NCRPIS

AMES, IOWA

North Central Regional Plant Introduction Station

NC7 Annual Report
January 1 - December 31, 2012

2012

USDA

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

NCRPIS ANNUAL REPORT - 2012

TABLE OF CONTENTS

NORTH CENTRAL REGIONAL PLANT INTRODUCTION STATION
NC-7 ANNUAL REPORT, JANUARY 1 - DECEMBER 31, 2012

I. PROJECT TITLE:

NC-7 "Plant Germplasm and Information Management and Utilization"

II. COOPERATING AGENCIES AND PRINCIPAL LEADERS (current):

A. Administrative Advisor

*W. Wintersteen, Iowa

B. Regional Coordinator

*C. Gardner, USDA-ARS, Iowa

C. State Experiment Stations Representatives

Voting members:

1. Illinois	G. Kling	7. Missouri	J. Shannon
2. Indiana	J. Janick	8. Nebraska	D. Santra
3. Iowa	T. Lübberstedt	9. N. Dakota	B. Johnson
4. Kansas	M. Stamm	10. Ohio	P. Jourdan
5. Michigan	A. Iezzoni	11. S. Dakota	K. Glover
6. Minnesota	J. Orf	12. Wisconsin	W. Tracy

Non-voting participants:

13. California-Davis	R. Karban	19. New Jersey	S. Handel
14. Connecticut	M. Brand	20. New Jersey	T. Molnar
15. Iowa	K. Lamkey	21. New York	M. Smith
16. Kansas	A. Fritz	22. Texas	D. Baltensperger
17. Michigan	J. Hancock	23. Wisconsin	S. Kaeppler
18. Missouri	S. Flint Garcia	24. Wisconsin	N. de Leon

D. U. S. Department of Agriculture

1. ARS National Program Staff, Plant Germplasm	*P. Bretting
2. ARS Plant Exchange Office	*E. Garvey
3. ARS Area Director, Midwest Area	R. Matteri
4. Cooperative State Research, Education and Extension Service	A. Thro
5. National Center for Agric. Util. Research	*T. Isbell
6. National Center for Genetic Resources Preservation	*D. Dierig

*Voting members

E. North Central Regional Plant Introduction Station, Ames, Iowa

See organizational chart, Figure 1 in the Appendix.

III. PROGRESS OF WORK AND PRINCIPAL ACCOMPLISHMENTS:

Personnel changes - July, 2012 – June, 2013:

Departures:

- Andrew Smelser, GEM Project Agri. Research Science Technician, May, 2013
- Vivan Bernau, Temporary Agri. Research Science Technician, Maize Curation, January, 2013

New Hires:

None

Vacant Positions:

- GEM Agri. Research Science Technician (advertised)
- Entomology Agri. Research Science Technician

Positions Abolished due to Sequestration:

- Agronomist (IT) (Vice-Kovach)
- Biological Science Technician (Vice-Erickson)

Management of Federal STEP (Student Temporary Employees):

USDA-ARS resources provided for 19 student part-time temporary positions in FY 2012. The temporary positions support curatorial activities including regeneration, seed processing, viability testing, farm and facilities operations, and IT support. Students were interviewed and selected by ISU Program Manager Larry Lockhart or ARS technicians. Marci Bushman, and Susan Siev managed the administrative aspects of all student hires, with support and guidance from Ames ARS HR Specialist Kim Grandon and Admin. Officer Carol Moran.

Budget:

As a result of federal sequestration in FY 2012, the two ARS CRIS projects that supports were decreased by 7.38%. The CRIS funding that supports plant genetic resource conservation activities decreased from $2,288,999 to $2,120,271, or $168,928. The CRIS Project that supports the Germplasm Enhancement of Maize Project (GEM) decreased from $1,118,053 to $1,036,282, or $82,571. Because of the collective loss of over $251,000 in funding, the anticipated cost of replacing our dryers following a fire in the fall of 2012, and the importance of retaining student labor to support curatorial activities, it was necessary to abolish the two vacant positions listed above.

Declining purchasing power of budgets, rising energy and operational expenses continue to erode our ability to support core functions. In FY12, personnel costs made up 87% of allocated funding. Further reductions in funding will force a reduction in student hiring, necessary for executing our genebank's mission. Like many other research units, our ability to cover all aspects of our mission is challenged; our personnel strive to cover all functions and serve the collections entrusted to us and our stakeholders to the best of our ability.

We are appreciative of the support of the Agricultural Experiment Stations of the North Central Regions, which have maintained their annual support and continued

to provide $522,980 in Hatch funds. These funds support the salaries of our nine ISU staff members, their professional travel, and some expenses. In addition, Iowa State University's Agricultural Experiment Station provides support valued at over $400,000 annually that supports infrastructure, administration, and benefits for current NCRPIS-ISU staff members and retirees.

Dr. Charles Block's Sclerotinia Initiative funding supports student labor and supplies used for this research.

Construction and Facilities:
In FY11 and12, re-covering and reglazing of two greenhouses were completed, supported by Federal Hatch funds. A fire destroyed a gas-fired dryer burner and the plenum on the outside of the building; the drying bins on the inside of the building and the building itself were not damaged, fortunately. Because of this, and because it is more effective to replace the second (undamaged) unit at the same time with newer technology as well, approximately $82,000 of our funding will be spent in FY13 to replace both dryer units.

In cooperation with ISU, the telecommunications infrastructure within the station was upgraded to10 gigabit capability, and the servers were relocated to an environmentally controlled room, remodeled and upgraded for this use.

Equipment: No significant equipment purchases were made in 2012.

IV. PROGRESS IN GERMPLASM AND INFORMATION MANAGEMENT, RESEARCH, AND EDUCATION (C. GARDNER):

(Part IV. summarizes the accomplishments and progress for calendar year 2012 presented in greater detail in the individual staff reports in the document.)

Acquisition and Documentation Highlights:
In 2012, (Appendix Table 1) 470 new accessions were acquired, nearly 1.0% of the previous collection holdings. Of these, 425 were received from within the NPGS through exploration and/or transfer. This compares with 485 new accessions in 2011, 516 new accessions in 2010, and 521 in 2009. Newly acquired germplasm included: 189 accessions from the Seeds of Success program, 93 accessions of *Daucus*, 33 accessions of wild *Helianthus*, ornamentals such as Fraxinus and *Gymnocladus* (Kentucky coffeetree). *Thlaspi*, *Zea* and others. A 288-member association mapping population, UGA-SAM1 of cultivated *Helianthus annuus* lines was received from the University of Georgia.

In 2012, our staff participated in collection expeditions that acquired *Fraxinus quadrangulata, Quercus muehlenbergii,* and other ornamentals from Iowa, Illinois, Indiana, Missouri, and Ohio; and *Helianthus* from New Mexico and Texas, including 10 accessions listed as threatened annual species *H. paradoxus*.

Other new additions include 36 *Thlaspi arvense* accessions from CO, IL, IA, SD and Chile; 14 *Camelina* from the Republic of Georgia; eight *Amaranthus* including grain types and a genetic stock; and an accession of *setaria italica* subsp. *viridis* used as a model organism for C4 photosynthesis research.

Of ongoing concern is the successful entry of germplasm collected from international explorations into the U.S. It is critical that clean, pest- and pathogen-free seed be shipped or carried in by collectors; sufficient time needs to be devoted to collection sample preparation and sufficient care post-collection. Excellent quantities of seed provided by collectors of many new accessions have made a significant proportion available and distributable immediately.

Permanent PI numbers were assigned to 448 accessions in 2012. Taxonomic re-identification was completed for 41 accessions; 67 accessions were nominated for inactivation. R. Stebbins continues to enter old passport information from logbooks for early Ames-numbered accessions.

Original seed samples continue to be scanned by L. Pfiffner in order to provide useful visual references for comparison of regeneration lots with original samples.

Regeneration and Maintenance Highlights:
In 2012, 759 accessions were newly grown for regeneration and 954 were harvested, as compared to 1,096 accessions grown for regeneration and 1,017 harvested in 2008 (Appendix Table 2). 2012 growing conditions varied from too wet early, to extremely hot and dry in July-September, which negatively impacted production of seed increases. An additional 422 perennials are growing in permanent plantings. About 917 accessions were made available to the public. Accessions backed up at the NCGRP in Ft. Collins in 2012 numbered 799, compared with 792 in 2011, 2,388 in 2010 and 1,848 in 2009. Eight percent of NCRPIS collection holdings are backed up at the NCGRP (Appendix Table 2). Overall collection availability is 74%, a decrease of 1% since 2012, despite 6% growth in collection size since 2006. An additional 560 accessions were sent to Ft. Collins for assembly with accessions from other NPGS sites and deposit to the Svalbard Global Germplasm Vault.

Assistance in regeneration was provided by USDA-ARS staff of Parlier, CA for increase of wild *Helianthus* taxa. *Daucus* regeneration efforts were supported by seed increases from Seminis Vegetable Seeds (R. Yzquierdo) and Nunhems (R. Freeman). Maize regeneration and observation assistance for 200 tropical maize populations was provided by Monsanto (D. Butruille) in Hawaii. T. Foley regenerated 14 expired maize PVPs at various locations. USDA-ARS staff of Mayaguez, PR and the St. Croix quarantine nursery staff supported regeneration of 86 maize accessions. GEM Project Coordinator Michael Blanco provided resources increase 8newly released GEM lines.

Spinach regenerations continue to be supported by cooperative efforts between the USDA-ARS and Sakata Seed America, Inc. in Salinas, CA.

Distribution:
2012 external distributions included 45,115 items of 18.811 unique accessions to fulfill 1,632 orders from 1,344 requestors, a new record. This compares with 2011 distributions of 38,402 items of 18,634 unique accessions to fulfill 1,501 orders from 1,180 requestors; 2010 distributions of 26,651 items of 13,226 accessions; and 2009 distributions of 26,904 items of 13,515 accessions to fulfill 1,487 orders from 1,081 requestors. Approximately 42% were distributed internationally and 58% to domestic researchers, as compared to the 28% sent internationally in 2010 (Appendix Table 3). These included large, one-time distributions to Embrapa (Brazil) and the Republic of Korea's RDA genebank. The relative numbers of distributions generally correlate well with the proportional makeup of the collections and vary from year to year, although demand for maize is usually greater than for other crops.

Curator	Collection Size 2012	% of Total Collections	% of 2012 Distributions	Collection Size 2011	% of Total Collections	% of 2011 Distributions
Barney	1507	3	1			
Brenner	8985	17	9	8963	17	23
Carstens	1709	3				
Marek	11548	22	28	11406	22	20
Medicinals	(Barney)			498	1	1
Millard	20679	40	44	20639	40	34
Reitsma	7695	15	18	7613	15	20
Widrlechner				2602	5	2
Totals	**52123**	**100**	**100**	**51,721**	**100**	**100**

Research demand for our plant genetic resources collections continues to be very high; requests for diversity and relationship analyses, disease resistance, biofuel, and health and nutrition contribute increasingly to these increases, as well as for basic research applications such as photoperiod response, and an array of performance traits. Demand for *Zea mays* inbred lines, *Helianthus*, Brassicaceae, flax, *Daucus,* quinoa and the culinary umbels for evaluation and characterization were particularly high. Maize inbred requests were driven by the publication of information from the genomic (genotyping by sequencing) and phenotypic analyses project.

NPGS curators at all sites continue to receive many requests from individuals not affiliated with research institutions, generally for home gardening. Home gardeners are redirected to other sources of commercially available materials. Although our resources cannot support maintaining and distributing the collections to home gardeners, we inform these requestors about plant genetic resource conservation, and encourage interested individuals to save seeds, conserve them, and share germplasm and associated information. The proliferation of websites instructing non-research requestors how to deceive curators at various germplasm sites in order to get free germplasm continues to be problematic. The careful efforts that go into each and every increase, characterization, imaging, processing, storage, viability testing, and distribution surely make these seeds among the most expensive to provide in the world.

Evaluation and Characterization:
In 2012, the NCRPIS utilized 844 accessions for internal observation, evaluation and characterization for a wide array of descriptor information, viability testing, pathology tests and back up (Appendix Table 4). About 24,045 observations associated with 8,030 accessions (Appendix Table 4) were entered in the GRIN database (http://www.ars.grin.gov/npgs/). 870 images were added to GRIN.

Information technology and telecommunications:
The NCRPIS staff provided expertise and leadership for the development of GRIN-Global (GG), the successor to the GRIN system; this has become the primary focus of two NCRPIS staff members, with substantial time by additional personnel. This project was undertaken as a partnership between USDA-ARS, Bioversity International and the Global Crop Diversity Trust (the Trust) to develop a genebank information management system which can be deployed to any genebank in the world. National Program 301 Leader, Peter Bretting, was the PI for this agreement. With the release of GRIN-Global V1.0 to the international community in December, 2011, efforts are currently focused on gap analysis and programming to address the implementation needs of the National Plant Germplasm System (NPGS) and to release V2.0.

The Database Management Unit (DBMU) in Beltsville, MD hosts the GRIN system and has the lead responsibility for NPGS implementation of GRIN-Global. Ames-based development team members include Pete Cyr, our Applications Software Development IT Specialist, Project Manager; Mark Millard, Maize Curator, Analyst; Lisa Burke, Seed Storage Manager, beta tester; and Candice Gardner, RL. A number of NPGS genebank personnel are involved in testing and gap analysis, and are providing valuable input representing the needs of the NPGS germplasm community.

Please see IT section for technically detailed reports on support activities.

Germplasm's Viability and Health:
Over 1,370 or 3% of the NCRPIS collections, were tested for viability in 2012, significantly fewer than in prior years due to a vacant technical position, budget challenges, and the need to direct student labor resources to other projects and the consequent labor constraints (Appendix Table 2). Our storage conditions (4 C, 25-35% relative humidity) are very good, and the efforts devoted to seed cleaning ensure storage of very clean seed lots, important to longevity of viability. We also need to add a field in the new GRIN-Global System that differentiates simple viability from 'pure live seed.' Dormant seeds that do not readily germinate should be considered in the context of accession viability.

Horticulturalist D. Barney initiated research on seed development, viability, and dormancy in *Actaea* and *Hypericum*.

Pathology team research (C. Block) focused on combining greenhouse and field resistance screening methods for Sclerotinia stalk rot in wild sunflowers; long-term survival and seed transmission of bacterial fruit blotch (*Acidovorax avenae* subsp.

citrulli), or BFB, in Cucurbits with an emphasis on identifying infected, older *Cucumis melo* seedlots; screening of all *Cucumis* seedlings grown for presence of Squash Mosaic Virus via ELISA; regular disease monitoring of cucurbit plantings from transplant to harvest and of *Helianthus* plantings for downy mildew, viruses and phytoplasmas; screening of maize for Stewart's wilt resistance and northern corn leaf blight; and testing maize inbreds of known Stewart's wilt response for Goss's wilt resistance. Increased incidence and severity of Goss' wilt of maize has led to intensified research on the biology and epidemiology of this disease. Field observations were made in the increase plots, and accessions were monitored in particular for diseases for which seed-borne transmission is of concern.

Dr. Block and collaborators continued evaluation of published PCR primer sets for specificity in detection of *Pantoea stewartii* subst. *stewartii* in maize seeds. This research has important implications for standardization of phytosanitary testing methods authorized for laboratories to use in determining whether maize seed meets criteria for importation in various countries.

Insect management:
The Entomology staff provided five insect pollinator species to control pollinate 268 accessions. Honeybees continue to be the primary pollinator used in the NCRPIS regeneration program, followed by the Alfalfa Leafcutter Bee (ALC).

Detailed, interesting observations and interpretative information regarding their field pollinator research activities can be found in their extensive section of the annual report for information on their continuing efforts to enhance the pollination program's effectiveness and efficiency. Substantial report space is devoted to this team's activities because of the uniqueness of this project, limited sources of such information, and relevance to the broader germplasm conservation world. Feedback and suggestions on experimental approaches are welcomed.

We continue to consider the impact of the effectiveness of insect pollinators on cross-fertilization of caged plantings, and whether the genetic profile of the accession is maintained during regeneration. Resources will determine whether we can devote focused studies to this question in the next five years, and will require careful selection of parent lots and assay of their progeny using molecular markers or known discernible traits.

Enhancement:
The Germplasm Enhancement of Maize Project (GEM) continues to work with public and private collaborators to adapt exotic maize germplasm to broaden the genetic diversity of temperate U.S. maize production and provide unique, key priority traits. Research and breeding are designed to improve exotic germplasm introgression methods, to provide unique sources of allelic diversity, and to identify traits and genes to support improvement of agronomic productivity, disease resistance, insect resistance, and value-added grain characteristics, including total extractable starch to support ethanol production, and resistant starch – of importance to human health and nutrition.

The Ames and Raleigh, NC GEM Projects and public collaborators have released 256 lines from 2001-2012, representing over 60 maize races. An important goal is development of a set of inbred lines representative of the diversity inherent to all of the races of maize. In addition to traditional introgression methods, the project is generating doubled-haploid maize lines in partnership with the ISU Doubled Haploid Facility to accomplish this objective, and also with collaboration of private sector partners to accomplish the initial increase of doubled-haploid seeds in Hawaii and Chile winter nurseries. Approximately 252 DH lines will be jointly released by USDA-ARS and ISU in 2013.

Photoperiod sensitive tropical maize often does not flower until September in Ames. GEM and maize curatorial teams have continued to collaboratively develop an effective method for photoperiod control in the field. While successful, it is difficult to achieve the field scale needed to support the number of accessions that require photoperiod control treatment. This effort has been leveraged by the sunflower project, which has used it very effectively to induce flowering in certain wild sunflower accessions. Photoperiod-control environment capacity on the order of one to three acres would be very useful in maintaining and providing unique genetic resources.

