

Project ND06210

Species-site Adaptation Study of Woody Plants for North Dakota

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Research Summary

Since the woody plant statewide cooperative evaluation program began in 1987, a total of sixty-one accessions have been planted at the Dickinson Research/Extension Center. Forty-five of these are still under evaluation. 1998 marked the twelfth year of the program. Test plant material includes selected species of seedlings and clonal material as well as potential and/or newly named introductions of woody plants. Data showed no significant differences in survival or growth between two seedling accessions of Japanese Tree Lilac. Dakota Pinnacle^{2/98} Birch, a narrower form of Asian White Birch and recent release from NDSU, had an 83% survival rate through four winters and plants produced excellent growth (34") in 1998. No significant differences in survival or growth were recorded for Autumn Radiance^{2/98} Winterberry Euonymus and an NDSU advanced selection of this species grown for comparison. Of the three Honey-locust clonal accessions under investigation, Imperial^{2/98} had a significantly lower survival rate (22%) compared to the 60% and 89% survival rates for two clonal selections from NDSU. All Manchurian Viburnum plants died from drought stress. Approximately 50% of the Manchurian walnut seedlings were still alive in 1998 but growth was minimal. Survival for two Illinois seedling accessions of Kentucky Coffeetree was significantly greater than survival for a North Dakota source.

Introduction

Statewide testing is important to determine adaptation of woody plants. The project goal is to conduct replicated trials in order to systematically evaluate native, domestic, and foreign woody plant accessions for cold and drought hardiness, establishment and survival, growth rate, vigor and potential for landscape, community forestry and shelter use under varying climatic and edaphic conditions throughout the state. Performance data enables valid woody plant recommendations to be made to wholesale growers, retail nurseries and garden centers, parks, golf courses and public consumers, based on regional adaptation zones in North Dakota. Some accessions being tested can be recommended throughout the state and region while others can only be recommended for certain portions of the state. Data

is reinforcing the concept of introducing regionally selected cultivars.

Materials and Methods

No new accessions were planted in 1998. Replacements were made in the 1997 plot, including seedlings of *Betula pendula* (European White Birch) and three seedling accessions of *Gymnocladus dioica* (Kentucky Coffeetree). Replacements were hand watered after planting for proper establishment. Data collected included percent survival, mean growth measured as height increase and plant vigor. Five-year mean stem diameter and mean crown diameter measurements were collected from two lilac accessions in the 1994 plot.

Results and Discussion

The primary limiting factor in the successful establishment of many of the woody plant accession at this site continues to be lack of adequate moisture. The application of a ring of organic mulch at the base of newly planted accessions plus greater attention to the water needs of young stock could greatly enhance the establishment rate for some of the test species. Six clonally propagated accessions have been dropped from the test list. They include: a Hankinson, ND accession of American arborvitae, three willows (Austree, Dwarf Arctic and Prairie Cascade), Imperial Honey-locust and Mancana Manchurian Ash. Nine seedling-grown accessions have also been dropped and include: Black Walnut, European Alder, Jack Pine, Lodgepole Pine, Douglas-fir, Pearfruit Corktree, Sugar Maple, Nannyberry, White Ash and Manchurian Viburnum. Several of these have failed to establish due to lack of cold or drought hardiness. The failure of many of these accessions reinforces the importance of proper seed source (provenance) in the ultimate establishment or failure of any seedling-grown woody plants. Heavy rabbit browsing caused severe injury to the Arborvitae and probably attributed to its demise.

