

## North Dakota State University Cold Climate Breeding<sup>©</sup>

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Climate and soil conditions present a challenge in growing landscape plants in the northern Great Plains. Only a small percentage of woody plant genotypes may perform satisfactorily as a result of insufficient winter hardiness; pest susceptibility; and lack of resistance to drought, desiccating winds, and unfavorable soil conditions [e.g., alkaline (pH) and saline soils]. Historically, there has been a deficiency of adapted, winter hardy, pest resistant woody plants for shelter and landscape uses in the northern Great Plains. As a result of this deficiency, there is a need to breed, evaluate and introduce adapted woody plants to increase plant diversity for this region and avoid monoculture disasters in the future.

The northern Great Plains is a diverse intercontinental environment with limited woody plant species that have been evaluated for use in U.S.D.A. Hardiness Zones 3 and 4. Dr. Dale E. Herman developed the North Dakota State University (NDSU) Woody Plant Improvement Program in the 1970s. Over the years, the Program has introduced 51 superior woody plants for production with increased winter hardiness and cultural tolerances for landscapes throughout the northern Great Plains.

The NDSU Woody Plant Improvement Program has eight objectives:

- 1) Obtain potential winter-hardy germplasm for evaluation and/or breeding efforts.
- 2) Replicate evaluations at several sites within North Dakota.
- 3) Narrow evaluations to most promising selections.
- 4) When possible, potential final selections are observed by researchers from regional universities and nursery industry personnel to provide additional input.
- 5) New name cultivar and select potential trademark name.
- 6) Distribute propagation material to wholesale nursery propagators.
- 7) License wholesale nursery firms to commercially produce the new woody plant.
- 8) Publish information to make known the new introductions at all levels.

Germplasm is obtained from multiple sources including: foreign and domestic seed sources including local and regional plant collections of potentially superior native species and specimens. Seedling populations are typically grown out and individuals with superior landscape attributes are selected for potential future releases as well as breeding efforts. Plant breeding was not a focus of the NDSU program and recently has been added as an effort for plant improvement. Both traditional breeding as well as mutagenic breeding is being conducted. Breeding efforts are being developed with multiple genera including *Acer*, *Magnolia*, *Prunus*, and others (Fig. 1). Plants are also evaluated through cooperative evaluation programs with Bailey Nurseries, Inc., St. Paul, Minnesota; J. Frank Schmidt & Son, Inc., Boring, Oregon; Iseli Nursery, Boring Oregon; U.S.D.A. (North Central Regional Plant Introduction Station) NC-7 program; and other firms.

Evaluations are conducted primarily at the NDSU Horticulture Farm, which includes the NDSU Dale E. Herman Research Arboretum. The farm is located near Absaraka, North Dakota (ND), which is a U.S.D.A. Hardiness Zone 4a. The soil type is a Spottswood sandy loam underlain by a water-bearing gravel layer. Under this gravel layer, which extends from 1-1.5 m below the soil surface, is a deep layer of medium loam. This research location provides ideal horticultural soil for evaluation efforts and typifies much of the soil types found in ND. Several other sites are utilized for replication of evaluations, which include city and park planting trials in Bismarck and Fargo, ND and evaluation plots in Carrington, ND (USDA hardiness zone 4a) and Langdon, ND (U.S.D.A. Hardiness Zone 3b) at the ND Agricultural Experiment Stations. The NDSU Dale E. Herman Research Arboretum consists of just over 14 ha and contains 150+ genera and over 3,000 accessions. This collection is one of the largest and most diverse collections of

woody plant germplasm in the Northern Great Plains.

Over 50 introductions have been made since the mid-1980s. In the near future, numerous additional woody plant releases are being planned. Some of the most promising selections include: several birch, several maples, a buckeye (Fig. 2), an elm, a thornless honeylocust, and selections from additional genera. These new releases will have gone through numerous years of evaluation along with research involving vegetative propagation methods.

One limiting factor with ornamental woody plant production is propagation. To have a successful introduction to the nursery trade, an efficient and economically feasible protocol for propagation must be established. New introductions require large clonal plant populations that are readily available for licensed nurseries. As a result, research on propagation is conducted along with evaluations so that nursery growers will have the necessary propagation information along with species recommendations. Propagation research focuses on stem cuttings, plant tissue culture, and grafting. All of the techniques result in clonal propagative material and are essential for increases population numbers of current and potential future introductions. Grafting rootstock compatibility studies are being conducted on select species to determine if grafting compatibility will be an issue, if it affects hardiness of the plant, and assists in decreasing production and management issues. Each species that has potential for release through the NDSU Woody Plant Improvement Program will be screened for propagation issues and protocols will be developed and released to nursery growers as well as published in peer-reviewed journals.

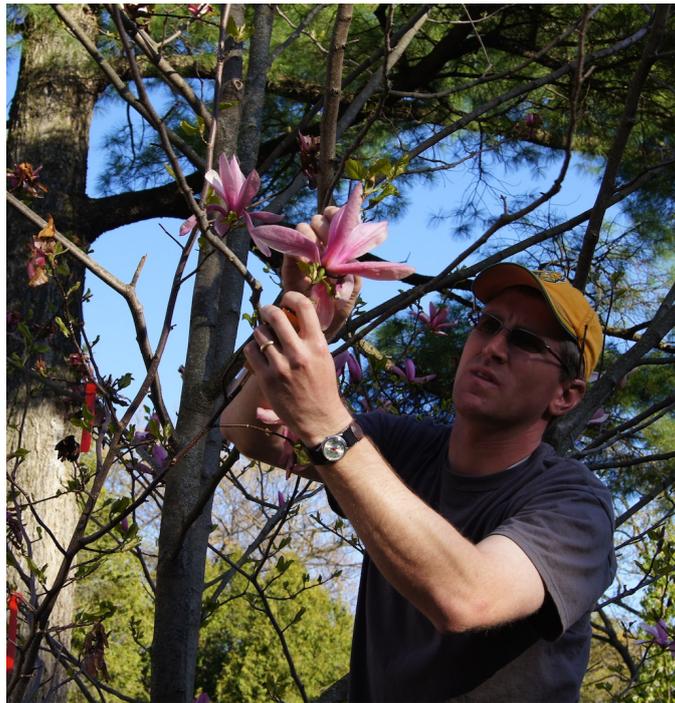


Fig. 1. North Dakota State University *Magnolia* breeding to introduce more ornamental traits into hardy late flowering *Magnolia* × *loebneri* ‘Ruth’, Spring Welcome<sup>®</sup> loebner magnolia.



Fig. 2. Upright buckeye (*Aesculus glabra*).

