A Peek into the North Dakota State University Woody Plant Improvement Program

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Summary

North Dakota State University's Woody Plant Improvement Program (WPIP), initiated in 1971, has released 61 woody plant selections into the ornamental nursery trade since 1986. With a focus on the U.S. northern Great Plains, the program aims to evaluate and introduce new woody plants suitable for the region's challenging conditions. The evaluations, conducted at three primary research sites in North Dakota, have assessed over 200 genera and 3,000 species and cultivars of trees and shrubs. The extensive collection at the NDSU Horticulture Research Farm and Dale E. Herman Research Arboretum includes more than 11,000 accessions, making it the largest and most diverse woody ornamental plant collection in the northern Great Plains. The WPIP employs various germplasm collection methods and plant improvement techniques, including landscape observation, mass selection, and traditional and mutagenic breeding. Notable recent selections include cultivars of Japanese elm, dwarf Korean birch, Ohio buckeye, birch, mollis

azalea, mugo pine, katsuratree, and mountain pine, with potential future introductions such as "Gumdrop" sugar maple and "Golden" littleleaf linden. The program's efforts contribute significantly to expanding the variety and resilience of woody plants for urban landscapes in challenging climates.

INTRODUCTION

Woody plant evaluations at North Dakota State University (NDSU) began in 1954. In 1971, Dr. Dale E. Herman initiated the NDSU Woody Plant Improvement Program (WPIP) with the first plant introductions beginning in 1986. To date, this program has released 61 woody plant selections into the ornamental nursery trade.

The NDSU WPIP has two primary goals. First, evaluate unreleased or released cultivars from the nursery trade, and second, increase diversity through selecting and/or breeding new woody plants suitable for the U.S. northern Great Plains. The NDSU WPIP program woody plant selections are ideal for urban climate conditions. North Dakota is the eighth driest state with respect to annual precipitation in the U.S. North Dakota soils are typically alkaline with a pH >8.0.

There are three primary research evaluation sites in North Dakota. The first is the NDSU Horticulture Research Farm (HRF) and Dale E. Herman Research Arboretum (DEHRA) (USDA hardiness zone 4a, Absaraka, ND Absaraka, ND, USA; Lat:46.9859, Long: -97.3549). The second are research plots in Fargo, ND (USDA hardiness zone 4a, Fargo, ND, USA; Lat: 46.918900, Long: -96.796681). The third is the NDSU Langdon Research Extension Center (USDA hardiness zone 3b, Langdon, ND; Lat: 48.7631, Long: -98.3713).

The NDSU WPIP has evaluated more than 200 genera and more than 3,000 species and cultivars of trees and shrubs. Over 11,000 accessions have been obtained and evaluated since planting began in 1974. The largest and most diverse woody ornamental plant collection in North Dakota and the northern Great Plains is located at the NDSU HRF and DEHRA with a total of 80 acres (~32 hectares).

The NDSU WPIP is involved with several woody plant evaluations, including cultivar comparisons done in conjunction with several industry cooperators and private breeders. For plant evaluation, selections and breeding, germplasm is collected using three different methods including foreign and domestic seed sources (growing out seedling populations and selection individuals with superior attributes), plant breeding (tradition breeding including F2 populations to observe segregation of traits, including hybridizing with both intra- and inter-specific hybridization), and *in vitro* tissue culture utilizing somaclonal variations, embryo rescue and mutagenesis. Three plant-improvement methods utilized are selections by landscape observation, mass selection (seed source and seed lot variation), and breeding (both traditional and mutagenic).

With the large germplasm collection located at the NDSU HRF and DEHRA, there are many accessions that have shown out-

standing hardiness and make excellent parents for improvement through breeding efforts. These include Spring Welcome® magnolia (*Magnolia* x*loebneri* 'Ruth') and Fall Grandeur™ red maple (*Acer rubrum* 'Minnkota'). Magnolia breeding objectives focus on flower tepal color, introducing any color from *M. acuminata* hybrids coupled with the hardy Spring Welcome® selection (white flower color). Maple (*Acer* spp.) breeding objectives include utilizing known hardy and environmental tolerant selections to develop a better adapted Freeman maple (*A.* x*freemanii*). Current selections, such as Autumn Blaze®, do not have consistent performance in the northern Great Plains with respect to pH tolerance and winter hardiness. Utilizing a red maple selection that is known to be pH tolerant and have reliable winter hardiness would be better suited for a Freeman maple hybrid selection in colder climates.

Ornamental breeding research at NDSU includes developing freeze test procedures for earlier hardiness screening, traditional breeding efforts (making interspecific crosses with cold hardy species and hybrids), developing propagation protocols (micropropagation, grafting and vegetative cuttings), and polyploid induction for future sterility breeding.

Some outstanding recent selections that have come out of the NDSU WPIP include Northern Empress® Japanese elm (*Ulmus davidiana* var. *japonica* 'Burgundy Glow'), Cinnamon Curls® dwarf Korean birch (*Betula costata* 'CinDak'), Lavaburst® Ohio buckeye (*Aesculus glabra* 'LavaDak'), Emerald Flare® birch (*Betula tianshanica* 'EmerDak'), and Fireflare Orange® mollis azalea (*Rhododendron* x*kosteranum* 'FireDak'), Hyland Splendor® mugo pine (*Pinus mugo* 'HyDak'), KoolKat® katsuratree (*Cercidiphyllum japonicum* 'KoolDak'), and Hyland Guard™ mountain pine (*Pinus uncinata* 'GuarDak'. Potential future selections may include "Gumdrop" sugar maple and "Golden" littleleaf linden.