Outreach and Scholarship:
Approximately 400 visitors toured the NCRPIS during 2011. Our staff participated in teaching students from grade K to postgraduate level, and provided outreach events to civic and other organizations about germplasm conservation and management, and the work done at the NCRPIS. Scientific and technical staff members continue to publish scholarly journal articles, make presentations at scientific meetings, and supervise graduate research programs.

Current and future foci:
Processes involved in regeneration, characterization, and making viable germplasm available are labor intensive. Currently, resources do not allow maintenance and regeneration efforts, including viability testing, to keep pace with demand. We will continue to try to improve conservation methods to better use the resources available to us, and to develop labor and resource saving technologies. We continue to evaluate activities that can be reasonably reduced without sacrificing collection health and quality, and to improve efficiency.

Continued emphasis will be placed on communicating with research stakeholders to identify and address development of comprehensive, genetically diverse collections to meet research and development needs. Climate change is forcing researchers to renew efforts to identify superior forage cultivars as well, and interest has increased in collections of suitable species. A 'gap analysis' process is utilized to examine distribution of crops and their wild relatives; information sources include herbarium records, floras of various countries and ecoregions, predictive analyses bases on GIS layers and habitat information, and scholarly publications that cite plant sources, traits, and performance attributes. Wise selection of targets is important to managing collection growth and effective use of resources.

2013 collecting efforts will be targeted to expand the *Fraxinus quadrangulata* collection from its native range, in advance of the destructive Emerald Ash Borer, continuing to preserve individual mother trees from the populations to support genetic research; *Gymnocladus* to enable selection of superior Kentucky coffee tree individuals for managed landscapes; *Chenopodium* and spinach relatives from the Wyoming; and *Helianthus* from the Pacific Northwest.

Better characterization information is essential to enable well-targeted use of the collections, especially given the increasing constraints of limited research and conservation resources. Collaboration between Vegetable Curator Kathy Reitsma and her staff at the NCRPIS and ARS researchers in Wisconsin (D. Spooner and P. Simon) focusee on *Daucus* characterization and taxonomy in 2009 - 2012. A major effort for phenotypic and genomic characterization the entire maize inbred collection was conducted in 2010-2011, and and submitted for publication in 2012. Oilseeds curation staff will increase the *Thlaspi* and *Camelina* collections in order to better support biofuel researchers, and currently conduct research to support their agronomic development and utilization.

Horticulturist M. Widrlechner served as chair of a national Technical Review Team that provided technical direction and oversight to an ARS project to update the USDA Plant Hardiness Zone Map using the best available technologies and data sets, and make it accessible via the Internet. The products of the completed project are publicly available at http://www.usna.usda.gov/Hardzone/. His efforts, together with those of Jeff Carstens, to develop inter-agency coordination of *Fraxinus* collection in the face of the Emerald Ash Borer threat will be continued in his absence.

Pathologist Charles Block's efforts to assess response of wild and cultivated *Helianthus* to Sclerotinia, the most important disease in sunflower production fields in North America, will continue, as will his efforts to develop superior methods to detect seed-borne disease. Curator Laura Marek and a Ph.D. student, Ivan Ayala-Diaz, continue to assess the genetic diversity of the *Camelina* and *Thlaspi* collections. Curator David Brenner is evaluating *Melilotus* accessions adapted to late-season planting that will over-winter well.

Software development efforts for the next two years will center on the development and deployment of the successor to the GRIN system, GRIN-Global - its schema, internal and public interfaces. These efforts are facilitated by contributions from germplasm stakeholders in the U.S. and abroad, as we seek examples of use cases and desired features and functionalities of the new system.

V. IMPACTS OF GERMPLASM USE BY NORTH CENTRAL REGIONAL RESEARCHERS:

Impacts of germplasm use by the researchers at the NCR institutions:
A detailed list of examples of germplasm use in research being conducted at NCR institutions was not requested of the RTAC members this year. NC7 Region

researchers typically account for nearly half of domestic plant germplasm distributions from the NCRPIS. Requests for germplasm continue to increase for research as well as non-research use. Requests become increasingly better targeted as the quantity and quality of information associated with the collection improves, thus sharing of findings resulting from use of NPGS germplasm, linked with the germplasm's identity and source, is critically important.

The linkage of the GEM Project, the maize curation project, and public and private collaborators throughout the U.S. has resulted in synergy which facilitates the use of exotic maize germplasm by public and private sector maize researchers. This unique partnership offers great potential for diversifying the genetic base of U.S. maize production, the purpose of the GEM Project.

Linkages among project participants and with other projects/agencies and contributions of the Regional Technical Advisory Committee:
Linkages are driven primarily by common research interests and objectives and by the heritage of the germplasm material utilized for research and education. All states utilize germplasm provided by the NCRPIS and many of the other 19 NPGS sites; the states have a complex array of collaborative research efforts between their institutions, and with the plant genetic resource curators at the NPGS sites.

The Regional Technical Advisory Committee (RTAC) has provided valuable direction in the following areas:

- requesting and suggesting organizational structure of information needed to determine project impact and provide accountability. This includes advice on useful formats for analyzing and evaluating the nature of distributions, whom they benefit, and how benefits are realized, which are essential for determining the impact and value of the project.
- identifying needed improvements to the public GRIN interface.
- providing input from their respective AES Directors to curators, genebank and other administrators.
- providing guidance to increase the NCRPIS program's relevance to NCR stakeholders.
- providing technical expertise, particularly in the areas of diversity assessment and taxonomy.
- providing added breadth in understanding issues at genebanks beyond the NCRPIS.
- understanding the challenges faced by public researchers partnering with other public institutions' researchers, both governmental and non-governmental. This has provided useful insights for ARS and NCR administrators to guide programmatic decision-making, as well as operational guidance; this function is key because of its direct impact on the public interest as well as the specific research interests of more directly involved stakeholders.

The technical committee gatherings provide an opportunity for the AES Directors' representatives to learn about and understand strategic issues which impact how their institutions operate and how they can cooperate more effectively to address

their mission in today's environment, and then provide this information to their Directors.

Some of the NC-7 RTAC's specific suggestions and contributions from their 2012 Annual Meeting in Ames, IA include the following (from the meeting minutes):

- The 2012 RTAC meeting was hosted by Candice Gardner and the staff of the NCRPIS and highlighted the extensive investigations of NC-7 participants using plant genetic resources to explore new agricultural products and new cropping systems. The opportunities afforded by the meeting and field tours are key to establishing the types of collaborative relationships that lead to long-term partnerships for major research and development efforts.
- The guidance and warm welcome by Academic Advisor and CALS Dean Wendy Wintersteen is appreciated.
- The NC7 Committee Members are encouraged by continued increase in demand for accessions by the genetic improvement community, but are concerned over increasing cost for distribution of seed especially for overseas requests and request by the general public some of whom are not research oriented. We proposed that this issue be considered by select committee composed of RTAC, NCRPIS, CGCs, and USDA program staff.
- Consideration should be given to increase internal (within each state) outreach for the Plant Introduction Station.
- The committee thanks Amy Iezoni for chairing the 2012 meeting; we look forward to the 2013 meeting at MSU, East Lansing in August, 2013.

VI. SUPPORT TEAM REPORTS:

A. Farm (L. Lockhart, L. Crim, B. Buzzell)

We supervised and coordinated daily operations at the NCRPIS farm, including management of all facilities, fields, and greenhouse space. We conducted all pesticide applications in the field and campus greenhouses. We responded to maintenance requests from staff members at the farm and the campus location. We selected, coordinated, and scheduled the student labor force of 19.0 FTE's. We coordinated and completed facility construction and upgrades.

Labor:
During 2012, 70 applications for hourly employment were received and reviewed. There were 45 interviews, resulting in 39 new or returning hourly employees hired. Currently there are 14.6 (FTE) Biological Science Aides working at the NCRPIS.

NCRPIS Farm Crew Personnel:
Larry Lockhart (Program manager II) has been on staff since 1985.
Lloyd Crim (Equipment Operator III) joined the staff in March 1998. He is now working half-time for the farm support group and half-time for the oilseeds project.
Brian Buzzell (Farm Mechanic) joined the staff in May 2002.
Scott McCubbin's (STEP) efforts were shared with the pollination and corn projects.

Maintenance projects:
During the past year the farm staff initiated and completed the following projects which enhanced the efficiency and safety of the station operations.

1. Coordinated re-glazing and repairs of two greenhouses.
2. Removed and replaced ceiling light fixtures in headquarters building. Light fixtures were upgraded to more efficient T-8 type.
3. Added warehouse shelving pallet racks to machine storage building. This greatly added to the storage capacity of the building. We are now able to store all of the cage frames inside.
4. Coordinated with Iowa State University to upgrade phone and data service.

Purchasing:
Larry Lockhart coordinated purchasing for the NCRPIS farm: this task included gathering and summarizing requests, writing specifications, and obtaining supplies for the farm.

Tours:
This past year, we organized and conducted 26 tours. There were approximately 400 visitors to the NCRPIS during 2012.

Staff Training:
We conducted Tractor and Utility Vehicle Safety, Worker Right-to-Know and Worker Protection Standard training sessions for the new staff and student employees as well as updates for existing staff.

B. Information Technology and Telecommunications (P. Cyr and J. Perrett)

Jesse Perrett acted as the first-line of support for the NCRPIS during 2012. Jesse is supervised by Pete Cyr, who is assignment to development of the GRIN-Global System (upgrade of the GRIN Germplasm Management System currently in use). The following list outlines the progress made by the IT team during 2012 at NCRPIS.

Equipment:
As of December 2012, the NCRPIS has 72 workstations installed for use by permanent staff members and part-time temporary student help. In 2012, 18 Dell Optiplex 620 workstations were upgraded to Optiplex 745 and 755 systems via internal component replacement. All desktop computers were upgraded to 4 or 8 GB of system memory and 30 solid state hard drives were installed in key computer systems. Upgrading the workstations was significantly less expensive than replacement cost which enabled NCRPIS funds to be used more efficiently in other areas of need.

A room was remodeled into a new server room by ISU in preparation for the building rewiring project. The new server room was equipped with three 220v circuits to allow for the addition of a third server rack. In addition to the wiring, a new 4 ton HVAC unit was installed to cool the new location.

All NCRPIS farm buildings received new network and telephone wiring in a joint project with Iowa State University as part of the planned upgrade of all campus building telecom wiring. This involved significant planning of jack locations, running new 10 gigabit capable wiring to all jacks, and removing all old telecom wiring once the cutover to the new system was complete. In conjunction with this, 30 telephones were upgraded to new IP telephones. Prior to the rewiring project, the NCRPIS Server room was moved from room 109A to room 115 to accommodate the extra telecom equipment in room 109A. All NCRPIS network jacks are now 1 Gigabit capable as a result of the upgrade providing greatly enhanced client-server communications throughput and reliability.

Three new Optiplex 7010 workstations were purchased and deployed for life cycle replacement. Five HP convertible tablets were acquired from excess property in order to enhance field data collection. One Wacom Intuos 5 drawing tablet was purchased to be shared among users needing to draw on maps or pictures for facilities mapping or presentations. Three surplus servers were received from NCAH.

Software:
All workstations at NCRPIS were upgraded to Windows 7 except for five workstations which have legacy software or connected lab equipment. The remaining five workstations have Windows XP with service pack 3 installed or are not connected to the internet. Installed Microsoft Office 2010 on 34 computers. Upgraded Acrobat version to X on all relevant computers.

Frequent updates to anti-virus and anti-spy-ware definitions in conjunction with regular full system scans help to ensure that these workstations remain vulnerability free. During 2012 all workstations and servers at NCRPIS received security updates

from Microsoft every month via the Iowa State University software update servers. PatchLink software was used to manage, track, and apply non-Microsoft software vulnerability patches for all non-Microsoft software in use on the workstations and servers at NCRPIS. In August, PatchLink was retired and the new USDA/ARS wide patching software called BigFix entered the testing phase.

All computer systems on campus and at the farm (servers and workstations) use Symantec Endpoint Protection for enhanced security against virus and spyware threats. All compatible laptop systems are encrypted using McAfee Endpoint Encryption whole hard drive encryption software. Users who need to load images to the GRIN database as well as remote users facilitate connectivity to ARSNet through the use of Cisco VPN software. Active Directory group policies are used to implement the necessary security policies on all machines.

All servers were upgraded to Windows Server 2012/2008 R2 with the exception of the pocket applications web server. A new SQL Server 2008 server was installed to house SharePoint, DVD indexing, and other SQL databases. Two servers were installed and configured for use with Grin Global.

Documentation:
Posted IT support videos and training documents, and information about farm operation, safety, and health to the NCRPIS intranet website. Provided input to the area IT office regarding system/component information for data calls.

Plans for 2013:
Complete installation of Microsoft Office 2010 on all computers.

Upgrade servers to Windows Server 2012 and research Windows 8 implementation.

Implement new patch management system.

Continue to replace NCRPIS workstations on an as needed basis (targeting a 3-5 year lifespan for daily use workstations).

Identify and surplus excess hardware.

GRIN-Global:
The GRIN-Global project is a joint partnership between USDA-ARS NPGS, the Global Crop Diversity Trust, and Bioversity International. The goal of the project is to redevelop the current GRIN Germplasm Management System in such a way that it can be deployed on any size computer with a minimum amount of effort and cost. The new germplasm management system (dubbed GRIN-Global) will support five different languages, four database systems and install on a single desktop computer. In 2012 the NCRPIS team enhanced the curator desktop applications (Curator Tool) for easier data searching and faster viewing and editing of accession data; provided enhancements to the database schema to support requests from the test user community; and enhanced the search engine and web services (middle tier) for improved speed and reliability.

C. Information Management-Germplasm Collections (R. Stebbins)

Acquisition:
The North Central Regional Plant Introduction Station (NCRPIS) acquired 482 new accessions in 2012. Of these new accessions, 425 were received from within the National Plant Germplasm System (NPGS) through exploration and transfer. This included 189 accessions from the Seeds of Success program, 93 accessions of *Daucus* collected by Philipp Simon, and 33 accessions of wild *Helianthus* from collection trips conducted by NCRPIS personnel.

The remaining 57 accessions received from outside the NPGS included 16 accessions of *Thlaspi* from Canada and 14 accessions of *Zea mays* subsp. *mays* from the Germplasm Enhancement of Maize project.

As new accessions are recorded in the Germplasm Resources Information Network (GRIN) database, we include as much passport information as possible. Typical passport information would include a source history, cooperator records, collection-site description and geographic coordinates for wild collections, pedigree, secondary identifiers, and any other pertinent information provided by the donor.

Maintenance:
Curatorial assistance was provided by processing requests for taxonomic re-identifications and nominations of accessions to the inactive file. In total, 41 accessions received taxonomic re-identifications. Among these were 10 accessions of *Echinochloa*. Also, 67 accessions were nominated for inactivation, including 47 accessions of woody species. 8 accessions of *Amaranthus* and 1 accession of *Celosia* were inactivated due to duplication. The inventory lots of these accessions were integrated together with lots of their respective duplicates.

Additionally, 448 accessions were assigned PI numbers. Included in this group were 214 accessions of *Helianthus*, 91 accessions of medicinal crops, and 68 accessions of *Chenopodium*.

Projects:
In October, I ended the last year of a second two-year term on the Ames Area Civil Rights Advisory Committee (AACRAC). The primary role of this committee is to promote general awareness of civil rights issues and foster opportunities for career development of minorities in agriculture. The committee holds monthly meetings and organizes activities to coincide with nationally recognized observances.

I also completed my third year of a three-year term on the Midwest Area Equal Opportunity Advisory Committee. The committee is sponsored by the Area Director. Committee members play three roles: 1) providing location perspectives to the committee on outreach, partnerships, special-emphasis programs, etc., 2) serving as a location liaison to/from the Area Office to help initiate/coordinate outreach related items at the location, and 3) being a location contact and resource.

Conclusions:
Compared to 2011, new accessions received at NCRPIS were 18 fewer than in 2012. Among the maintenance areas, 10 fewer re-identifications were made,62 fewer nominations to the inactive file, PI-number assignments were 240 higher, and 24 fewer duplications were resolved than in the previous year. The number of new accessions acquired and the totals for re-identifications and nominations to the inactive file were below their 17-year averages. Resolved duplications were also below its 14-year average. PI-number assignments were above the 17-year average.

D. Order processing (R. Stebbins)

During 2012, 2,213 orders were entered into GRIN, the highest number of orders ever initiated in one year. These orders led to the external distribution of 45,115 items (primarily seed packets, but also vegetative samples) (Table 3A-1). Of these, 26,350 items (58%) were distributed within the United States, and 18,765 (42%) were sent to foreign requestors. Additionally, 3,746 items were distributed within the NCRPIS, for such uses as regeneration, evaluation, and germination and disease testing.

The number of orders entered into GRIN in 2012 was 178 more than that of 2011 (a new record for the NCRPIS); moreover, the number of items distributed was up by 4,685. The number of requests received electronically this year was 1,960, an increase of 250 from 2011.

E. Seed Storage (L. Burke, L. Pfiffner)

Two full-time, permanent federal employees (Lisa Burke and Lisa Pfiffner), and one part-time student staffed the seed storage area. Lisa Pfiffner continued to serve as the federal supervisor for several of the crews led by state employees.

In 2012, we stored 1726 inventory lots, including 823 original seed lots. Of the original lots stored, 205 were *Fraxinus*, along with 212 *Zea*, and 87 *Helianthus*. Of the increase lots, 692 Ames increases and 211 non-Ames increases were stored. During storage, 112 lots were bulked with previously regenerated samples to create 52 new bulked lots, all of which became available for distribution. Of all stored lots, 709 lots had sufficient seed quantities to be made available for distribution. We split 84 original lots to make them available for distribution in limited quantities. We reviewed 2649 inventory lots for seed quantity, and any discrepancies were corrected in the GRIN database. Five hundred six samples were prepared and transferred to a -20C freezer for long-term storage.

