

**Project ND06210 - Species-site Adaptation Study of Woody Plants
Evaluated at the NDSU Dickinson Research Extension Center**

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Research Summary

2000 marked the fourteenth year of the statewide cooperative woody plant evaluation program. Sixty-five accessions have been planted at the Dickinson Research/Extension Center since the program began in 1987. Forty-nine of these are still under investigation, including seedling populations of several species, some clonal material plus potential and/or recently named woody plant introductions. Additional items planted at this site in 2000 included seedling accessions of Tatarian Maple and Olga Bay Larch. Two NDSU accessions of Honey-locust continue to show promise as clones with better hardiness and adaptability. Both clones have had significantly greater percent survival to date compared to 'Imperial', a widely available clone used as the standard. NDSU selection 919A honey-locust has produced the greatest mean growth, mean crown diameter and mean stem caliper of the three clones under investigation. This promising new introduction was recently named *Gleditsia triacanthos* var. *inermis* 'Harve' - Northern AcclaimTM. It will be commercially available in limited supplies in 2002. Dakota Pinnacle® Birch, a 1996 introduction also from NDSU, continues to produce good growth. It has had good survival through six growing seasons. Three seedling populations of Kentucky Coffeetree continue to show decline from drought stress and related environmental factors. Data shows survival percentages ranging from 20-50% for the coffeetree accessions. Winter dieback was quite severe on Centurion and Red Baron Flowering Crabapples, and to a lesser extent on Thornless Cockspur Hawthorn and Snowbird Hawthorn. Ten-year data showed that NDSU Sel. #22 honeysuckle had the best overall performance of the four clones tested. A study to determine the benefits of growing two species of pine seedlings in Supertube® Treeshelters showed no significant benefits. After ten years, overall performance of Red Pine and Swiss Mountain Pine was best for seedlings growing without the tubes compared to those in the treeshelters. Two clonal accessions of Laurel Willow from NDSU had significantly greater survival compared to a St. Cloud source and the control. The St. Cloud source produced the largest plant of the four clones tested.

Introduction

Adaptation of woody plants to North Dakota conditions can best be achieved through statewide testing. 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 assures greater validity to woody plant recommendations for 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 are reinforcing the concept of introducing regionally selected cultivars.

Materials and Methods

Two new entries were planted in 2000. These included seedling accessions of *Acer tataricum* (Tatarian Maple) and *Larix gmelinii* var. *olgensis* (Olga Bay Larch). Centurion and Red Baron crabapple replacements were planted in the 1999 plot. Newly planted items were hand watered after planting to aid in establishment. Data collected included percent mean survival, mean growth measured as height increase, plant vigor, mean crown diameter and mean stem diameter.

Results and Discussion

Adequate moisture for successful plant establishment and sustained growth of plantings continues to be a concern at this site. Proper management practices could reduce plant mortalities caused by drought stress. The following practices have been recommended for implementation: (1) in-row cultivation, (2) applying a ring of organic mulch, such as bark chips, around individual plants and (3) greater attention to the water needs of young stock.

A synopsis of the performance of woody accessions planted from 1987 thru 1995 can be found in the 1999 Dickinson Roundup Report. Since no new accessions were added to this site in 1996, five-year mean stem diameter and mean crown diameter measurements were unavailable for the 2000 data set. 1998 data is also absent since no additional plantings were made that year. Performance of accessions planted in 1997, 1999 and 2000 is detailed below. Growth and survival data are presented in Table 1. Plants of a clonal accession of European White Birch (*Betula pendula*) struggled to establish early on but had better performance in 2000, including greater mean growth compared to earlier years. This accession continues to perform much better at Langdon and Minot where more favorable conditions exist.

Three seedling sources of Kentucky Coffeetree (*Gymnocladus dioica*) at this site have also struggled to survive and grow. The accompanying table lists survival percentages ranging from a low of 20% for the Fargo source to 50% for the Hanover, IL source. Stem dieback ranged from about -2" for the Seneca source to -16" for the Fargo source. Coffeetrees are usually slow to establish and could benefit greatly from supplemental watering plus the use of mulch around tree bases to reduce moisture stress. Although the Fargo source had no dieback in 1999, data show it had the greatest dieback in 2000. Approximately 75% of the Centurion and Red Baron crabapple plants were still alive after two growing seasons but none of the plants of either clone showed much vigor. Both clones averaged over 20" of dieback, despite a rather mild winter in 1999-2000. The above two cultivars are highly recommended for eastern North Dakota but so far they have shown a lack of hardiness at this site. Stem dieback on the two hawthorns ranged from approximately -1" for the Thornless Cockspur Hawthorn (*Crataegus crus-galli* 'Inermis') to -8" for 'Snowbird' Hawthorn (*C. x mordenensis* 'Snowbird'). Like the crabapples, the hawthorns have performed well in eastern ND and need to be evaluated more fully in the western part of the state. The larch and tatarian maple accessions did not grow much their first growing season. Survival data for these will be collected in the fall of 2001.