Accessions which have performed well to date include three NDSU green ash (*Fraxinus pennsylvanica*) cultivars, namely Dakota Centennial^[2] - ^[2]Wahpeton^[2], Prairie Dome^[2] - ^[2]Leeds^[2] and Prairie Spire^[2] - ^[2]Rugby^[2] ash. Another NDSU release that has performed well is Prairie Gem^[2] Flowering Pear (*Pyrus ussuriensis* ^[2]MorDak^[2]). This white-flowered, ornamental pear produces a dense oval canopy of thick, dark-green, leathery leaves. It is best suited for urban and rural landscape sites rather than field plantings. Flame Willow (*Salix alba* ^[2]Flame^[2]) has shown relatively good survival in a low moisture environment like the Dickinson site. It has good hardiness, but like all willows, it requires better than average moisture, or supplemental moisture during dry periods. This cultivar has a medium growth rate, attractive orange branches and an upright-oval form. Three NDSU clonal selections of honeysuckle (*Lonicera*) have had excellent survival and have exhibited excellent resistance to the Russian honeysuckle aphid. Freedom honeysuckle, grown as a comparison cultivar, is rank growing compared to the three NDSU selections. Selection #10 produces a very dense, more dwarf form than the other three clones. Three cultivars of Red Osier Dogwood (*Cornus sericea*), including the recently introduced ^[2]Cardinal^[2] from the University of Minnesota have grown slowly under low moisture conditions. ^[2]Bergeson Compact^[2] has had the best survival of the three being tested and it may show promise as a cultivar better adapted in drier environments.

Swiss Mountain pine (*Pinus uncinata*), the tree form of mugo pine, has had better survival than red pine (*P. resinosa*). Plants, however, are smaller because it tends to be a slow-growing species. Initial survival was greater for two clonally propagated accessions of laurel willow (*Salix pentandra*) from near Brinsmade, ND compared to the control clone and a selection from St. Cloud, MN which had relatively low survival. Performance of all four of these laurel willow clones has been poor at Dickinson compared to growth and survival at several other

ND sites. Allegheny serviceberry (*Amelanchier laevis*), a small-tree relative of our native juneberry (*A. alnifolia*), has grown slow but survival has been good.

A Wisconsin seedling accession of White Ash (*Fraxinus americana*) has died back severely the first few years and has been dropped since it lacks sufficient hardiness. A Minnesota seedling accession of black cherry (*Prunus serotina*) has had good initial survival and may prove to have sufficient hardiness to be recommended. Additional work needs to be done with this lesser known species of *Prunus* to identify a superior seed source. Data shows the Killdeer Mountain source of paper birch (*Betula papyrifera*) to be superior in survival and growth response compared to a native Nebraska source. Sand birch (*Betula alba* 'Kamtschatka') has had good initial survival.

Additional years of testing will be needed to determine its longevity. Survival of a fast-growing, glossy-leaved hybrid birch (*Betula x piperi*) has been very poor at Dickinson. This clonal selection appears to lack sufficient winter hardiness for southwestern ND and further data collection will probably be terminated. Attempts to establish plants of pearfruit corkscrew (*Phellodendron piriforme*) in 1994 and again in 1995 were unsuccessful due to severe drought stress and it too was removed from the evaluation list. Performance of the latter accession at Carrington, Langdon and Minot has been very good with 100% survival after five years.

The following discussion details performance data for accessions planted in 1994, 1995 and 1997 at the Dickinson site. Except for replacements, no new plantings were made in 1996 or 1998 so data for those years is absent in the accompanying table. Fifth year survival of a commercial nursery source of Japanese Tree Lilac (*Syringa reticulata*) was 95% compared to the 80% rate for a Minnesota source. Mean growth in 1998 was similar for the two. Data showed no significant differences in five-year mean crown diameter or mean stem diameter for these two lilac accessions, which are surviving and growing on a very exposed, extremely drought site. Early data suggest that Japanese Tree Lilac, especially when grown under more favorable urban conditions, could be a valuable addition to the small tree inventory for southwestern North Dakota.

Dakota Pinnacle[®] birch, with its narrow columnar growth habit and good vigor, has 83% survival through three winters. Plants averaged 34" of new growth in 1998. It is performing well at six other sites. Prairie Radiance™ Winterberry Euonymus (*Euonymus bungeana* Verona[®]) and an NDSU advanced selection of this species grown for comparison showed no significant differences in percent survival or mean growth. Prairie Radiance™, released by NDSU in 1997, develops into a small tree and is capable of producing excellent fall color, especially in lighter textured soils. Survival differences were noted between Imperial[®] Honey-locust, a standard commercial cultivar which had 22% survival and two clonal accessions from NDSU. Data showed NDSU Sel. 919 with 89% survival and NDSU Sel. 9110 with 60%, both of which were significantly greater than Imperial[®]. Only 47% of Manchurian Walnut (*Juglans mandshurica*) seedlings are still alive after four years. Remaining plants are growing very slowly and winter dieback has been observed on plants within this group, suggesting this species may have questionable adaptability in exposed sites in southwestern North Dakota.