We filled 1775 seed orders in 2012, including those for distribution, observation, germination, transfer and backup. NCRPIS distributed 46,999 packets (the majority filled by seed storage personnel) to meet distribution and observation requests. Two large orders for the Ames maize inbred panel (2423 inventory lots) were filled simultaneously in April in four days. One large order shipped to Pakistan for 1501 cultivated flax was filled in May. An order for 1977 cultivated sunflowers was shipped

to Brazil in February. Seven orders totaling 5359 items were shipped to South Korea. There were 367 lots sent to the National Center for Genetic Resources Preservation (NCGRP) for backup, involving both accessions new to NCGRP and supplemental lots for previously supplied accessions. We transferred 14 inventory lots to other NPGS sites. 24 germination orders were filled, involving 596 lots.

2012 saw the continuation of the prepacking program. With the aid of our student worker, we prepacked 42,803 packets of 2,949 inventory lots. All the maize inbreds that were not already prepacked or filled by scoop were prepacked.

NCRPIS continued to participate in sending seed to the Svalbard Global Seed Vault in 2012, by preparing 560 accessions for backup there. Sample amounts ranged from 200 to 800 seeds depending on the amount of seed needed for two regenerations. For tracking purposes, an inventory action code (SVALBARD) was added to all lots shipped. Packets were filled and orders sent to NCGRP for repackaging and consolidated shipment to Svalbard.

Seed storage personnel continued to maintain the germplasm distribution display in the farm headquarters hallway. New maps were printed at the start of 2012, and destinations for both domestic and international shipments were marked.

Scanning of original seed samples continues. In 2012, 426 scans were taken, mostly of original samples. Some imaged samples were new to the station while others were being pulled for regeneration when the entire sample was needed. Creating a visual reference of seed lots that have been used up for planting is an important tool to allow future comparisons with the increase lots by curators and storage personnel.

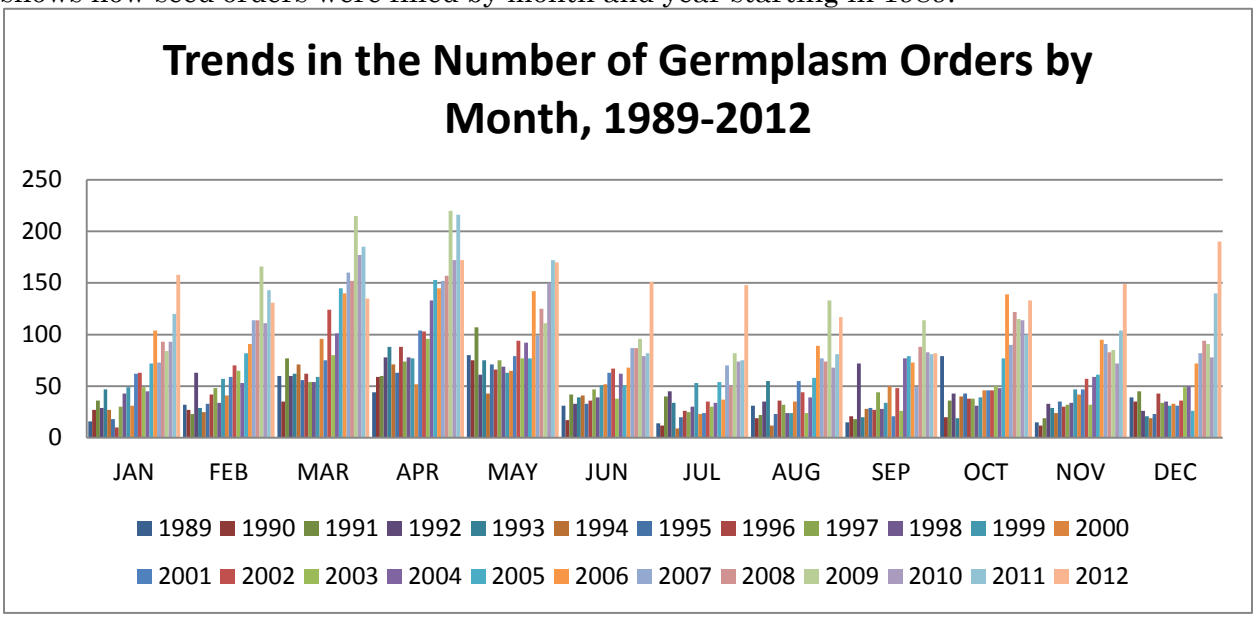
Lisa Burke continued to participate in the development of GRIN Global. In September she traveled to The National Center for Genetic Resources Preservation for five days to work with NCGRP staff on GRIN Global needs.

Lisa Pfiffner continues to work on her studies in Purity Analysis as the primary staff member working with new original seed samples, thus familiarizing herself with many types of seeds and potential contaminants

With the departure of Maria Erickson, the station's germination technician, Lisa Pfiffner has assumed responsibility for aspects of the seed germination program. She handles testing of newly regenerated seed lots and special testing for regeneration purposes. Both activities are key in storing regeneration seed lots and aiding curators in regenerating seed lots.

Lisa Burke continued as the station's CPR/AED/First Aid instructor. She provided three-year First Aid certification for 24 NCRPIS student workers and two-year CPR/AED/First Aid certification for 6 staff members. Included in the First Aid classes were two interns and two student workers from campus. Each session was entered into the National Safety Council database and certificates of completion provided for each participant. Cooperative work with campus staff on improving the CPR/AED/First Aid training was continued.

Chart1: Over time the dynamics of when seed orders are received and filled has changed. What used to be a seasonal pattern has evolved into a year round demand. This graphic shows how seed orders were filled by month and year starting in 1989.



VII. CURATORIAL AND SCIENTIFIC TEAM REPORTS

A. Controlled Insect Pollination Service Program (S. Hanlin)

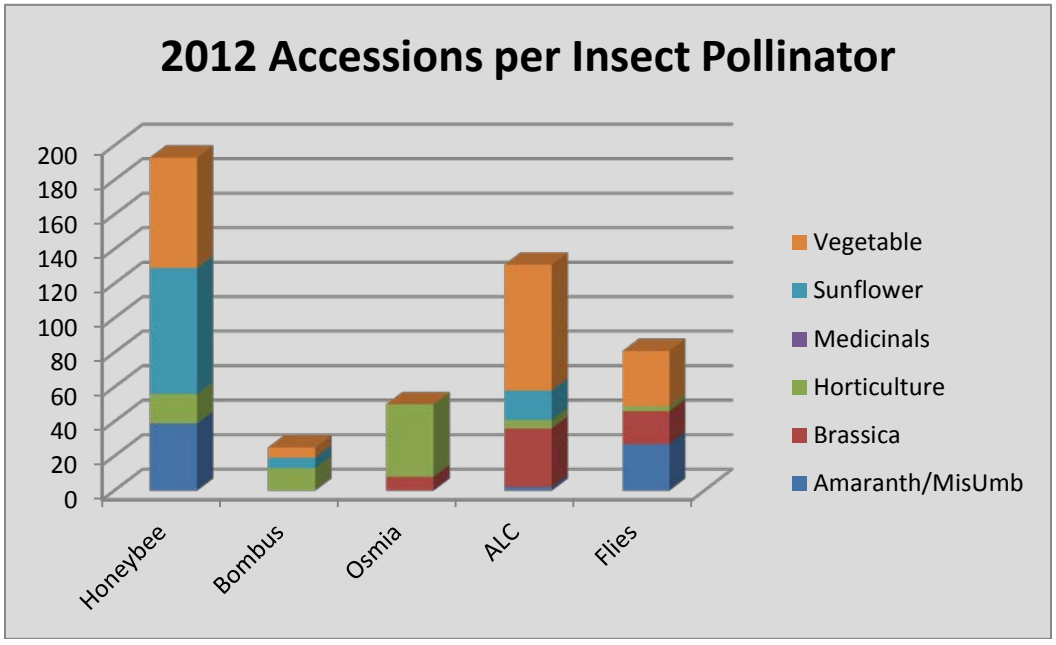
Summary of Pollinators supplied to 2012 regeneration cages

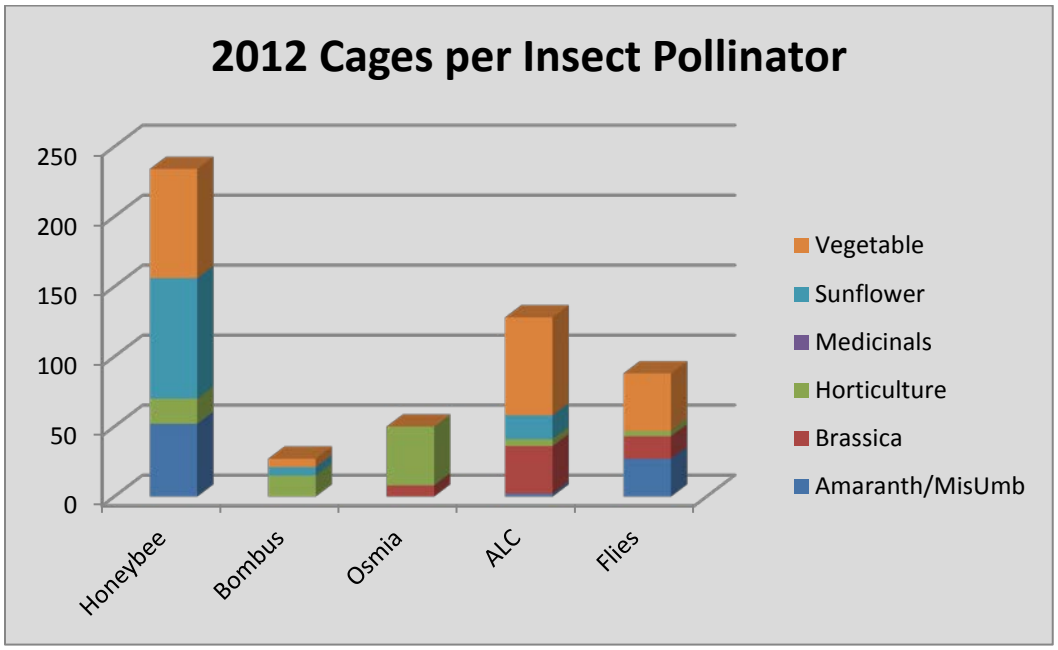
Number of Unique ACCESSIONS per pollinator

	Honeybee	Bombus	Osmia	Flies	ALC	TOTAL
Amaranth/MisUmb	39	0	0	27	2	68
Brassica	0	0	8	19	34	61
Horticulture	17	13	42	3	5	80
Medicinals	0	0	0	0	0	0
Sunflower	73	6	0	0	17	96
Vegetable	64	6	0	32	73	175
OVERALL	193	25	50	81	131	480

Number of TOTAL CAGES per pollinator

	Honeybee	Bombus	Osmia	Flies	ALC	TOTAL
Amaranth/MisUmb	52	0	0	27	2	81
Brassica	0	0	8	16	34	58
Horticulture	18	15	42	4	5	84
Medicinals	0	0	0	0	0	0
Sunflower	86	6	0	0	17	109
Vegetable	78	6	0	41	70	195
OVERALL	234	27	50	88	128	527





Progress:

Caged pollination:

Bee pollinators (minus the alfalfa leafcutting bee) were supplied a single time to 311 cages for controlled pollination of 268 accessions. Alfalfa leafcutting bee and fly-pollinated cages are tabulated and reported separately due to multiple distributions of those insects to the same cages over the pollination season.

Honey bee pollination:

Honey bees were used to pollinate 193 accessions in the field.

2012 Honeybee Pollinator Deliveries to Regeneration Cages

Crop Group	Total # of Accessions	# of Genera	# Accessions/Genera
Oilseeds	73	1	73 *Helianthus*
Horticulture/ Medicinals	17/0	9	4 *Cornus,* 4 *Staphylea*, 2 *Ligustrum*, 2 *Physocarpus,* 1 *Ampelopsis,* 1 *Baptisia,* 1 *Blephilia,* 1 *Cercis*, 1 *Euonymus*
Vegetable	64	4	38 *Cucumis*, 14 *Daucus*, 11 *Cucurbita,* 1 *Ocimum*
Misc.Umbels	39	10	15 *Melilotus*, 8 *Coriandrum,* 5 *Foeniculum,* 2 *Ammi*, 2 *Orlaya,* 2 *Petroselinum*, 2 P*impinella,* 1 *Achyranthes,* 1 *Anethum,* 1 *Eryngium,*
Total	**193**	**24**	

Overwintering success: 100% of the 25 three story parent colonies, 73% of the 62 two story parent colonies and 26% of the 72 double-story and 2 single-story nucleus colonies stored in the 2011 indoor wintering facility survived, comparable to the 33% (outdoor wrapping), 55% and 7% from 2010.

No colonies were left outside during the winter 2011, all colonies and nucleus hives were placed into the over-wintering room. We removed all colonies and nucs from the overwintering facility starting on March 1, 2012. In the winter of 2012, we placed in the overwintering facility 57 three story parent colonies, 32 two story parent colonies and 121 double story nucleus hives,.

We purchased 20 "Buckfast" 3-pound packages to supplement over-winter losses and 50 "Buckfast" queens to supply spring nucs used for cage pollinations. The packages were placed into full size hives and given three feedings of high fructose corn syrup and one pollen treatment. The queens were placed into nucleus boxes with two frames of brood and three frames of adhering bees.

In mid-April we selected queens from resilient, over-wintered parent colonies to produce queens for nucleus hives during summer 2012 and set them up in cell builder colonies. Queen rearing throughout the summer of 2012 produced an average of 45 queens per week. Nucleus hives were produced until late July; nucs not used in cages for pollination were fed, an additional super placed on top and strengthened for over-wintering.

In July, all strong double and single story nucleus hives were made into colonies. The hive transfer was done earlier than in past summers because of a reduction in pollination needs. All medium-strength single story nucleus hives containing three to four frames of bees had an additional super placed on top to prepare them for over-wintering. Many of the parent colonies contained a higher than normal number of frames of bees and honey in late fall and could not be reduced to two story hives and were over-wintered in 2012 as three story colonies.

In June, 25% of the parent colonies were sampled for varroa mites using "sticky boards" with a HopGuard® treatment (see ARS Photo by Scott Bauer). There was an average of 9 mites per board, which is lower than documented economic threshold of 30 mites. In August, 50% of all hives in the field were sampled using the powdered sugar roll method. Mite counts were comparable to results found in June with an average of 10 mites per 100 bees. Because no mite treatment has been applied for the past two years, all hives were treated twice in a six week period using the mite control HopGuard®.

All parent colonies and nucleus hives were given two treatments of Fumagilin – B® in March 2012 for the prevention of dysentery (nosema). In September/October, all hives being prepared for over-wintering were given four medicated feedings of Fumagilin – B®. In May all hives received two spring treatments of Tylan for prevention of American Foul Brood (AFB). There was no sign of AFB during the summer, so no fall treatment was given.

For wax moth control during the summer, supers with frames were stacked at right angles to each other or separated by single sheets of newspaper to prevent adult moth migration. Starting in June, the lights in the equipment room were left on during working hours (8 hours/day) and three "fermentation traps" were placed around the stacks of frames. The traps consisted of plastic gallon container with a mixture of water, sugar, vinegar, and a banana peel. In July, adult moths were observed flying around lights and pupa were found in several supers. In years past, these non-chemical control methods kept the moths at low populations. However, during the summer of 2012 these methods appeared to have limited control of wax moth and approximately 20 supers of comb were damaged. In winter, temperatures in the unheated storage room limit serious moth problems.

We continue to use our syrup feeding system of a 1,050 gallon polypropylene tank, a 30 gallon poly "mixing" tank and a dish washer for cleaning feeding containers. To prevent crystallizing of the high fructose corn syrup (HFCS) in the large interior storage tank, the contents were circulated for at least five minutes daily. Additional HFCS was purchased to supplement feeding of bees during the summer and into the spring of 2013.

All bee locations were re-registered with the Iowa Department of Agriculture and Land Stewardship (IDALS). The IDALS registry assists pesticide applicators in locating bee-yards and in obtaining contact information of appropriate beekeepers prior to spraying. Two private land owners and a USDA location were eliminated from use in 2012, with no new locations added.

Bombus pollination:
Fifteen "mini-research" colonies of *Bombus impatiens* were purchased from a commercial supplier and used to pollinate 27 field cages with 25 accessions. A single *Bombus* hive can be used for pollinating more than one cage with a minimum lapse of 48 hours between sites to prevent pollen contamination.

2012 *Bombus* Pollinator Deliveries to Regeneration Cages

Crop Group	Total # of Accessions	# of Genera	# Accessions/Genera
Horticulture/ Medicinals	13/0	2	12 *Baptisia*, 1 *Ampelopsis*
Vegetable	6	2	5 *Cucurbita* (2 hives/cage), 1 *Cucumis*
Oilseeds	6	1	1 *Helianthus*
Total	**25**	**5**	

We continued to use 60-quart protective plastic containers to house the cardboard *Bombus* hives while in field cages. The plastic container and hive are placed on a honey bee hive body and lid for a stand and have two water-filled quart containers as weights to prevent the wind from blowing the container and hive off of the stand.

Osmia cornifrons/*O. lignaria* pollination:
Osmia were used to pollinate a total of 45 field cages with 45 accessions.

