fargo, ND, seed source
- one seedling accession of Kentucky coffeetree (*Gymnocladus dioica*) - Hannover, IL seed source
- one seedling accession of Kentucky coffeetree (*Gymnocladus dioica*) - Seneca, IL seed source.

Using a 15' x 20' spacing, all material was hand planted. A tractor mounted post hole auger was used to dig holes for the Kentucky coffeetrees. Shovels were used to plant the smaller birch plants. Hand watering was done immediately after planting to aid in establishment. Data collected included percent survival, mean growth (measured as height increase) and plant vigor. Five-year data from the 1993 plot was collected and included mean crown diameter and mean stem (trunk) diameter data. Plant replacements were made in the 1995 plot.


Results And Discussion

Since the program began in 1987, plant establishment at this site has been difficult. The lack of adequate moisture continues to be the primary limiting factor in the successful establishment of many woody plants at this location. Establishment or failure of seedling grown accessions is often directly related to the origin of the seed source, referred to as provenance. The provenance appears to have a direct relationship to both cold and drought hardiness. The following six seedling-grown accessions have failed to establish or have died because they lacked either cold or drought hardiness: black walnut, European (black) alder, jack pine, lodgepole pine, Douglas-fir, pearfruit corktree and Manchurian viburnum. In addition, the following clonally propagated accessions have been removed from evaluations for the same reasons: 'Mancana' Manchurian ash, 'Austree' willow, 'Prairie Cascade' willow, dwarf arctic willow, a Hankinson, ND clone of American arborvitae and Imperial ²⁰/₁₁ Honey-locust. Better after-planting care, especially the application of a ring of organic mulch around the base of individual plants and greater attention to the water needs of newly planted stock, may have resulted in higher establishment rates for some of the aforementioned accessions. No new plantings were added in 1996, thus that year is missing from the accompanying table. The following discussion details performance data for test plots planted in 1993, 1994, 1995 and 1997 at the Dickinson site.

A seedling accession of sand birch from Lawyer Nursery(Plains, MT) had 92% survival after five years and

averaged about eight inches of growth in 1997. The seedling population of paper birch from a native Killdeer Mountain seed source had significantly greater survival (92%) compared to the Nebraska source (24%). Both accessions averaged nearly two feet of growth in 1997. The former accession also had significantly greater mean stem caliper or trunk diameter (2.5 inches) compared to the out-of-state source (1.3 inches). Only eight percent of a hybrid birch population is still alive. This accession appears to lack sufficient cold hardiness for southwestern ND and further evaluations will probably cease. A clonal accession of American arborvitae from Fargo will also be dropped from the list. Deer and rabbit browse coupled with winter browning and dieback all contributed to its poor performance.

An Iowa commercial nursery source of Japanese tree lilac from a 1994 planting is surviving 100% compared to 63% for the Minnesota source. Both seedling accessions of lilac averaged less than five inches of new growth. This species is often slow to establish and minimal growth may occur during establishment.

Dakota Pinnacle birch, a recent release from NDSU, has 100% survival through two winters and mean growth was 18.5 inches in 1997. This cultivar may have good potential for southwestern ND. Its narrow columnar growth habit is very desirable in the landscape, especially in situations where space constraints are a problem. Winter survival for Autumn Radiance winterberry *Euonymus* (a 1997 release from NDSU) and a comparison clone were 88% and 100% respectively. Autumn Radiance had greater mean growth, though not significant. Winter survival of a clonally propagated honey-locust selection from NDSU was 75% compared to a second clone which had only 29% survival. All plants of Imperial  honey-locust, a control cultivar currently popular in the nursery trade, were dead after the first winter. Further evaluations of this accession will also cease. Seventy percent of the Manchurian walnut seedlings are still alive. Establishment of this accession has been difficult and data showed a mean growth of -2.2", indicating some dieback. Inadequate moisture levels between 1995 and 1997 resulted in extremely low fall vigor for the Manchurian viburnum seedlings. This led to 100% mortality for this moisture loving species. It too will be dropped from further testing at this site.

The European white birch seedlings produced minimal growth in 1997. Of the three Kentucky coffeetree seedling accessions being evaluated, the Fargo, ND source had significantly greater mean growth than the two Illinois sources. Winter survival for the latter four accessions will be collected in fall of 1998.

Conclusions/implications of Research

Woody plant adaptation can best be determined by statewide testing. This program continues to illustrate the need for proper seed source or provenance testing. Performance data enables valid recommendations to be made to wholesale growers, retail nurseries and garden centers, parks, golf courses and public consumers regarding specific accessions in the various sectors of the state. Certain accessions under evaluation can be recommended throughout the state and region. Others can only be recommended for certain portions of the state. This project was initiated in 1987 in order to systematically evaluate native, domestic, and foreign woody plant accessions for hardiness and adaptation under the varied conditions throughout North Dakota. The research project is unique since it is the only one to specifically determine adaptation of woody plants in an experimental, replicated plot format. Data reinforce the concept of introducing regionally selected cultivars.

Based on survival and adaptation data collected from performance records, the following NDSU clonally propagated introductions can be recommended for ornamental plantings, especially in urban sites as specimen or boulevard plants:

- Prairie Gem flowering pear
- Prairie Dome Ash
- Prairie Spire Ash
- Dakota Centennial Ash
- Red Wing Amur maple

Prairie Gem makes a fine deciduous small tree. It has semi-glossy, leathery, deep emerald-green foliage, thick twigs and a very dense, globose tree form. All three ash cultivars have semi-glossy, dark green leaves and golden yellow autumn color. The growth habit of Prairie Spire ash is striking in that it produces an attractive, narrowly upright, dense growth habit with little pruning needed. Once established, Red Wing Amur maple is very stress tolerant and is well adapted for use in shelterbelt and urban landscapes. It does not, however, perform well in alkaline or saline sites where chlorosis becomes a problem. Initial performance data indicate that seedling populations of paper birch grown from seed off of native trees in the Killdeer Mountains north of Dickinson are well adapted to southwestern North Dakota. Additional accessions which perform well at the Dickinson site will be added to the

recommended list as data becomes available.

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