

# Germplasm Resources for New Crops Research: North Central Regional Plant Introduction Station Ames, IA U.S.A.



L. F. Marek<sup>1</sup>, D. M. Brenner<sup>1</sup>, J. H. McCoy<sup>2</sup>, and C. A. C. Gardner<sup>2</sup>

<sup>1</sup>North Central Regional Plant Introduction Station, Agronomy Department,  
Iowa State University, Ames, IA 50011, USA

<sup>2</sup>North Central Regional Plant Introduction Station, USDA-ARS,  
Iowa State University, Ames, IA 50011, USA

## ABSTRACT

As part of the United States National Plant Germplasm System (NPGS), at the North Central Regional Plant Introduction Station (NCRPIS) we work to conserve genetically diverse crop germplasm and associated information, to conduct germplasm-related research, and to distribute this germplasm to researchers and educators world-wide. We manage numerous industrial, nutritional and medicinal germplasms including species of *Amaranthus*, *Chenopodium*, *Cuphea*, *Echinacea*, *Euphorbia*, *Helianthus*, *Hypericum*, *Linum*, *Perilla*, *Vernonia*, and diverse *Umbelliferae*.

The *Cuphea* collection includes 648 accessions (64 of the estimated 260 species in this genus). Accessions from ten of these species have been used in the development of *Cuphea* lines for domestic production of industrially important mid-chain fatty acids (caprylic, capric, lauric, and myristic) currently derived solely from petroleum and coconut and palm oils. As part of a national team made up of public and private sector groups, our station is establishing reliable germination conditions for the wild germplasm that provides the reserve of genetic diversity for *Cuphea*.

We maintain 151 accessions of *Echinacea* (representing all 9 species in the genus) and 92 accessions of *Hypericum* (48 species) as part of a focus on collection, regeneration, and evaluation of genetically diverse medicinal plant species. In collaboration with Iowa State University, the University of Iowa and the National Institutes of Health, we provide germplasm for in-depth study of the phytopharmaceutical properties of *Echinacea* and *Hypericum*. Research projects associated with our medicinal plant collections include studies of genetic and chemical diversity, bioactivity, proteomics, determination of mechanisms of action, and enhancement breeding.

The *Amaranthus* collection includes 3,329 accessions (40 of the estimated 60 species). This germplasm originated in 85 countries. Representation of both wild and cultivated sources make the collection an important resource for taxonomic studies as well as for baseline herbicide resistance, nutritional and molecular research. The world's record tallest amaranth (461 cm) was grown in Ames in 2004 from seeds of *Amaranthus australis*, accession PI 553076. The large plants of PI 553076 are potentially useful for biomass production.

## Cuphea

*Cuphea* is of interest as an oilseed source of capric and lauric fatty acids, used in cosmetics and detergents. Varietal development by Steve Knapp led to release of PSR 23. Breeding challenges included eliminating seed dormancy, seed shattering, reducing stalk lodging and stem and pod stickiness. Efforts of USDA-ARS researchers from the NCAUR lab in Peoria, IL and from Morris, MN are devoted to oilseed chemistry, extracting and processing, and crop management. NCRPIS holdings include 650 accessions of species with potential to contribute to oilseed crop development (Curator L. Marek).



Cuphea variety PSR 23 was derived from a cross of *C. lanceolata* x *C. viscosissima* populations (Knapp).

## Helianthus



Perennial sunflower field at NCRPIS caged for controlled pollination and seed increase. We plan for 50 plants per accession in 10x10x20 ft cages. Honeybee nuclei are usually placed into the cages at mid-bloom. We make multiple harvests of the wild sunflowers because the heads shatter as they mature.

The *Helianthus* collection serves as a source of genes for improvement of oil compositional traits, disease and insect resistance and general agronomic and horticultural improvement. Sunflower oil is low in trans-fatty acids and excellent for human nutrition; it also performs well when used in cooking at high temperature.

## Amaranthus

*Amaranthus* holdings include 3,329 accessions of many species. Internationally, amaranth is valued for consumption as a grain with high quality protein for human and animal nutrition, and as a leafy vegetable or forage crop. Some species have horticultural and ornamental appeal. *A. australis* is a huge plant with a hollow stem that may be of interest for biomass production. The collection is heavily used by weed scientists for screening herbicide efficacy or studying herbicide resistance development. Traits under improvement include grain fragrance and flavor, harvest traits, establishment traits, specialty grain starch types for premium product specifications, low-nitrate forage selections, and pigments for foods.



Field observation and cage regenerations



Greenhouse regenerations

## NCRPIS Helianthus holdings

Perennial taxa:	63
Annual taxa:	23
Total taxa:	40
Cultivated accessions:	1690
Wild accessions:	2120
Total accessions:	2962



## Medicinal Plants

New medicinal holdings at the NCRPIS include 311 accessions of *Echinacea* sp. (prairie coneflower, used to boost the immune system), *Hypericum* sp. (St. John's wort), *Actea racemosa* (black cohosh, used in the treatment of menopausal symptoms), *Sanguinaria canadensis* (bloodroot), *Hydrastis canadensis* (goldenseal, used for immune stimulation) and *Chamaelium luteum* (fairywand, used as a phytoestrogen).

An NIH grant focused on the *Echinacea* and *Hypericum* collections and their phytopharmaceutical functions with respect to anti-viral immune properties partially supports our work with medicinal plants.

## NCRPIS On-line Information

The NPGS holds over 500,000 plant germplasm accessions for use in agronomic, horticultural, industrial, and nutritional improvement applications. Please visit <http://www.ars-grin.gov/npgs/> for complete system information.

To review collection holdings at the NCRPIS and order seed, go to: <http://www.ars-grin.gov/npgs/> Select "Search GRIN" to find accessions. Select "Repository Home Pages" and the North Central Regional Plant Introduction Station (NC7)" to find out about us.



Accessions in the Echinacea collection