2012 *Osmia* Bee Pollinator Deliveries to Regeneration Cages

Crop Group	# of Cages	Total # of Accessions	# of Genera	# Accessions/ Genera
Brassica/ Oilseeds	3/0	3	1	3 *Brassica*
Horticulture/ Medicinals	42/0	42	3	39 *Aronia*, 2 *Staphylea*, 1 *Cercis*
Total	**45/0**	**45**	**4**	

In the 2011 growing season, we obtained an increase of ca. 2113 *Osmia* pupae which could be used for pollination and increase during the 2012 pollination season. We were unable to purchase commercial cells in the spring to supplement our increases.

The 2113 pupae were used to fill 76 two-inch domiciles; of these, 45 were used in pollination cages and 31 were used at "increase" sites.

We collected ca. 18 pupae from domiciles in 2012 for use in the spring of 2013. The obtained pupae population will be inadequate for cage requests in 2013 and we will need to purchase extra pupae for use in pollination cages.

Through the use of a GPS unit and Google-Earth, we tracked and plotted all "increase" domicile locations for retrieval later in the summer.

Alfalfa leafcutting bee (ALC) *Megachile rotundata*:

ALC bees were purchased as larvae in leaf cells from a single supplier for use in 2012, arriving in Ames, IA on December 8, 2011. The bee cells were held in refrigerated storage until scheduled for placement in warm incubation and bee emergence boxes. Bees were available weekly throughout the year for use in plant regeneration cages in the field and greenhouse from early November 2011 through the end of December 2012.

In 2012, 1276 total ALC deliveries were made to a total of eight fields and three greenhouses with 121 cages containing 131 accessions. Five greenhouse cages of *Cuccumis* and *Daucus* and one cage of *Erysimum* are still undergoing pollination at the transition from 2012 into 2013.

2012 Alfalfa Leafcutter Pollinator Deliveries to Regeneration Cages

Crop Group	# of Deliveries	# of Cages	# of Locations	# of Accessions	# of Genera	Time Period
Brassica-Oilseeds	244	27	3	34	6	Feb. – Dec.
Horticulture	94	5	2	5	2	Nov. – Sept.
Sunflower	27	17	2	17	1	Sept. – Oct.
Misc.Umbels	14	2	1	2	1	March – May
Vegetables	897	70	5	73	3	Jan. – Dec.
Total	**1276**	**121**	**13**	**131**	**13**	**Jan – Dec.**

Numbers of active ALC-supplied cages and frequency of bee delivery vary seasonally and by cage structure/location and individual accession characteristics. In normal pollination situations, ALC bees/cells are only provided to crops in the summertime. However at the station, ALC are used outside of the normal time frame. From January through August, greenhouse cages were supplied weekly with bees. 2012 field requests for ALC bees started in mid-May and the number of weekly active cage increased rapidly through late August.

In 2011 we received Canadian sourced cells, which have fewer parasites and parasitoids than found in domestic cells. Based on the need for additional storage trays and refrigerated storage, the supplier did ship an additional amount of pupae for pollination use.

Field cage requests ended by Mid-September; however bees where continued to be emergenced and placed into field cages of *Helianthus* into mid- October.

Flies (Blue Bottle Flies and Houseflies):

Fly pupae of two species (Calliphoridae and *Musca domestica*) were purchased from two suppliers and incubated for weekly use from November 2011 through December 2012 for caged plant pollinations in the greenhouse and field. In 2012, 835 fly deliveries were made to five fields and three greenhouses with 88 cages containing 81accessions representing 21 genera.

An average of 15 greenhouse cages received flies weekly from November 2011 through the end of October 2012.

Two greenhouse vegetables cages, and single greenhouse cages of *Erysimum* and miscellaneous umbels were being pollinated at the end of 2012 into 2013.

2012 Fly Pollinator Deliveries to Regeneration Cages

Crop Group	# of Deliveries	# of Cages	# of Locations	# of Accessions	# of Genera	Time Period
Brassica/Oilseeds	135	16	3	19	6	March. – Oct.
Horticulture	26	4	2	3	3	Nov. – May
Misc. Umbels	169	27	2	27	11	March – Sept.
Vegetables	505	41	3	32	1	Jan. – Dec.
Total	**835**	**88**	**10**	**81**	**21**	**Jan. – Dec.**

Only blue bottle flies were distributed weekly in winter and spring greenhouse cages due to blue bottle flies working at cooler temperatures and a large number of cage requests in the cooler greenhouse. Both blue bottle flies and houseflies were distributed weekly to summer field cages. Re-supplying flies weekly to cages ensures continued pollinator presence. If appropriate and available, bee pollinators may be present in the same cages receiving flies.

Tests (Hanlin):

Daucus observation plot study:

In 2011, several varieties of domiciles were placed into an observation plot of *Daucus* and the plot and domiciles were observed daily for activity by entomology staff. In 2012, because of disease reduction of plants and few pollinators being observed by vegetable curatorial staff, no observations were made of the Daucus plot by entomology staff.

Wax moth control in stored honey bee supers:

During the winter supers of frames were stacked as in 2010/2011 either separated by newspaper or at right angles. Fermentation traps were placed at several locations near the stacks of supers in early June and in mid-June the lights were left on during the working hours five days a week. In July, adult moths were observed around the top of stacks of supers and webbing with larva was found on frames in several supers. In order to control further spread of moths, the worst frames were discarded immediately and all partially damaged frames were placed into hives for cleanup and control as they were found. The non-chemical control methods used successfully in the past two years did not work as well in 2012, however, we will continue using these methods because of the reduced chemical hazards to humans and honey bees.

With the retirement of S. McClurg from the USDA; ARS, S. Hanlin took over the emerging and distribution of ALC and flies in addition to the duties caring for and distributing honey bee, *Bombus* and *osmia* bees. S. Hanlin assist curatorial staff with Pocket Pollinator issues which occurred including setting up 2012 imbedded workbooks for several curators.

Safety:

Chemical Inventory:

In January, S. Hanlin updated the Entomology chemical inventory including obtaining updated MSDS for new chemicals.

Presentations and Outreach:
On March 20, S. Hanlin acted as liaison between L. Marek (oilseed curator) and L. Mora (California beekeeper) to discuss methods of improving the quality of honey bees and sunflower pollination at the Parlier, CA regeneration site.

On May 9, S. Hanlin and K. Tow (Biological Science Aid) spoke to approximately 147 sixth grade students on honey bees and beekeeping at the Squirrel Hollow Outdoor Classroom held in Jefferson IA.

In June, S. Hanlin hosted the station interns (K. Kupa and T. Stone) for a week, teaching them queen grafting, nucleus hive construction, pollinator introduction and data collection using Pocket Pollinator.

On June 27 & 28, S. Hanlin, K. Tow (biological Science Aid) and D. Helm (biological Science Aid) assisted with the "4-H Youth Conference Workshop", hosting two groups of approximately 16 participants and providing them the opportunity to work with a nucleus hive of honey bees and learn about the pollinators used at the station.

On July 25, S. Hanlin spoke at Des Moines Area Community College (DMACC-Boone) to 23 Jr. High journalism class students about honey bees and beekeeping. Several of the students interviewed S. Hanlin for a final class project in which an article was written for a class produced newspaper.

S. Hanlin provided honey bees, ALC and assistance to R. Palmer (USDA-retired), M. Vangorp and B. Smith (student summer assistants) throughout the summer for a "honey bee proboscis reflex tests" for which honey bees and ALC were tested on attraction training to male sterile lines of soybeans.

In the spring of 2012, S. Hanlin loaned two ALC domiciles to E. Hellweg (high school student) for a "summer soybean cage comparison study". S. Hanlin also assisted E. Hellweg in ordering bees and with ALC guidance for his experiment.

Plans for 2013:
Daucus observation plot:
S. Hanlin will continue making solitary bee observations in the *Daucus* observation plot. Domiciles will not be placed in the field this year unless solitary bees are observed pollinating umbel flowers. Observations will be made several times a week rather than daily unless vegetable curatorial staff reports bee sightings or entomology staff begins to observe increase populations of bees.

Redesigned ALC domiciles:
During the winter, all cardboard wedges holding Styrofoam nest inserts will be replaced with a wood block attached to the domicile. S. Hanlin and crew will test if this redesign makes the nest inserts more secure in the domiciles and are not blown out by winds during the 2013 summer cage pollinations.

Test screen bottom boards for mite control:
A non-chemical control for varroa mites is to place a hive on top of a bottom board in which the majority of the bottom is "open" with only a piece of 1/8" screen being the

bottom rather than solid boards. The control of mites occurs when the mites become detached from adult bees and fall to the bottom; they fall through the screen and are not able to reattach and expire. A comparison will be done using the 20 screen bottom boards and an additional 6 screen sampling bottom boards, compared to the remaining colonies which are placed on traditional solid bottom boards. Mite sampling will be done using both the sticky board method and the powdered sugar roll method.

B. Plant Pathology (C. Block, B. Van Roekel)

Disease Resistance Evaluations:

Sclerotinia wilt resistance in wild sunflower (Helianthus):

We conducted greenhouse evaluations of wild perennial sunflowers for Sclerotinia stalk rot resistance, caused by *Sclerotinia sclerotiorum*, with co-investigators Dr. Thomas Gulya (USDA-ARS, Fargo, ND) and Dr. Laura Marek (NCRPIS). Plants were tested in the greenhouse under high disease pressure, with the goal of identifying accessions that showed significantly better survival percentages than the most resistant hybrid check, Croplan 305. In 2012, six perennial species were evaluated, including *Helianthus decapetalus*, *H. giganteus*, *H. maximiliani*, *H. nuttallii*, *H. simulans*, and *H. verticillatus*. All of the perennial species showed remarkable resistance. Sixty percent plant survival is viewed as a general indicator of a high level of resistance. For *H. decapetalus*, 13 of 14 accessions had >90% plant survival and 10 had 100% survival. For *H. giganteus*, 14 of 17 accessions had > 90% plant survival and five had 100% survival. For *H. maximiliani*, 42 of 45 accessions had >90% plant survival and ten had 100% plant survival. For *H. nuttallii,* 34 of 39 accessions had >90% plant survival and 11 had 100% plant survival. For *H. simulans* (4 acc.), 3 of 4 accessions had >80 plant survival and the fourth had 100%. *Helianthus verticillatus* (2 acc.) had one accession at 77% survival and the other accession at 95%.

2012 Maize field plots:

Stewart's wilt (*Pantoea stewartii*) disease resistance evaluations were conducted on 250 maize inbreds, including 57 accessions re-tested from previous years, 59 untested GEM entries, 67 new Australian inbreds and 53 untested ex-PVPs. Accessions were rated on a 1-9 scale with 1.0 being nearly immune and 9.0 being highly susceptible. Disease development was excellent and we identified several highly-resistant accessions (Table 1). The most resistant accessions were two check inbreds, PI 558533 (Mo21R) and PI 601689 (WIL500). The most susceptible accession was a check inbred, Ames 20140 (Mt42) which rated 9.0.

Table 1. Stewart's wilt resistance of maize accessions rating ≤2.0 in 2012.

Entry	Alternate ID	Other notes	2012 SW average score (1-9 scale of R to S)
PI 558533	Mo21R; resistant check	Pedigree: H22 X Mo21A ^5 – resistant to northern corn leaf blight.	1.0
PI 601689	WIL500	Developed by Wilson Hybrids from tropical germplasm population.	1.0
Ames 30954	GEMN-0081	Pedigree: FS8B(T):N1802-382-001-B-B	1.4
Ames 31249	GEMS-0215	Pedigree: NS1:S08-6-1-2-B	1.7
PI 559936	PHBW8	Expired PVP- Pioneer Hi-Bred; resistant to Goss's wilt.	1.7
PI 559952	PHV53	Expired PVP- Pioneer Hi-Bred; resistant to Goss's wilt.	1.7
NSL 437923	AusTRCF 305849	Pedigree: {{{{{38-11(WX)xCJ(2)-sibbed (WX)}xMO17(2)}-sibbed (WX)>}xMO17(2)}-sibbed (WX)}xMO17(2)-(WX)	2.0

Disease observations on seed increase crops:
Plant health monitoring continued with field inspections of seed parent plants for maize (curation and GEM), sunflowers, and cucurbits:

Maize:
The pathology team inspected 170 seed increase plots (maize curation) for disease presence and severity. Plots were inspected for 12 diseases – gray leaf spot, Stewart's wilt, Goss's wilt, northern and southern corn leaf blight, eyespot, crazy top, common rust, common smut, head smut, sorghum downy mildew and wheat streak mosaic virus. Nine hundred and twenty pathogen records (field observations) were added to GRIN. Similarly, 740 entries of GEM lines were inspected for the same diseases. In terms of typical diseases of phytosanitary concern for export, none were found – no Stewart's wilt, Goss's wilt, crazy top or other downy mildew diseases, head smut, or southern corn leaf blight were observed.

Sunflower:
Multiple field inspections of sunflower were carried out for downy mildew, viruses, and phytoplasmas. No downy mildew (the main phytosanitary issue) was present and no unusual disease problems were noted.

Cucurbits:
The cucurbit transplants were monitored two times per week in the greenhouse for bacterial fruit blotch and none was found for the eighth consecutive year. One infected accession was later identified in the field and the plants were destroyed.
Routine disease testing for squash mosaic virus was conducted on all seedlings prior to transplanting. One hundred and one accessions with 3,034 plants were sampled. Four SqMV-infected plants were identified by ELISA from one *Cucurbita pepo* accession. These plants were eliminated before transplanting. This effort was

successful in keeping SqMV out of the field plantings. SqMV test results are summarized in Table 3.

Table 3: Squash mosaic virus testing results for 2012.

Species	Accessions tested	Accessions with infected plants	Plants tested	# of SqMV infected plants
Cucumis spp. (*melo, sativus)*	87	0	2563	0
Cucurbita pepo	14	1	471	4
Total	101	1	3034	4

Seed Health Testing/Seed Treatment:
We carry out a seed health testing and fungicide seed treatment program to support international seed shipments – 249 laboratory tests were run, 90% for maize and 10% on other crops. Between 700 and 1000 seed packets (sunflower plus maize) were treated with fungicides for international seed orders.

Laboratory research activities:
We continued a collaborative study with A. Robertson (ISU Plant Pathology Dept.) and L. Shepherd (ISU Seed Science Center) to look at Goss's wilt (*Clavibacter michiganensis* subsp. *nebraskensis*) seed infection and seed transmission. The increase in Goss's wilt incidence and severity since 2007 has raised questions as to the role of seed infection in disease spread. We found a significant difference in kernel infection on plants with 10% or more diseased leaf area as compared to plants with 5% or less diseased leaf area. The highest percentage of seed infection observed was 2%, from a plot with 100% diseased leaf area. No seed transmission was detected from this lot, but seed transmission is rare and larger sample sizes are needed to increase the chances for detection. Seed from heavily-infected field plots in 2012 has been harvested for additional seed transmission work in 2013.

We continued a project in collaboration with G. Munkvold and L. Shepherd (ISU Seed Science Center) to evaluate published PCR primer sets for specificity in detecting *Pantoea stewartii*. Isolated several additional *Pantoea* isolates (non-*stewartii*, non-pathogenic) from maize seed of tropical origin that gave false positives with both ELISA and PCR testing methods. Research is underway to characterize approximately 80 plant-associated Pantoea isolates (multiple species) via PCR reaction, biochemical tests, pathogenicity testing, and multi-locus DNA sequencing.

Publications:
Marek, L.F., C.C. Block, and C.A.C. Gardner. 2012. 2012 Update: New sunflower genetic resources in the U.S. national sunflower collection and potential use for crop improvement. Proc.18th Int'l Sunf. Conf., Feb. 27-Mar 1, 2012, Mar del Plata, Argentina. Online: www.asagir.org.ar/asagir2008/archivos_congreso/2012 Update New Sunflower Genetic Resources in the US National Sunflower Collection and Potential Use for Crop Improvement.doc.

Three book chapters were submitted for the 2nd edition of the *APS Manual on Detection of Plant Pathogenic Bacteria in Seed and Planting Material* are currently in review:
Shepherd, L.M. and C.C Block. 201X. Detection of *Pseudomonas savastanoi* pv. *glycinea* in soybean seeds.

Block, C.C., L.M. Shepherd and J.K. Pataky. 201X. Detection of *Pantoea stewartii* subsp. *stewartii* in maize seeds.

Shepherd, L.M., C.C Block, and A.K. Vidaver. 201X. Detection of *Clavibacter michiganensis* subsp. *nebraskensis* in maize seeds.

C. ***Amaranthus, Celosia, Chenopodium, Coronilla, Dalea, Echinochloa, Galega, Marina, Melilotus, Panicum, Perilla, Setaria, Spinacia* and miscellaneous Apiaceae and Poaceae (D. Brenner and S. Flomo)**

Acquisition and inactivation:
Twenty-three accessions were acquired (Table 1), including 1 *Amaranthus*, 7 *Apiaceae,* 2 Chenopodiaceae, 3 grasses, 1 legume, and 7 *Portulaca*.

A dwarf genetic stock amaranth with dark green wrinkled leaf blades (PI 666334) was selected from PI 619242 by David Brenner, and accessioned.

Seven Apiaceae were donated by Phil Simon and David Spooner from their plant exploration in Morocco. They include: One *Ammi* (Ames 31544), one *Smyrnium* (Ames 31618), and five unidentified Apiaceae (Ames 31619 to Ames 31623).

We added two of the obscure Chenopodiaceae genera needed for systematics research. Grace Kostel of Black Hills State University collected seeds of *Suckleya suckleyana* at the Belle Fourche Reservoir in South Dakota (PI 667181) and the accession is already regenerated. She also arranged for Mr. Nelson Winkle to collect and send us *Cycloloma atriplicifolium* (Ames 31625).