Ten-year data collected from plants growing in the 1991 plot are presented in Table 2. Four clonal accessions of Honeysuckle (*Lonicera*) with high resistance to the Russian Honeysuckle Aphid (*Hyadaphis tataricae*) were planted to determine the hardiness and adaptability of three NDSU selections compared with *Lonicera* x 'Freedom', used as the control. The latter is an introduced cultivar of honeysuckle with reputed resistance to the aphid. Survival ranged from a high of 92% for NDSU Sel. #22 to 75% for NDSU Sel. #10 and Freedom, a fast growing cultivar which develops a very rank, open habit. The latter produced a plant roughly 2 $\frac{21}{11}$ times taller than NDSU Sel. #1 and Sel. #10 and twice as tall as Sel. #22. Field observations showed all three NDSU clones with greater density than Freedom. NDSU Sel. #22 produced the nicest looking plant overall. This hardy clone maintains a dense, healthy foliage canopy throughout the growing season. It had a mean height of 56" after ten years. It would make a good shrub for southwest landscapes.

A comparison study between seedling trees of Red Pine (*Pinus resinosa*) grown in Supertube® Treeshelters versus seedlings grown without the tubes resulted in greater % survival for trees without tubes (Table 2). The treeshelters are corrugated plastic tubes placed around young trees to accelerate growth and prevent rodent injury. Mean height and crown width were greater for plants grown without tubes, though the differences were not significant. Value of the tubes seems to be species dependent, often working better on deciduous species than evergreen species. The tubes appear to restrict lateral movement in the wind and reduce caliper development. Table 2 data reinforce this idea in that mean stem diameter for red pine was greater for plants without tubes.

Data show similar results with Swiss Mountain Pine (*Pinus uncinata* syn. *P. mugo* var. *rostrata*), a tree form of Mugo Pine (*P. mugo*). Even though survival was greater for seedlings in treeshelters (60%) versus no tubes (40%), pine seedlings without tubes had greater mean height, width and stem diameter compared to seedlings with tubes around them.

Two NDSU clonal selections of Laurel Willow (*Salix pentandra*) showed significantly greater survival (83% for Brinsmade #1 and 92% for Brinsmade #2) compared to an accession from St. Cloud, MN (25% survival) and the control which had 0% survival. The St. Cloud source produced the greatest mean height and crown width, though not significantly greater than the other two accessions. The three willow accessions still remaining at Dickinson have produced plants much smaller in size compared to those growing at three other North Dakota sites having more favorable moisture. Laurel willow plants at the Langdon site averaged 20+ feet in height for the same ten-year period compared to the tallest clone at Dickinson which averaged only 7' in height. Inadequate moisture has been a severely limiting factor to the optimum performance of this moisture-loving species at the latter site.

In terms of plant establishment and sustained growth of tree and shrub species, the Dickinson Research/Extension Center site is by far the most difficult of the seven sites currently used for cooperative woody plant evaluations. The implementation of recommended management practices, including in-row cultivation, the application of wood chip mulch around the base of plants and greater attention to the water needs of young stock, could have significantly reduced mortality rates on many of the planted accessions and on new accessions which will be planted in the future at this site.

Table 1. 2000 Growth and Survival Data for Accessions Planted in 1997, 1999 and 2000 at the NDSU Dickinson Research/Extension Center.

PLANT ACCESSION	YEAR PLANTED	% MEAN SURVIVAL	MEAN GROWTH (IN.)
EUROPEAN WHITE BIRCH <i>(Betula pendula)</i>	1997	75	9.1
KENTUCKY COFFEETREE <i>(Gymnocladus dioica)</i>			
Fargo, ND (Source 1)	1997	20a ^x	-16.3a ^x
Hannover, IL (Source 2)	1997	50a	-5.1a
Seneca, IL (Source 3)	1997	40a	-1.6a
CRABAPPLE (<i>Malus</i> hybrids)			
'Centurion'	1999	78a ^x	-24.0a ^x
'Red Baron'	1999	75a	-21.4a
HAWTHORN			
<i>Crataegus crus-galli</i> 'Inermis'	1999	89a ^x	-1.1a ^x
<i>C. x mordenensis</i> 'Snowbird'	1999	100a	-7.6a
LARCH (<i>Larix gmelinii</i> var. <i>olgensis</i>)	2000	y	6.7
MAPLE (<i>Acer tataricum</i>)	2000	y	3.6

^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 Survival data for 2000 accessions will be collected in the fall 2001.

Table 2. Ten-Year Summary of Survival and Growth Data for Accessions Planted in 1991 at the NDSU Dickinson Research/Extension Center.

PLANT ACCESSION	PERCENT MEAN SURVIVAL	10 YR. MEAN HT (IN.)	10 YR. MEAN CROWN WIDTH (IN.)	10 YR. MEAN STEM DIAM (IN.)
HONEYSUCKLE (<i>Lonicera</i>)				
NDSU Sel #1	83a ^x	30a ^x	36a ^x	y
NDSU Sel #10	75a	32a	33a	y
NDSU Sel #22	92a	46b	56b	y
'Freedom' (Control)	75a	83c	73c	y
RED PINE (<i>Pinus resinosa</i>)				
Without Treeshelter	70a	73a	44a	2.1a
With Treeshelter	30a	56a	26a	1.4a
SWISS MOUNTAIN PINE				
<i>(Pinus uncinata (syn. P. mugo var. rostrata))</i>				
Without Treeshelter	40a	43a	23a	1.6a
With Treeshelter	60a	36a	17a	1.1a
LAUREL WILLOW (<i>Salix pentandra</i>)				
Brinsmade #1				
Brinsmade #2	83a	66a	57a	y
St. Cloud Source	92a	68a	64a	y
Control	25b	87a	83a	y
	0	0	0	

^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 Ten-year mean stem diameter was not collected on these accessions which typically grow multiple-trunked.

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