Manchurian Viburnum (*Viburnum burejaeticum*) did not establish at this site due mainly to drought-stress problems and it has been dropped from the Dickinson evaluation. This species is performing best at Langdon with poorer performance at Carrington and Minot. Survival has been good to date for a 1997 planting of European White Birch (*Betula pendula*). This clonally propagated selection is from a large specimen growing at the Carrington Research/Extension Center. Survival for three seedling accessions of Kentucky Coffeetree (*Gymnocladus dioica*) ranges from a high of 92% for the Hannover, IL source to 27% for the Fargo source. Plants of this species have

been slow to establish and dieback has occurred on some plants of all three accessions, as indicated by the negative mean growth in the table.

Woody plants scheduled for planting at Dickinson in 1999 include *Crataegus crus-galli* ^{2/91} Inermis ^{2/91} (Thornless cockspur Hawthorn), *Crataegus x mordenensis* ^{2/91} Snowbird ^{2/91} (Snowbird Hawthorn), *Malus x* ^{2/91} Centurian ^{2/91} (Centurian Crabapple) and *Malus x* ^{2/91} Red Baron ^{2/91} (Red Baron Crabapple).

**DICKINSON RESEARCH EXTENSION CENTER
WOODY PLANT COOPERATIVE EVALUATION PROGRAM
1998 GROWTH AND SURVIVAL DATA**

				<u>FIVE-YEAR MEAN</u>	
PLANT ACCESSION	YEAR PLTD	% MEAN SURVIVAL	MEAN GROWTH (inches)	Crown Diameter (inches)	Stem Caliper (inches)
JAPANESE TREE LILAC <i>(Syringa reticulata)</i> Smith Nursery (Source 1) St. Johns College (Source 2)	1994 1994	95a ^x 80a	2.9a ^x 4.4a	17.4a 18.6a	1.1a 1.0a
PEARFRUIT CORKTREE <i>(Phellodendron piriforme)</i>	1994	0	0	0	0
DAKOTA PINNACLE ^{2/91} BIRCH <i>(Betula platyphylla 'Fargo')</i>	1995	83	34.3	y	y
WINTERBERRY EUONYMUS <i>(Euonymus bungeana)</i> PrairieRadiance ^{2/91} (NDSU-92360)	1995	92a ^x	10.4a ^x	y	y

Sel #4 NDSU-92362	1995	100a	10.9a	y	y
HONEY-LOCUST (<i>Gleditsia triacanthos var. inermis</i>)					
Sel. NDSU-919 (Source 1)	1995	89a ^x	5.3a ^x	y	y
Sel. NDSU-9110 (Source 2)	1995	60a	22.8a	y	y
Imperial  (Source 3)	1995	22b	34.3a	y	y
MANCHURIAN WALNUT (<i>Juglans mandshurica</i>)	1995	47	2.1	y	y
MANCHURIAN VIBURNUM (<i>Viburnum burejaeticum</i>)	1995	0	0	0	0
EUROPEAN WHITE BIRCH (<i>Betula pendula</i>)	1997	100	4.2	y	y
KENTUCKY COFFEETREE (<i>Gymnocladus dioica</i>)					
Fargo, ND (Source 1)	1997	27 a	-2.2 a	y	y
Hannover, IL (Source 2)	1997	92 b	-0.7 a	y	y
Seneca, IL (Source 3)	1997	75 b	-0.4 a	y	y

^x Column values followed by the same letter were not significant at the 0.05% level based on Student Newman Kuels Multiple Range Test.

^y Five-year data collected only for items planted in 1994.