Three native grass accessions were transferred from Pullman, Washington, originating from the Bureau of Land Management, Millennium Seed Bank Project: one *Glyceria* (Ames 31334), and two species of *Tridens* (Ames 31469, and Ames 31470). One native legume, *Dalea mollis* (Ames 31414) was also accessioned from the same source.

The *Portulaca* collection was transferred here to the NCRPIS, from the Ornamental Plant Germplasm Center in Ohio. The collection is small, with only seven accessions. However *Portulaca* is a significant world vegetable with negligible germplasm collections world-wide. This goal is to facilitate development of the crop which has nutritional and horticultural advantages. We plan to eventually acquire the wild species of the United States so there will be more diversity in the collection for new research and development.

Maintenance and distribution:
The overall availability for these crops was unchanged from 2011 at 86%, although there were small deviations for many of the crops (Table 1). Five accessions were inactivated, two for in-viability and three for duplication. New PI numbers were assigned to 99 accessions; most of these are wild *Chenopodium* collected in the United States.

Improving passport data continued in 2012. Twenty-eight accession-actions were entered in GRIN to document passport additions and improvements. Fifty-seven secondary identifiers were entered in GRIN from old paper records. Samuel Flomo loaded 324 accession images into GRIN.

The number of accessions of these crops tested for germination (Table 2), 60 (1%) is less than are tested in most years. Numbers fluctuate depending on station priorities, labor availability, and scheduling variations.

We continue to receive requests for non-research seed uses. Most of these requests were refused and the requestors were referred to commercial sources.

Amaranthus:
In *Amaranthus*, the remaining Asian Vegetable Research Development Center numbers were entered from the handwritten Rodale Research Center's germplasm log-in book. This allowed three duplicate accessions to be merged after the duplication was confirmed by grow-outs.

Chenopodium:
A breeding project led by Kevin Murphy at Washington State University is using our quinoa germplasm. The project includes cooperation from Brigham Young University, Oregon State University, and Utah State University. The funding is from the USDA National Institute of Food and Agriculture. Washington State University will sponsor a research symposium in August to coincide with the 2013 United Nations International Year of Quinoa.

The quinoa crop is expanding world-wide and therefore generating orders for us. We had 84 Chenopodium order recipients in 2012 for a 357 accession collection, compared to 14 order recipients for the spinach collection which is a similar size.

Miscellaneous Legumes:
Two *Dalea* accessions were regenerated for us by the National Arid Land Plant Genetic Resources Unit in Parlier, California.

Melilotus:
Seventeen *Melilotus* accessions were harvested in 2012 and 33 accessions were planted in the Farm Greenhouse #2 in October 2012 for spring transplanting into the field. They will be pollinated with caged bees and harvested in mid-2013. We plan to store 77 seed lots from previous years in 2013.

In 2012 we increased the *Melilotus* plant populations per cage to take advantage of the new larger cages that are now standard. Previously we used two cages to accommodate populations of over 100 plants. The new cages accommodated populations of 130 plants each; with substantial savings of labor and field space.

Miscellaneous Apiaceae:
Our colleagues at the National Arid Land Plant Genetic resources Unit in Parlier, California regenerated four cumin accessions by seeding directly in field soil. We sent more seeds for an expanded planting in 2012-2013. Cumin is much better adapted as a winter-crop there than in the environments we have tried in Iowa.

Perilla:
The viability of four *Perilla* distribution seed lots deteriorated, and replacement lots were regenerated for storing in 2013. *Perilla* seeds generally have poor life spans in storage.

Spinacia and allied genera:
Seed lots of 30 accessions were delivered to us in March of 2012 by the seed regeneration cooperators in Salinas, California, Sakata Seed and the USDA-ARS. There was no California seed regeneration in 2012-2013 since the inventories are sufficiently up to date. We regenerated two accessions of wild *Spinacia* germplasm in greenhouses at the NCRPIS.

The root and stem of a wild spinach *Spinacia tetrandra* accession (Ames 26356) with seeds clustered at the soil level.

We regenerated a large seed lot of PI 173122, a landrace spinach from Turkey, in the field in Ames, Iowa. The intention is to have a large seed lot to distribute for generic purposes.

Characterization/evaluation/taxonomy:
Two new papers on the systematics of Chenopodiaceae were published, and resulted in changed generic names in our collection. Both papers are by Fuentes-Bazan, S. et al., published in 2012. Both of these papers cite our germplasm.

Bisexual Spinach:
A new descriptor on the frequency of bisexual spinach plants (MONOECIOUS) was installed in GRIN in cooperation with Beiquan Mou. It is populated with 129 observations taken during seed increases in Salinas. In addition to the frequency of monoecious plants I loaded the counts of male and female plants in a comment field, so the frequency information can be interpreted in the context of population size and gender ratios. Monoecious plants are useful because they can be self-pollinated to develop plant breeding lines that are somewhat homozygous.

Amaranth Photoperiod:
Three descriptors for amaranth photoperiod response were written, loaded into GRIN, and populated with data on ten accessions. The new descriptors: DAY-LONG, DAY-SHORT, and DAY-RESPON are in the amaranth phenology area. This progress was possible with the work of our Summer Intern, Tiffanie Stone, who studied plants in long-day and short-day growth chambers provided by the USDA-ARS National Laboratory for Agriculture and the Environment. The long-term goal is to identify day-length neutral germplasm, for use in production agriculture.

Most amaranth accessions flower more quickly in short day lengths than in long day lengths.

Millets:
In early 2012 a comparative grow-out of 177 millet seed lots from 38 accessions was used to investigate "problem" seed lots increased at our station in the 1980s. The problem is that we have two dissimilar original seed lots for PI numbers, resulting in dissimilar lineages within accessions. In most cases we determined which seed lots were unlike our best original seed, and recorded notes in the inventory comment field of GRIN. However these dissimilar lineages have histories in millet breeding at the University of Nebraska's Panhandle Station, and are the source of the important modern commercial cultivars. The long term resolution may be assignment of new PI numbers for the Nebraska sourced material to maintain them separately from the original PI numbers. The passport data for the millet collection was improved by entering in GRIN the remaining IPM (from ICRISAT) numbers written on seed packets received from Nebraska in the1980's. These IPM numbers will allow comparisons with Nebraska research publications published in the 1970s.

Taxonomy:
In 2012, David Brenner made 20 taxonomic re-identifications, involving nine different genera. In addition, three existing taxonomic determinations were confirmed with entries in GRIN's annotation area.

We are cooperating with K. Reitsma of the Vegetable Project, and Dr. David Spooner of the USDA-ARS in Wisconsin on a revision of the genera related to *Daucus*. Many of our minor Apiaceae genera are involved in this study.

Tordylium trachycarpum (Ames 25716) is one of the taxa in the miscellaneous Apiaceae that has seed heads similar to those of *Daucus*.

Enhancement and/or utilization:
A set of nine spinach downy-mildew disease differential accessions are available on GRIN. The seed lots were provided by Naktuinbouw (Netherlands Inspection Service for Horticulture) and Lindsey du Toit of Washington State University, as part of a project led by Gary Pederson at the USDA-ARS Plant Introduction Station in Griffin, Georgia. This is part of an initiative to establish a set of host plant differential standards for use in determination of races of the pathogen. Each differential (host plant) is susceptible to different pathogen races; when the differentials are exposed to an isolate of unknown race, the pattern of susceptible and non-susceptible host reactions is used to determine the isolate's race, or indicate if it is an unknown.

Publications and presentations:
David Brenner taught classes about seed saving in the Yucatan peninsula of Mexico on a Farmer to Farmer project sponsored by US-Agency for International Development; and hosted by the Escuela de Agricultura Ecologica U Yits Ka' an, of Mani, Yucatan. The assignment was 16 days long, from November 26 to December 11. David taught three workshops about seed cleaning, drying, and storage. The training was requested mostly because vegetable growers in Yucatan are unable to save seeds of radishes and some other introduced vegetables, since their environment does not provide sufficient chilling to induce flowering. David diagnosed the problem as lack of

a chilling period and proposed introducing tropically adapted germplasm from southern Asia that does not have a chill requirement for flowering.

Seed-saving students in Yucatan, Mexico, at one of the workshops led by David Brenner (wearing a red shirt).

Crop Germplasm Committee reports:
Written progress reports were prepared for the Clover and Special Purpose Legumes, Forage and Turf Grass, Leafy Vegetable, and New Crops Crop Germplasm Committees (CGCs). Additionally David was the recording secretary for both the grass and clover CGCs. There is discussion about potentially merging the clover and grass CGCs or to meet back to back to reduce duplication of presentations. Membership of both committees has shrunken recently.

Manuscript Reviews:
David Brenner reviewed six scientific journal articles and project proposals for external organizations.

Grin-Global development:
David Brenner and Samuel Flomo participated in the winter 2012 GRIN-Global webinar series and made suggestions for enhancements.

Some research publications derived from use of our germplasm or associated information:
Bennetzen, J.L., J. Schmutz, H.Wang, R. Percifield, J. Hawkins, A.C. Pontaroli, M. Estep, L. Feng, J.N. Vaughn, J. Grimwood, J. Jenkins, K. Barry, E. Lindquist, U. Hellsten, S. Deshpande, X. Wang, X. Wu, T. Mitros, J. Triplett, X. Yang, C. Ye, M. Mauro-Herrera, L Wang, P. Li, M. Sharma, P. C. Ronald, O. Panaud, E.A. Kellogg, T.P. Brutnell, A.N. Doust, G.A. Tuskan, D. Rokhsar, and K.M. Devos. 2012. Reference genome sequence of the model plant *Setaria.* Nature Biotechnology 30:549-554.

Dwivedi, S., H. Upadhyaya, S. Senthilvel, C. Hash, K. Fukunaga, X. Diao, D. Santra, and D. Baltensperger. 2012. Millets: Genetic and genomic resources. Plant Breeding Reviews 35:247-401.

Fuentes-Bazan, S., P. Uotila, and T. Borsch. 2012. A novel phylogeny-based generic classification for *Chenopodium* sensu lato, and a tribal rearrangement of *Chenopodioideae* (*Chenopodiaceae*). Wildenowia 42:5-24.

Fuentes-Bazan, S., G. Mansion, and T. Borsch. 2012. Towards a species level tree of the globally diverse genus *Chenopodium* (Chenopodiaceae). Molecular Phylogenetics and Evolution 62:359-374.

Gaines, T.A., S.M. Ward, B. Bukun, C. Preston, J.E. Leach, P. Westra 2012 Interspecific hybridization transfers a previously unknown glyphosate resistance mechanism in *Amaranthus* species. Evolutionary Applications 5:29-38.

Kolano, B., H. Tomczak, R. Molewska, R.N. Jellen, and J. Maluszynska. 2012. Distribution of 5S and 35S rRNA gene sites in 34 *Chenopodium* species (Amaranthaceae). Botanical Journal of the Linnean Society 170:220-231.

Li, Ning Yu, Cing Lin Fu, Ping Zhuang, Bing Guo, Bi Zou and Zhi An Li 2012. Effect of fertilizers on CD uptake of Amaranthus hypochondriacus a high biomass, fast growing and easily cultivated Cd hyperaccumulator. International Journal of Phytoremediation.

Villarroel-Zeballos, M., L.J. du Toit, J.C. Correll. 2012 Screening for resistance to verticillium wilt in spinach and isolation of *Verticillium dahlia* from seed of spinach accessions. HortScience 47:1297-1303.

Research indirectly related to our germplasm:

Caselato-Sousa, V.M., and Jaime Amaya-Farfan. 2012 State of knowledge on amaranth grain: A comprehensive review. Journal of Food Science 77(4):R93-R104.

Liu, J., A.S. Davis and P.J. Tranel 2012 Pollen biology and dispersal dynamics in waterhemp (Amaranthus tuberculatus). Weed Science 60:416-422.

Riar, D.S., J.K. Norsworthy. J.A. Bond, M.T. Bararpour, M.J. Wilson, and R.C. Scott. 2012. Resistance of Echinochloa crus-galli populations to acetolactate synthase-inhibiting herbicides. International Journal of Agronomy doi:10.115/2012/893953.

Yerka, M.K., N. De Leon, and D. Stoltenberg. 2012. Pollen-mediated gene flow in common lambsquarters (*Chenopodium album*). Weed Science 60:600-606.

Plans for 2013:

A grant proposal titled “Plant Exploration in Nevada for Wild Relatives of Spinach” was written by David Brenner and is funded for a June of 2013 collecting trip.

The United Nations has declared 2013 as the International Year of Quinoa (A/RES/66/221). We will participate by distributing information about the event and perhaps also in a more active way.

We plan to expand the search for day-length neutrality in *Amaranthus* with an early August field planting. In August the day-lengths are short enough for most amaranths go into flower quickly as small short and useless plants. But if some grow to full size, it will indicate day-length neutrality.

The 2011 planting for observation of the *Amaranthus tricolor* collection was a successful way to resolve many issues of duplication, characterization, and taxonomy. A similar planting of the African Vegetable Type *Amaranthus cruentus* collection should be done for the same purposes.

D. Horticulture (D. Barney, J. Carstens)

2012 was a period of restructuring and consolidation of the NCRPIS Horticulture program, following the retirement of Mark Widrlechner in September 2011 and the departure of NC7 Medicinals curator, Luping Qu in mid-summer 2011. Danny L. Barney, Ph.D. transferred into NCRPIS to fill Mark Widrlechner's horticulturist and curator positions on June 18, 2012. Dan had been horticulturist and curator at the USDA-ARS Arctic and Subarctic Plant Gene Bank in Palmer Alaska from 2010-2012. He transferred when ARS closed all ARS facilities in Alaska. Previously, he had been professor of horticulture at the University of Idaho and superintendent of the UI Sandpoint Research & Extension Center from 1988-2010.

Genera within the previous NC7 Ornamentals collection were split into woody landscape versus herbaceous plants for purposes of curation. Jeff Carstens assumed the position of curator of the NC7 woody landscape plant collection (trees and shrubs). Dan Barney assumed the position of curator of the NC7 medicinals, NC7 mints, and NC7 ornamentals (herbaceous).

Acquisition:
During 2012, we added 168 accessions to the horticulture collections. Of those, 91 accessions were woody-landscape accessions. Some of the significant woody-landscape accessions included samples of *Fraxinus quadrangulata* (14 accessions) collected in Iowa, Illinois, and Indiana by Jeffrey D. Carstens and Jonathan D. Mahoney (NCRPIS Biological Science Aide); *Cornus* spp. (4 accessions) collected by Jeffrey D. Carstens and Andrew P. Schmitz (Brenton Arboretum); *Quercus muehlenbergii* (4 accessions) collected by Jeffrey D. Carstens and Irvin Larsen (NCRPIS Oilseeds Technician); *Fraxinus pennsylvanica* (4 accessions) donated by Dr. Joseph Zeleznik (North Dakota State University); and *F. platypoda* and *F. lanuginosa* donated by Dr. Kang Wang (Beijing Botanical Garden). A large quantity of accessions (52) including *Cercocarpus, Fraxinus, Rhus, Symphoricarpos* and other miscellaneous taxa of western United States origin were donated through the US. Bureau of Land Management's Seeds of Success program. A total of 77 herbaceous accessions were added to the horticulture collection. We added one each *Actaea* and *Echinacea*, and three each *Hypericum* and

Prunella accessions to the medicinal collection. Four of the eight accessions came through the U.S. Bureau of Land Management Seeds of Success program. Two *Hypericum* accessions from the U.K. were donated by Elena Olsen of CABI, Delemont, Switzerland. One *Prunella* accession from Oregon was donated by Andrew P. Schmitz (Brenton Arboretum). Four *Agastache urticifolia* and 14 *Monarda* accessions were added to the mint collection. Fifteen of the 18 accessions came through the Seeds of Success program. For the herbaceous ornamentals collection, 51 accessions were added representing nine genera. The largest number of accessions were *Phacelia* (27), followed by *Potentilla* (8), *Drymocallis* (5), *Scrophularia* (4), *Baileya* (2), *Carex* (2), and one each of *Dasiphora*, *Euploca*, and *Lythrum*. Forty-nine of the 51 accessions came through the U.S. Bureau of Land Management.

Acquisition of *Fraxinus* germplasm from North America continues to move forward. The USDA-ARS Plant Exchange Office supported a collection trip to Iowa, Illinois, and Indiana in 2012 specifically to obtain germplasm of *Fraxinus quadrangulata*. PEO support was also approved for a collection trip in 2013 to Mississippi to target polyploid specimens in the *F. americana* complex. Collaboration with U.S. Forest Service, the Natural Resources Conservation Service, the Seeds of Success program, the Canadian Forest Service, tribal governments, state agencies, and many other partners continues in order to conserve the genetically diverse ecotypes of North American *Fraxinus*. The NPGS Ash Conservation Project webpage was updated in November 2012 with the help of Jesse Perrett, and now displays maps of all recently obtained accessions.

Maintenance:
No new field plantings were made for the medicinals, mints, or herbaceous ornamentals collections during 2012, although small numbers of *Actaea*, *Baptisia*, and *Blephilia* remained in the fields for regeneration purposes.

Maintenance efforts for woody-landscape accessions continued in 2012, resulting in substantial progress in regenerating *Aronia* spp. In 2012, a total of 29 *Aronia* accessions were harvested. Due to the small quantities of *Aronia* seeds harvested per accession, many of the *Aronia* accessions will need multiple, annual harvests in order to back-up and make accessions available. Additional efforts resulted in the establishment of 4 *Cornus rugosa* accessions.

The horticulture crew continues to mulch long-term field plantings in order to increase plant growth and reduce the time and labor needed for mowing and weeding.

Availability:
During 2012, approximately 73% of the medicinals and mints collections were available, up 2% and 4%, respectively, from last year. For 2012, 64% of the ornamentals and 45% of the woody landscape accessions were available. Combining the figures for the latter two maintenance groups showed an increase of about 3% in availability over last year.

Regeneration:
Regeneration efforts in 2012 focused on established, caged shrubs and on seed germination for future regeneration cycles. The harvests listed in Table 2 include 41 cage increases of woody-landscape accessions and 9 woody-landscape accessions from isolation. All other harvests were obtained from native populations as original seed. Through these activities and those from the previous year, 98 accessions were made available for distribution (Table 2.) Seeds from 21 accessions including *Spiraea, Diervilla,* and *Physocarpus* were pulled in 2012 for future regeneration cycles.

With no new plantings for the medicinals, mints, or ornamentals collections, regeneration efforts were limited for 2012. One mint and 18 ornamental accessions were harvested from previous year's plantings.

An evaluation of the medicinals, mints, and ornamentals collections was completed, taking seed inventory numbers, seed age, viability test records, backup status, and priority of the genera into account. Accessions were ranked on a scale of 1 to 5, with accessions ranked 1 being severely at risk and those ranked 5 having abundant quantities of relatively young seeds with acceptable viability and those accessions being backed up. Priority lists were prepared for regenerating each of the three collections, focusing on the most at-risk accessions first. Regeneration for seed increase, regeneration for planned phenotyping studies, and regeneration for seed viability trials were integrated. Planned regeneration will be discussed in more detail under the Plans for 2013 section.

Viability Testing:
With the departure of Maria Erickson from the seed viability testing program, seed testing figures were substantially below those for 2011. In all, 12 medicinals (2% of the collection), 6 mints (3%), 130 ornamentals (16%), and 78 of woody landscape (5%) accessions were tested for germinability.

Back-up:
The percentages of accessions backed up increased for the medicinals and mints collections, rising to 77% and 82%, respectively from 71% and 76% in 2011. Sixty-four percent of the ornamentals and 38% of the woody landscape accessions were backed up, with an increase in backup status for the combined collections up 3% from last year.

Distribution:
Distribution figures for the horticulture collections are summarized below (and in Table 3). The number of medicinals orders was the lowest for the six-year period beginning in 2007, with the number of recipients also decreasing but the number of items and accessions being shipped increasing slightly, compared with 2011. For the mints collection, the numbers of orders and requestors has been relatively stable since 2009, although the numbers of items and accessions have decreased somewhat. Combining the ornamentals and woody landscape accessions shows 96 shipped orders and 91 recipients, with 272 items and 217 accessions being shipped. These figures are lower than in 2011.

For the combined horticulture program, we received a total of 202 orders (45 of which were cancelled and do not appear in the table below or Table 3). Of these, 64% (130) were NRR orders. Of the NRR orders received by the horticulture program, alone or jointly with other NCRPIS curators, 45 whole orders were cancelled and 85 partial orders were shipped. Of the 410 horticulture items requested, 336 were cancelled and 74 were shipped.

The taxa in most demand for each collection are: mints – *Monarda*; herbaceous ornamentals – *Calendula*; medicinals – *Hypericum*; woody landscape plants – *Aronia*.

Crop	Year	No. of Orders	No. of Recipients	No. of Items Distributed	No. of Accessions Distributed
Medicinals	2007	58	48	358	181
	2008	34	31	232	161
	2009	64	52	267	154
	2010	35	31	165	129
	2011	47	45	125	91
	2012	**32**	**29**	**166**	**97**
Mints	2007	10	10	54	47
	2008	14	14	88	64
	2009	33	31	179	92
	2010	22	22	54	34
	2011	34	32	125	79
	2012	**29**	**29**	**81**	**58**
Ornamentals *	2007	75	71	268	196
	2008	92	83	352	249
	2009	110	95	607	390
	2010	82	73	301	248
	2011	114	95	599	405
	2012	**49**	**48**	**106**	**86**
Woody Landscape *	**2012**	**47**	**43**	**166**	**131**

* For 2007-2011, herbaceous ornamental and woody landscape plants were reported as a single group. Beginning in 2012, the two crops were split into separate maintenance groups.

Characterization/taxonomy:
In 2012, one mint and four *Aronia* accessions were reidentified. No characterization or taxonomic activities were conducted for the medicinals or ornamentals collections. During 2012, Lisa Pfiffner and Jeff Carstens captured seed images of 202 horticulture accessions, and Jeff Carstens imaged an additional 246 plant images. Images were named following the NCRPIS imaging standard protocol and loaded to GRIN.

Evaluation:
No evaluations were made of medicinals, mints, or ornamentals during 2012. Accessions to be used for phenotyping and evaluation will be regenerated in early.

Throughout the 2012 growing season, observational data was obtained from *Aronia* accessions growing at NCRPIS. A total of 245 observations focused on 38 *Aronia* accessions were captured and entered into GRIN. Observations included plant height, peak flowering date, peak fruiting date, inflorescence number, fruit diameter, fruit weight, flower diameter, and peak fall color.

In order to assess clinal variation in seed size, obtain a large data set applicable for future taxonomic descriptions, and potentially identify polyploid *Fraxinus*, seed length and width measurements were obtained from 181 mother trees (45 accessions) and loaded to GRIN. Clinal variation refers to ecotypes or forms of species exhibiting phenotypic and/or genetic differences over a geographical area, generally due to environmental heterogeneity.

Enhancement:
No enhancement activities were conducted on the medicinals, mints, or ornamentals collections in 2012.

A small, long-term project to conduct recurrent selection on *Fraxinus ornus* (flowering ash) for improved winter survival continued with the cultivation of a seedling population (Ames 29231) produced from the intermated progeny of trees selected in Urbana, IL.

Coordination of the NC-7 Regional Ornamental Trials:
In 2012, no woody-landscape accessions were distributed through the NC-7 Regional Ornamental Trials. In order to prepare for future distribution, a three day collecting trip was executed to harvest *Quercus muehlenbergii.* A total of 4 accessions were harvested including NA 81138 (Lee County, Iowa); NA 81139 (McLean County, Illinois); NA 81140 (Lawrence County, Indiana); NA 81141 (Clark County, Indiana) by Jeffrey D. Carstens and Irvin D. Larsen. Two additional *Q. muehlenbergii* accessions were acquired through collaboration which included NA 81198 (Franklin County, Ohio – collected by Peter Zale) and PI 495614 (Holt County, Missouri – collected by Sean Cleary).

Germplasm activities in crops other than those curated:
Dan Barney made a presentation at the 2012 American Society for Horticultural Science conference on *Abies lasiocarpa* var. *arizonica* and var. *lasiocarpa* (corkbark and subalpine fir, respectively) provenance trials he conducted at the University of Idaho. A manuscript for HortTechnology describing that work is scheduled for completion in early 2013, as is a Pacific Northwest Extension bulletin being prepared by the University of Idaho, Oregon State University, and Washington State University.

Dan Barney continued collaboration with researchers at the USDA-ARS National Clonal Germplasm Repository – Corvallis on manuscripts describing genetic profiling of *Paeonia* and *Rheum*, which research began when he was stationed in Alaska and curated those genera.

Research products:
No research products were developed during 2012.

Dan Barney's other research and training activities:
Research was begun in 2012 with emphasis on seed viability assessments, dormancy, and seed development as it relates to dormancy and viability. Primary genera selected for study include *Actaea*, *Fraxinus*, and *Hypericum*. Should time and other resources allow, parallel studies will be conducted with *Euonymus* and *Staphylea*.
The *Actaea racemosa* seed viability and germination research is divided into seven phases, examining seed development and the effects of warm and cold stratification, light, germination temperatures, storage, and the use of GA to substitute for cold stratification. Germination protocols developed during these trials will be applied in tests to other *Actaea* species curated by the National Plant Germplasm System.

Hypericum studies are divided into six phases that examine seed development and the effects of desiccation and storage, germination temperatures, warm and cold stratification, scarification, afterripening, gibberellic acid, seed washing to remove germination inhibitors, and time in storage.

Detailed protocols for the *Fraxinus* research are scheduled for development in early 2013, but generally involve correlating seed development with dormancy requirements and the testing of various germination protocols. The primary focus will be on *Fraxinus americana*, *F. nigra*, *F. pennsylvanica*, and *F. quadrangulata.*

Other Horticultural project-training and staff-development activities:
Dan Barney attended the following:
- 4th Curator Workshop and Plant Germplasm Operations Committee meeting in Spokane, Washington June 5-7, 2012.
- Herbaceous Ornamental Crop Germplasm Committee (HOCGC) meeting, Miami, Florida, July 30, 2012.
- American Society for Horticultural Science conference in Miami, Florida, July 31-August 2, 2012.
- NC7 RTAC meeting, Ames, Iowa, August 14-16, 2012.

Jeffrey Carstens attended the following:
- 4th Curator Workshop and Plant Germplasm Operations Committee meeting in Spokane, Washington June 5-7, 2012.
- NC7 RTAC meeting, Ames, Iowa, August 14-16, 2012.
- 2012 Iowa Shade Tree Short Course.

Manuscript and Proposal Review:
Dan Barney reviewed a manuscript on *Citrullus colocynthis* seed germination and dormancy-breaking for the Journal of Medicinal Plants Research.

Posters, Presentations, and Seminars:
Barney, D.L., M. Bauer, and J. Jensen. 2012. Seed source significantly influences growth rates and disease resistance of *Abies lasiocarpa* grown for ornamental nursery stock and Christmas trees. Poster presentation to the American Society for Horticultural Science conference, Miami, FL, 2 August 2012.

Barney, D.L. Collecting and curating horticultural crop germplasm. Oral presentation to the Iowa State Department of Horticulture, Ames, IA, 5 November 2012.
Carstens, J.D. The NPGS and the Ash Conservation Project. Presentation to the North Dakota State University (Fargo, ND) Introduction to Prairie and Community Forestry Course. 24 October 2012.

Jenderek, M.M., Ambruzs, B.D., Holman, G.E., Volk, G.M., Ellis, D.D., Widrlechner, M.P., Carstens, J.D. 2012. Cryopreservation of *Salix* sp. dormant winter buds. Poster presentation to the American Society of Horticulture Science conference, Miami, FL, 2 August 2012.

Publications which appeared in print (or online) in 2012:
Barney, .L. and K.E. Hummer. 2012. Northern highbush and half-high blueberries on the Alaskan Kenai Peninsula: Preliminary observations. J. Amer. Pomological Soc. 66(3):145-152.

Barney, D.L. and K.E. Hummer. 2012. Rhubarb: Botany, horticulture, and genetic resources. Hort. Rev. 40:147-182.

Barney, D.L., N.L. Robertson, K.E. Hummer, and B.S. Gilmore. 2012. *Ribes* L. gene bank management in the United States. Acta Hort. 946:73-76.

Debnath, S. and D. Barney. 2012. Shoot regeneration and plantlet formation by cascade huckleberry, mountain huckleberry, and oval-leaf bilberry on a zeatin-containing nutrient medium. HortTechnology 22:106-113.

Mickelbart, M.V., J.D. Carstens, and M.J. Gosney. 2012. Evaluation of Native U.S. Shrubs at Purdue. Indiana Nursery & Landscape Association. September/October 2012. p. 22-24.

Conclusions and Plans for 2013:
Curation:
We will attempt to regenerate approximately 139 medicinal and herbaceous ornamental accessions during 2013 for seed increase, phenotyping studies, and seed development and viability trials. Seed increase for the ornamentals will focus on Baptisia in order to develop sufficient seed inventories for transfer of the collection to the Ornamental Plant Germplasm Center in Columbus, Ohio. We will also attempt to regenerate accessions with critically low numbers of seed for *Anemone*, *Comandra*, *Mandragora*, *Matricaria*, *Symphytum*, and *Thalictrum*. In some cases, only a single seed remains for an accession. Medicinal regenerations will focus on small numbers of *Actaea* and *Prunella*, with a large number of *Hypericum* taxa scheduled for regeneration.

We do not plan to regenerate any of the NC7 mints until 2014.
Other plans for the medicinals, mints, and ornamentals collections include seed and clonal distributions, seed and plant imaging for GRIN, backing up such accessions as are not yet backed up and sufficient seed are available, inactivating defunct seed lots, and updating GRIN information.

Curation efforts in 2012 focused on *Fraxinus* acquisition and seed processing, with a total of 95 mother tree samples obtained. Given the serious threat caused by the continued expansion of Emerald Ash Borer in the North Central Region, collaboration will continue with Kevin Conrad (National Arboretum), Ned Garvey (Plant Exchange Office), Dave Ellis (NCGRP), Kris Bachtell (Morton Arboretum), and Bob Karrfalt (USDA Forest Service) to refine and execute plans to conserve North American ash (*Fraxinus*) germplasm (and acquire Chinese germplasm). A collecting trip to Mississippi in 2013 is being planned specifically to obtain polyploidy specimens in the *F. americana* complex. A collection proposal to target *F. quadrangulata* throughout western Ohio, Kentucky, Tennessee, and central Missouri will be submitted to the USDA-PEO office in Beltsville, MD.

Collaboration with Andy Schmitz at the Brenton Arboretum, Dallas Center, IA to assemble collections of *Gymnocladus* (Kentucky Coffeetree) continues. These efforts will hopefully allow for potential selection of superior plants for production and subsequent use in managed landscapes. Plans have been developed to execute a collection trip in February/March 2013. NCRPIS currently holds thirty-seven accessions of *Gymnocladus dioicus* represented as seed collections from native populations

Regenerations in 2013 will focus on producing control-pollinated seeds from the large number of shrub accessions now established in field cages, including *Aronia, Cornus,* and *Staphylea.* Plans are to establish 21 woody landscape accessions of *Diervilla, Spiraea,* and *Physocarpus* accessions.

Ames-numbered, woody-landscape accessions that are currently available for distribution will be considered as candidates for the assignment of PI numbers in 2013, which involves passport-data proofing, identity verification, and duplication checks.

Evaluation:
Actaea, *Hypericum*, and *Prunella* accessions will be regenerated during 2013 for phenotyping. The focus during 2013 will be to establish the phenotyping plots and maintain the plants. Data collections should begin in 2014.

Plans for 2013 also call for developing draft descriptor lists for *Actaea*, *Hypericum*, and *Prunella* and submitting them to the Medicinal and Essential Oil Crop Germplasm Committee for approval (MEOCGC).

Similar to 2012, evaluation data will be collected for *Aronia* accessions growing at NCRPIS. Data to be captured will include the following: peak flowering date, peak fruit ripening date, flower diameter, number of inflorescences per branch, fruit

diameter, fruit color, fruit weight, density, fall color leaf retention, and total soluble solids.

Other plans include the classification of *Fraxinus* and *Gymnocladus* accessions to Omernik's Level II Ecoregion to load to GRIN.

Research:
Dan Barney will continue his research trials on seed development, viability, and dormancy in *Actaea* and *Hypericum*. These trials include studies of morphology during seed development through seed maturation, storage, and germination. Other aspects include evaluating the effects of seed treatments and germination protocols, as described earlier in this section.

Dan Barney and Jeff Carstens will pursue parallel seed development, viability, and dormancy trials for *Fraxinus*.

Jeff Carstens intends to execute initial experiments on the pollination and reproductive biology of *Gymnocladus*. Other activities will include documenting the benefits in utilizing a portable seed dryer during seed collection trips, which was delayed due to extremely dry environmental conditions in 2012.

Staff Development:
Plans are for Dan Barney to attend the HOCGC meeting via teleconference. The meeting is tentatively scheduled for July 12 in Columbus, Ohio, to be held in conjunction with the OFC Short Course. He is tentatively scheduled to attend the MEOCGC in conjunction with the Association for the Advancement of Industrial Crops to be held in Washington, DC October 12-16, 2013.

Jeff Carstens will likely attend the Iowa Shade Tree Short Course, ArcGIS skills training, Graduate School USA leadership training, and safety training. Jeff Carstens also plans to attend the Woody Landscape Plant CGC meeting to be held in Portland, OR October 2-4, 2013.

E. Maize Curation (M. Millard)

Personnel:
Filling technical staff positions was initiated in early 2012 and was completed near the end of the year. Brady North was hired in April, 2012 as an Iowa State University maize Agricultural Specialist filling the position open since September 2011. Brady has a bachelor's degree from Iowa State University and has research work experience at Iowa State and Monsanto. This position is funded by the NC7 Multi-state Project. Vivian Bernau was hired as a federal temporary biological science technician in May to do the ear measurements on the 2011 ears produced for the inbred phenotyping / genotyping project and to assist with the nursery work. She had worked a number of semesters as a federal student employee while an Iowa State student on the North Central Regional Plant Introduction Station (NCRPIS) oilseed project. Unfortunately for the NCRPIS but fortunately for Vivian, she accepted a visiting scientist position at CIAT in Colombia starting in January 2012, working on the Crop Wild Relatives

Project. She has a strong interest in curatorial work, especially on an international level. There was one unsuccessful attempt to fill the federal technical position during the summer of 2012, but near the end of 2012 Bruce Hall, who had worked as an NCRPIS term federal technician and whose duties included the Ames portion of the inbred phenotyping / genotyping project during 2010 and who had then left the NCRPIS to take a permanent position, returned to the NCRPIS. He transferred back to our maize curation project in November 2012 from another federal unit on campus, now as a permanent federal technician. He had been fully trained on NCRPIS procedures in 2010 and has gained additional maize research experience. He was able to immediately assist with the backlog of maize curatorial projects.

Research Progress:
We began using the genotypic data obtained from the large genotyping / phenotyping project to characterize all Ames available inbreds to manage maize collections. Maria Cinta Romay, a postdoc with the Buckler lab, presented genomic data analysis at the Maize Genetics meetings in 2012. Publications are being prepared on this work. The lab provided the maize project a nearest neighbor analysis dataset of the 2500+ accessions, as well as a relationship matrix of all 2500+ accessions. These datasets estimate matches of hundreds of thousands of SNP markers between entries. Several of these accessions had multiple inventories represented. The plan of the maize project was to use these data to identify near duplicates and remove them from distribution. Second but no less important, was to use the data to identify dissimilar lineages maintained as one accession and separate those into two or more accessions, as appropriate.

The maize curator loaded these datasets into a MS SQLSERVER database, organized in such a way that any inbred entry could be queried and compared to any other inbred or group of inbreds in the dataset and presented the query results in a sorted list ordered on relationship. The plan for 2013 is to refine the presentation to also present pedigree and other passport and phenotypic data to simplify confirmation of the comparisons. The curator has been using this relatively crude tool to review duplicate entries. So far, approximately 80 accessions with multiple duplicate distribution lineages have been simplified to one distribution lineage. Additionally, 5 new accessions were created from among the 300 inbreds of the Goodman-Buckler diversity set. These inbreds had been previously distributed under an id of an accession with the same cultivar name. The collection now has a new accession id for Goodman-Buckler versions of CI90C, 38-11, A214N, CI28A, and F44. These were added to previously identified Goodman-Buckler versions of P39, Hi27, IA2132, CI91B, N7A, and CI7. The data indicate that they are genotypically related to the accessions, but are different enough in the opinion of the maize curator that they may give different results when used in research and breeding. Previous to these separations, distributions had been made to requestors from different lots based on the requirements of the requestor. This required a very time consuming process to fill orders for these accessions. These inbreds were part of the 300 accession Goodman-Buckler diversity set referenced many times in the maize literature and are in high demand.

The curator will continue to refine the tool and use it for collection management. A primary use will be during regeneration planning, resulting in reduced regeneration

and maintenance costs. The curator also hopes to sample DNA and obtain GBS data from inbreds that could potentially be added to the collection. Characterizing the inbreds prior to incorporating them into the collection may be helpful in determining whether they should be introduced into the collections as new permanent accessions before a lot of effort goes into regeneration. A similar tool will be developed in 2013 by the maizeGDB staff for inclusion on the maizeGDB website targeting public users without knowledge of the underlying inventory structure.

Efforts continued on large genotyping / phenotyping nursery of all Ames available inbreds. In 2012 a large portion of the 2011 two-rep planting ears were described. Progress has been slow due to staffing challenges. In review, the 2011 planting replicated the 2010 Ames planting which suffered severe storm damage, and was supplemented with additional 400 entries consisting of additional available inbreds and GEM accessions. Leaf tissue for DNA genotyping was only taken from accessions not grown in 2010 or when 2010 samples were of poor quality or gave results that needed confirmation. Dr. T. Rocheford's crew from Purdue University harvested tassels for tassel phenotyping. They were dried in Ames and shipped to Purdue for data capture. Phenological and phenotypic data were captured from the Ames planting, and the harvested ears await characterization.

GRIN-Global V1.0 was released in December, 2011. In 2012, staff at all NPGS sites was exposed to this version of the software and an analysis of its performance provided a list of additional refinements that will need to be accomplished by the U.S. GRIN-Global team in order for GRIN-Global to be put into full U.S. production. Originally, the project was a collaboration between The Global Crop Diversity Trust, Bioversity International, and USDA-ARS. Its goal was to create the next generation of the GRIN system as a scalable, license-free, database-flexible system suitable for adoption by any genebank in the world. The project development team was led by IT Specialist Pete Cyr of Ames and commenced in early 2008. The majority of the current project team members are from the GRIN database management unit (DBMU), Beltsville. The maize curator, who has a long history of working with the current GRIN system, was assigned to serve as an analyst on the development team.

Acquisition:
In 2012, 40 new accessions were received for *Zea, Coix, and Tripsacum*. These included 8 GEM accessions from Ames location, one of which is a waxy inbred line, GEMS-0206. Other inbreds included two Crop Science Registered inbreds from Tifton, Georgia, GT601(AM-1) and GT602(AM-2); two Texas inbreds from Dr. Wenwei Xu at Lubbock, Texas; and 21 expired PVPs. There were two other populations received of maize. From the Omaha Tribe of Nebraska, the station received a white flour corn and we received a Crops Science registration of Missouri's CRW3 (S1) C6.

Five new inbred accessions were created from lots previously associated with another accession. These accessions were part of the Goodman-Buckler diversity set and the SNP data from the Buckler lab indicated that they should be maintained separately. These five were previously regenerated and therefore do not count toward new accessions.

Regeneration:
There were 410 (2.0% of the collection) Zea accession regeneration attempts harvested in 2012. This compares with 475 (2.3% of the collection) in 2011 and 560 (2.8% of the collection) in 2010. For perspective, maize accessions store for about 30 years in the intermediate cold storage conditions at Ames. The breakdown of the regeneration nurseries are as follows:

1. An even smaller nursery of 123 accessions was grown in Ames in the summer of 2012 than the small nurseries of 260 accessions in 2011 and 280 in 2010 (1,778 rows vs. 2,009 vs. 2,576 25-foot rows). The germplasm grown in 2012 consisting mainly of inbred lines, 68 PVPs and 45 other miscellaneous inbred lines. No populations and a few GEM lines were grown to reduce labor requirements. Several inbreds in high demand were grown at the 20 rows per accession level rather than the standard 10.

   Good spring conditions allowed for an average planting date in early May. Technical help was not available until mid-April to assist in nursery prep. After planting, growing conditions were dry making emergence slow and somewhat irregular. After emergence growth was good and faster than usual; pollinating started early on June 29th. The crop was in excellent condition. After pollinations began, little significant rain occurred and temperatures were much above average. Trickle irrigation was used regularly on one field representing a third of the planting and an overhead gun was used on the other field, weekly. Two wind events during pollination resulted in some green snap, but most inbreds suffered little damage and only a few accessions root lodged, mostly non-PVPs. Early 6:00 AM start times and voluntary evening pre-sunset 2nd sessions were undertaken to put tassel bags up after the heat of the day on difficult accessions. At harvest it was apparent that evening setup was beneficial with less scatter-grain occurring on those ears compared to accessions setup in early afternoon. The trickle irrigated field performed better than the field irrigated with the overhead system. Several of the overhead-irrigated accessions suffered tassel blasting. Growing conditions were better into the fall but continued on the dry side, requiring some additional irrigation. Harvest season weather was good. Efforts to have student staff available early in the semester, plus early maturity and a small nursery allowed for the earliest harvest finish in the Maize Curator's 32 year career, on October 5th. No Stewart's wilt was observed in any increases, as in 2011 and 2010, thus no ELISA testing is necessary on 2012 Ames increase lots to meet phytosanitary requirements. Ear health was better than average, but scattergrain was common, as in 2011. All factors considered, the summer regeneration is rated as average.

2. Fifty-one tropical inbreds that are in high demand were grown by the Germplasm Introduction & Research Unit, St. Croix, U.S. Virgin Islands in the winter of 2011-2012. These were received in May, 2012. Thirty-five tropical accessions were shipped to St. Croix for regeneration during the 2012 summer season consisting of 25 tropical inbreds and 10 populations. These were received in November, 2012.

3. Monsanto shipped seed from a nursery of 150 accessions in February, 2012 that was planted in the fall of 2011 and hand pollinated. These 2-row increases

targeted accessions in extra low supply and of unproven adaptation to winter Oahu, Hawaii conditions. Monsanto grew, pollinated, harvested and shipped a nursery of 50 tropical populations from Oahu, HI grown between February-July 2012, targeting 100 females per population of mainly lowland tropical adaptation. Many thanks to all at Monsanto who assisted in these large tropical nurseries.

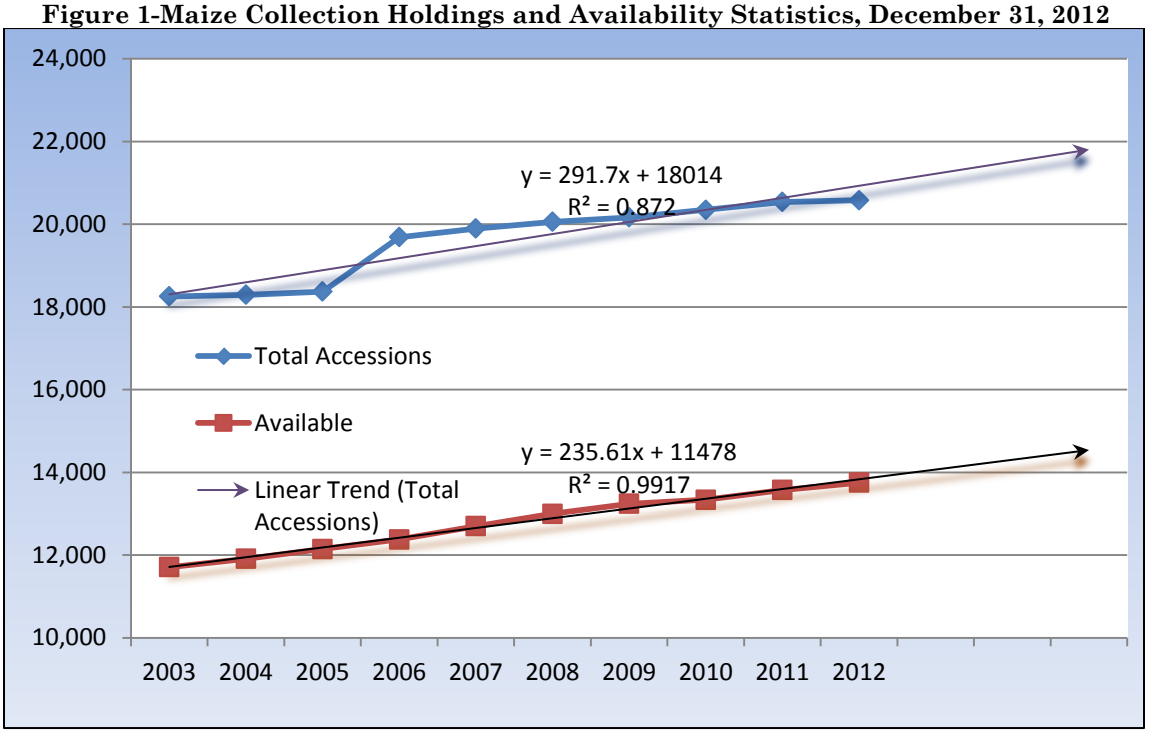
4. Eight GEMs were grown by the Ames GEM team in the summer of 2012 for the collection. Many thanks to Mike Blanco and Andy Smelser.

5. Greenhouse increases included five teosintes that were held over for a year and one harvest.

Maintenance:
There were 20,579 accessions of *Zea* held at the NCRPIS as of December 31, 2012. This represents a .2% increase over the 20,540 accessions held at the NCRPIS at the end of 2011. GEMs and expiring PVPs made up the majority of the additions. The maize curator maintains an additional 100 accessions from the *Coix* and *Tripsacum* genera.

There were 13,753 available accession at the end of 2012 (66.8% of the total compared to 13,572 (66.1%) at the end of 2011 and 13,338 (65.6%) at the end of 2010. Progress in this area continues to be steadily positive, but continues to slow due to personnel resource uncertainties. Progress would not be possible without in kind regeneration assistance of Monsanto, the GEM programs in North Carolina and Iowa, and others.

Figure 1-Maize Collection Holdings and Availability Statistics, December 31, 2012



This table indicates that *Zea* accession availability continues to maintain though the collection grows and accessions become unavailable. Efforts in recent years have been focused on increasing inbreds and expired PVPs to meet demand. Flat budgets and staffing make substantial increases in the number of available accessions difficult.

Yearly Accession Availability

Year	Total Accessions	Available Accessions	% Available	New Accessions
2003	18,255	11,709	64.1%	236
2004	18,293	11,910	65.1%	1063*
2005	18,370	12,145	66.1%	75
2006	19,687	12,378	62.9%	285
2007	19,894	12,699	63.8%	124
2008	20,057	12,997	64.8%	150
2009	20,166	12,239	65.7%	105
2010	20,347	13,338	65.6%	178
2011	20,540	13,572	66.1%	180
2012	20,579	13,753	66.8%	39

*Accessions from Major Goodman collection were received in 2004, but were incorporated into the collection totals in 2005, 2006, and 2007 as time permitted.

Viability testing was up slightly in 2012 even as the tech position handling viability testing became vacant with a resignation. There were 743 accessions tested representing 3.6% of the collection. In 2011, 508 accessions were tested representing 2.5% of the collection. Five percent, 6%, and 7% of the collection was tested in 2010, 2009, and 2008 respectively. A goal of doing a test every 10 years on collections is desirable to make sure seed is as healthy as possible for research. In 2012, 44 accessions were backed up at the NCGRP compared to 2011, 126 accessions were backed up at the NCGRP compared to 126, 105, and 71 in the 2011, 2010, and 2009 respectively. The percent of the collection backed up held at 73% in 2012.

Distribution:
Orders for all accessions maintained by the maize curator including those of the genera Tripsacum and Coix increased 9% over 2011 compared to a 14% increase the year before. Expired PVP-lines continue to be a major maize distribution category followed by NAM inbred parents, the Goodman-Buckler inbred diversity set, and all other inbred lines.

Packets distributions were inflated by another distribution of the entire collection of 2,423 available inbred lines (now known as the 'Ames Panel') within the U.S. for more phenotyping. This set was not sent oversees in 2012 therefore the overseas packet distribution was down a bit even though foreign orders increased substantially. Foreign requests also focus on the distribution types listed in the previous paragraph.

Orders for expired PVPs were sent to 168 requestors (27% of all *Zea* requestors). Expired PVPs made up some portion of 32% of all Zea orders shipped. Packet distributions of these expired PVP inbreds was up from the previous year because of a similar number expiring and over 100 new requestors in 2012 who did not order in 2011. Figure 2 and 3-Maize display how disproportionate distributions for expired PVPs and inbred lines are compared to their number in the collection.

Expired PVP Annual Distribution Data				
Year	**Total Packets Distributed**	**Total Accessions Distributed**	**Orders Processed**	**Individual Cooperators**
2007	3,269	130	192	109
2008	2,593	153	197	111
2009	3,930	194	240	127
2010	5,441	238	237	147
2011	5,278	277	265	158
2012	**6,737**	**303**	**269**	**168**

Annual Distribution Data*								
Year	**Total Packets Distributed**	**Foreign Packets Distributed**	**Total Accessions Distributed**	**Foreign Accessions Distributed**	**Orders Processed**	**Foreign Orders Processed**	**Individual Requestors**	**Foreign requestors**
2008	15,371	1,206	6,970	722	626	64	418	57
2009	13,538	1,767	5,113	1,049	783	78	531	66
2010	22,111	1,587	4,296	945	655	73	456	63
2011	16,638	4,087	4,479	2,477	748	78	546	67
2012	**20,230**	**3,424**	**4,476**	**1,436**	**815**	**100**	**622**	**88**
Averages '08-'12	17,578	2,414	5,067	1,326	725	79	515	68

* Includes normal distribution orders, non-research orders, and orders planted for observations. Observations orders are not included in the appendix tables, but are significant in maize.

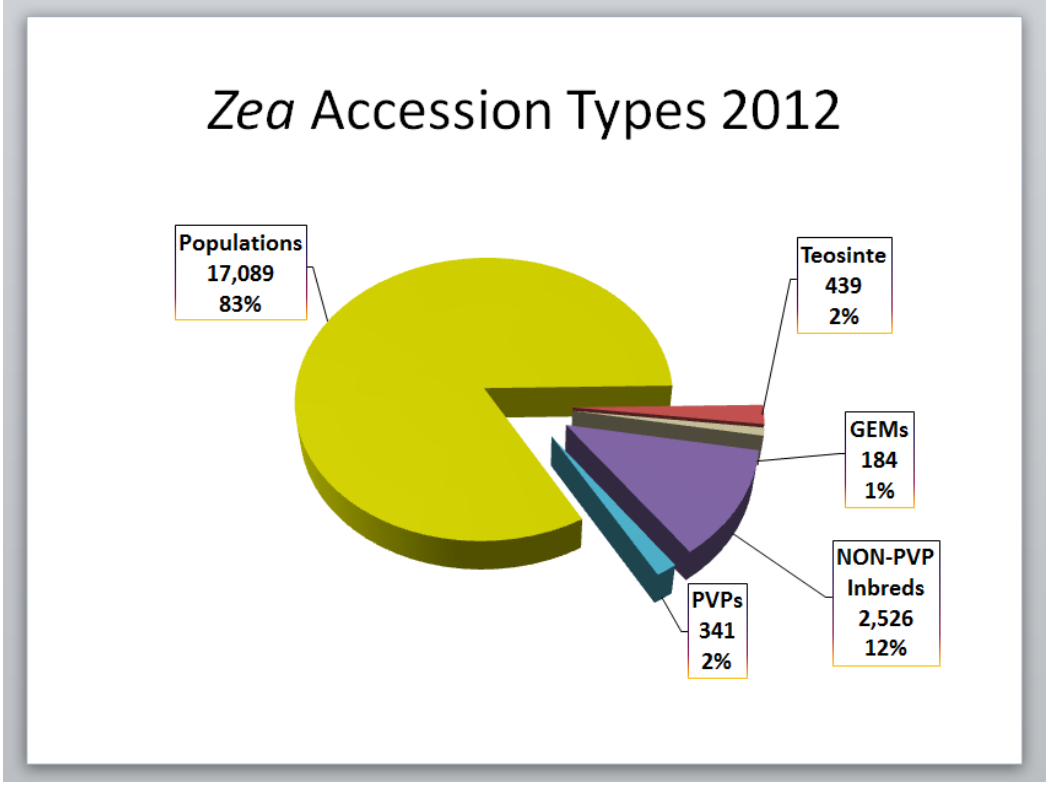


Figure 2-Maize Collection types

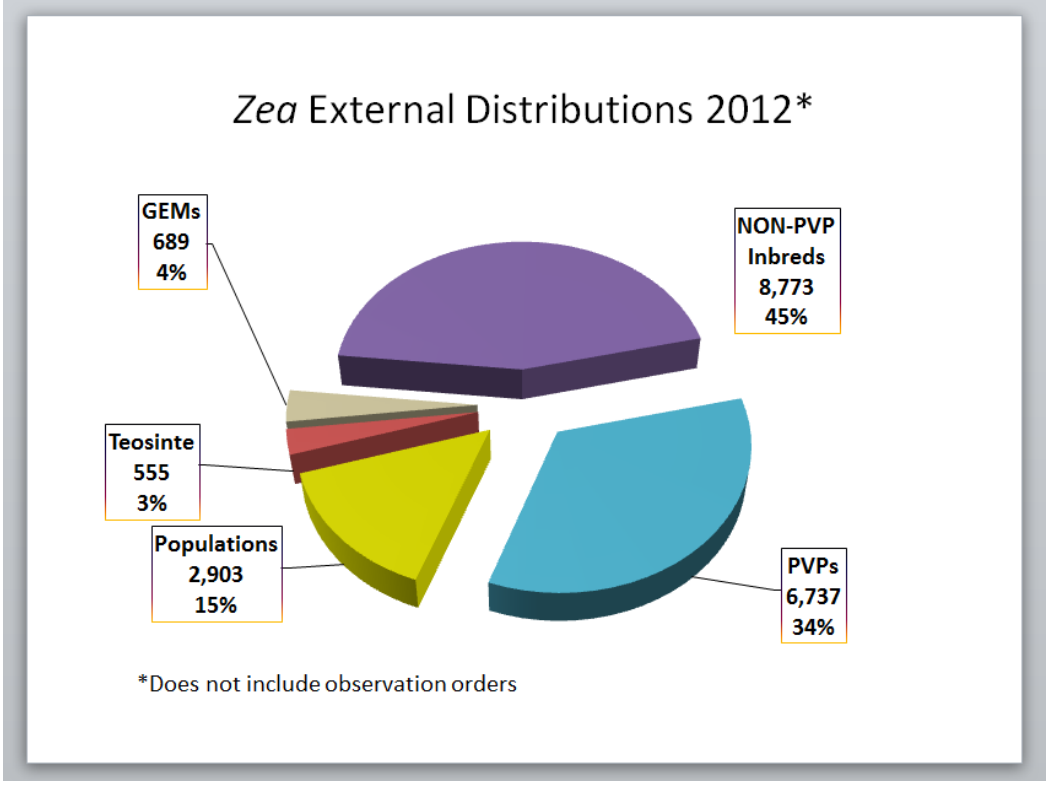


Figure 3-Maize Collection Type Distributions

Characterization:
There were 13,212 data points loaded into GRIN on 5,196 accession in 2012 compared to 14,607 data points loaded into GRIN on 2,807 accessions in 2011 and 8,217 data points loaded into GRIN on 885 accessions in 2010.

We image 556 accessions in 2012 compared to 699 accessions in 2011 compared to 699, 520, and 599 in 2011, 2010 and 2009 respectively.

As mentioned earlier, over 2,500 inbred accessions were characterized phenotypically in Ames in the field in 2011 and additional SNP data was obtained in E. Buckler's lab from samples taken in Ames supplementing the 2010 data. Ears were harvested in 2011, but due to staff turnover a third of the ears remained to be phenotyped in 2013. The phenotypic data will be available on GRIN after publication. The SNP data was made available to the curator in late 2011. And a paper is expected to be published in 2013.

Evaluation:
Two disease screening nurseries were sent out in 2012. Dr. Bill Dolezal, Pioneer Hi-Bred/DuPont, screened 250 accessions for northern leaf blight resistance and diplodia ear rot screening. Unfortunately this nursery was lost due to the drought in central Iowa. Many thanks are extended to Pioneer Hi-Bred/DuPont for this long-term contribution. Dr. Charles Block, USDA-ARS pathologist at the NCRPIS, screened 200 accessions for Stewart's wilt resistance.

Plans for 2013:
In 2013 attending to regenerations and regeneration processing will need to take precedence. Student labor is not expected to increase. Regeneration remains my first priority because without viable seed, distribution and resulting research cannot be done.

Data will continue to be captured on the ears harvested in 2011 for the 2,500+ inbred phenotyping/genotyping project, to be finished by mid-2013. We will assist in analyses and publication of the results.

Monsanto continues to regenerate tropical accessions on Oahu, Hawaii. Fifty tropical accessions will be shipped in February, 2013. Additional nurseries will occur during the winter 2013-2014. Processing is caught up so increase effort will go into this cooperative effort.

The SNP data provided in 2012 from the inbed genotyping/phenotyping project will be heavily used in determining the status of non-PI'ed inbred lines. The curator will be assisting the MaizeGDB staff in putting together a public tool on MaizeGDB for inbred similarity comparisons.

NSL and Ames numbered accessions will be reviewed and PI numbers assigned. Over 1,200 Ames-numbered accessions and 400 available NSL-numbered accessions could be assigned permanent PI numbers in 2013.

GRIN-Global development. Assisting NPGS in migration from GRIN to GRIN-Global will continue to be a major effort for the maize curator. As more users test,

additional needs are identified. Enhancement of versions for deployment in the U.S. is anticipated to continue in 2013.

Little funding is available for a tropical nursery at present. However it is hoped that trained staff will be available along with funding so that a tropical nursery could be planted in 2013-2014.

We will continue acquiring germplasm from public collections.

I will continue to augment the collection of images currently on GRIN of 5,000 accessions with images of additional accessions in 2013.

F. Oilseed Crops (L. Marek, L. Crim, I. Larsen)

Project management:
Farm worker L. Crim continues to work for the oilseeds project part-time.

Acquisition:
We received 417 new oil seed accessions in 2012.

Helianthus:
Association mapping population, UGA-SAM1, comprised of 288 cultivated *H. annuus* lines, was received from the University of GA. Primarily developed from PI lines, the mapping population members have received temporary Ames numbers until which time specific lines are determined to require PI numbers. Four requests for distribution are pending seed processing and organization. Twenty-five cultivated *Helianthus annuus* accessions with expired property right protection (CSR; Crop Science Registry) were received from NCGRP, Ft Collins. Twenty-three of the new cultivated accessions were increased in 2012; the remainder will be increased in 2013. In addition, two cultivated sunflower land race lines from South Korea were received from the Rural Development Agency, South Korea which will be distributed under the standard international material transfer agreement after regeneration in 2013. Forty-five new wild *Helianthus* accessions were received in 2012. Eleven accessions (eight annual, three perennial) were transferred from the W6 Regional Plant Introduction Station, material wild collected in the western US in a cooperative project with the BLM. One accession, wild collected in TX, was donated by Dr. Jarrad Prasifka, USDA, Fargo, ND. Thirty-three accessions (22 annual and 11 perennial) were collected during a National Germplasm Resources Laboratory Plant Exchange Office sponsored exploration in NM and western TX led by Dr. Marek, including 10 accessions of the United States Fish and Wildlife Service listed threatened annual species, *H. paradoxus*, endemic to the endangered ciénega habitat in that geographic region.

Brassicaceae:
Two new *Brassica napus* accessions with expired property rights protection (PVP, Plant Variety Protection) were received from NCGRP, Ft. Collins. In addition, one new wild-type *B. juncea* was received from South Korea from the Rural Development Agency, South Korea which will be distributed under the standard international material transfer agreement after regeneration in 2013. Twenty-four new crucifer

accessions were received: 16 new *Thlaspi arvense* accessions wild collected in Canada, and two *Erysimum*, five *Lepidium* and one *Noccaea* transferred from the W6 Regional Plant Introduction Station, material wild collected in the western US in a cooperative project with the BLM.

Linum, *Euphorbia* and Miscellaneous Asters:
Seventeen wild flax, one *Euphorbia* and 12 miscellaneous asters were transferred to the NCRPIS from the W6 Regional Plant Introduction Station, material wild collected in the western US in a cooperative project with the BLM.

Collection Maintenance:
General statistics about availability and management of the collections are presented in Tables 1 and 2 in the appendix. We continue to regenerate fewer accessions than in previous years due to reduced and stagnant operating budgets. Selected details for oil seed accessions increased during 2012 are noted below.

Helianthus, Ames regenerations:
Cultivated *H. annuus* accessions are 93% available. We are managing our increases to maintain a high level of availability and to ensure that core collection accessions and other specific groups of interest are available. In 2012, 79 *H. annuus* cultivated accessions were regenerated in the field. One accession was not harvested because the cage in which it was growing was destroyed by a late July windstorm while all plants were in full flower. Cultivated *H. annuus* accessions requiring long seasons or short days to flower are increased in the NCRPIS greenhouse as space allows. Two accessions were increased during the winter of 2011-2012. Wild annual *Helianthus* accessions are 95% available and wild perennial accessions are 74% available (20% available seven years ago). We caged nine wild annual *Helianthus* accessions and harvested seed from all nine accessions. Seed was harvested from 22 caged perennial accessions, 10 of which had been previously established in the field. The July windstorm mentioned above also damaged annual and perennial cages which were re-built.

Helianthus, Parlier alternate grow-out site regenerations:
We continue to partner with NPGS Parlier, CA personnel to regenerate wild taxa requiring longer growing seasons than are reliably obtained in Ames. The Parlier environment also provides a valuable alternative for growing mountain and desert species that do not grow well in mid-western humidity and heavy soils. The Parlier location uses sunflower cages and pollinator insects (honeybees) purchased by NCRPIS and can grow up to 40 sunflower accessions per year. We germinate seeds in Ames and ship live seedlings to Parlier. The Parlier staff transplants seedlings and manages plant growth. Plots are caged before flowering, pollinator insects are introduced, and harvested material is shipped to Ames for threshing and processing. In 2012, we sent seedlings for 36 accessions, one plot established in 2011 was maintained and re-caged, and all 37 plots were harvested. The 2012 harvested material arrived in Ames in December for processing.

The Parlier staff records basic field data (transplant, flowering and harvest dates) but does not have the staff to record standard descriptor data such as ray and disc flower color, plant height, and branching characteristics nor to take images. Phenotypic information is a valuable component associated with each accession and

it is important that the observation data be captured. In September 2012, Mr. Larsen, oilseeds project technician, and I traveled to Parlier to record descriptor information and to take images.

We have an excellent partnership with the NPGS Parlier staff, ensuring successful regenerations of many wild sunflower taxa. We are most grateful for the dedicated efforts of Mr. Jerry Serimian, Parlier field technician, and Dr. Gabriela Romano, Parlier curator.

Brassicaceae regenerations:
Brassicaceae accessions are 90% available. In 2012, populations for 37 Brassicaceae accessions, 15 *Brassica* and 22 miscellaneous crucifers, were established in the field. Seed was harvested from 27 of the field established accessions. Seven *Brassica* and one crucifer accessions did not flower. The non-flowering *Brassica* accessions were re-planted in the field in mid-September and over-wintered in the field using standard winter canola planting protocols in an attempt to obtain natural vernalization, flowering and seed production in spring 2013. One crucifer accession did not produce any seed and will be re-grown in 2013. Six greenhouse maintained *Thlaspi arvense* (miscellaneous crucifer) planted in fall 2011 were harvested in early spring 2012. We made a separation of about a dozen plants which bolted and flowered much earlier than the rest of the plants in one of the accessions, Ames 31018, collected west of Pine, CO, southwest of Denver in 2010. None of the plants in the other five *T. arvense* accessions in the winter FGH-2 regeneration flowered as early. We are growing plants from seed from the early and later flowering plants from Ames 31018 in FGH-2 during the winter 2012-2013 to observe if the differential flowering habit is maintained. If it is, a separate accession number will be created for the earlier flowering plants. We are maintaining an additional eight brassicaceae accessions in FGH-2 (one *Brassica* and seven miscellaneous crucifers) which have not flowered. Ten of the 31 new 2010 *Thlaspi arvense* accessions without enough seed to allow distributions, were started in fall 2012 for winter 2012-2013 greenhouse regeneration.

Linum regenerations:
Cultivated flax accessions are 99.5% available. No cultivated flax regenerations were attempted in 2012. Wild flax accessions are 81% available. Two wild flax accessions established in the field in 2011 and overwintered to 2012 were harvested.

Cuphea:
No *Cuphea* regenerations were attempted in 2012. Seeds are available for 94% of the accessions of seven species (*Cuphea calophylla, C. carthegenensis, C. lanceolata, C. lutea, C. tolucana, C. viscosissima, C. wrightii)* and the *Cuphea* hybrid accessions that have been part of the agronomic development efforts by members of the National *Cuphea* Consortium. Over all, the *Cuphea* collection is 80% available.

Miscellaneous asters:
The miscellaneous asters are 27% available. No miscellaneous aster regenerations were attempted in 2012.

Euphorbia:
The *Euphorbia* collection is 42% available. No *Euphorbia* regenerations were attempted in 2012.

Distributions:
General statistics about oil seed collection distributions are presented in Table 3 in the appendix. In the past few years, requests for seeds for home gardening purposes have increased dramatically. About 33% of the orders requesting oilseed crops in 2012 were in the non-research request category (the majority were multi-curator orders); however, less than 2% of the total oilseed items distributed (fewer than 200 items) were sent to non-research requesters.

Helianthus:
In 2012, the largest distributions were 1977 accessions (*H. annuus* cultivated and wild) sent to the Embrapa Sunflower Genebank in Londrina, Parana, Brazil for their research focused on disease resistance and other stress tolerance traits and 2087 accessions (941 cultivated, 1146 wild) sent to the Rural Development Administration Genebank, Republic of Korea; both are assumed to be one time distributions.

Of the remaining sunflower distributions, 31% were sent to support disease resistance evaluations and research, 30% were sent for general breeding purposes and almost 20% were sent for evolutionary history and genetic research. The breeding group at Triumph Seed continues to use NCRPIS sunflower germplasm in their development of short stature, early season sunflowers for cultivated production.

Brassicaceae:
In 2012, the largest distribution was 1251 accessions (789 *Brassica* and 462 miscellaneous crucifers) sent to the Rural Development Administration Genebank, Republic of Korea, assumed to be a onetime distribution.

Of the remaining brassicaceae distributions, 20% were sent for an evaluation of winter versus spring-type flowering characteristics in the *Brassica napus* collection and 30% were sent for disease resistance evaluations and research.

Linum:
A large order of more than 1500 accessions was sent to support diversification of cultivated flax genetic resources in Turkey. Typically 100 to 200 flax accessions are distributed each year. This was the largest flax distribution since 2005.

Cuphea:
Cuphea accessions were distributed in 2012 to support ornamental breeding (37%), to support fatty acid research (32%), for teaching (25%) miscellaneous purposes.

Euphorbia:
Euphorbia accessions were distributed during 2012 for a study about seed lignin and for research about genes expressed during root development.

Miscellaneous asters:
Miscellaneous asters accessions were distributed to support lipid metabolism research, as a *Helianthu*s near relative for pathogen host analyses, and for a study about genes expressed during root development.

Research Activities
General statistics about observations and images recorded for the collections are presented in Table 4 in the appendix.

Helianthus:
Disease resistance evaluations: *Sclerotinia* is the most important disease in sunflower production fields in northern North America. The pathology group at the USDA Sunflower Research Unit, Fargo, began field evaluations in 2008 to screen all untested cultivated sunflower accessions for response to this important disease after I identified all accessions without disease evaluation data. An initial test group of 250 was selected and these accessions have remained a focus of field efforts directed by the Fargo pathologist. We continue to partner with the pathology group in Fargo and work to ensure that the accessions identified as "best" are available for distribution to the sunflower research community. In 2011 field evaluations expanded to include screening for *Phomopsis* resistance and top accessions identified in 2011 and confirmed in 2012 are part of our priority regeneration efforts for 2013.

Field evaluations are labor intensive and are clearly subject to variable weather conditions. We are also participating in joint effort managed by the Ames pathologist to screen a representative subset of all wild sunflower accessions for *Sclerotinia* resistance in the greenhouse. Previously, the Ames pathologist developed a greenhouse screen that successfully predicted field response allowing only the most promising accessions to be followed up with field testing. Generally, wild annual accessions are susceptible and wild perennial accessions are resistant; however, tested *H. argophyllus* (an annual species native to southwestern coastal Texas and of interest in several biomass projects) accessions averaged more than 80% resistant.

Brassicaceae:
Thlaspi and *Camelina sativa* agronomic characteristics: We continue to assist ISU Fullbright sponsored graduate student Ivan Ayala in his evaluation of agronomic characters in *Thlaspi arvense* and *Camelina sativa* both Brassicaceae species with remarkable cold tolerance and relatively short life-cycle oilseed plants with a possible use as a non-food or fuel component in multi-crop systems.

Professional Activities:
Meetings and Presentations:
January: I attended the 2012 National Sunflower Association Research Forum, Fargo, ND. This meeting represents an important opportunity to interact with the sunflower research and production community. The Sunflower Crop Germplasm Committee held their meeting in association with the Research Forum and I presented the sunflower collection status report.

January: I attended the 20th Annual Plant and Animal Genome Conference, San Diego, CA as co-author on three posters presenting research funded by the 2009-2011 USDA/DOE Genomics of Biomass Feedstocks grant for which I was co-PI.

February/March: I attended the 18th International Sunflower Association in Mar del Plata, Argentina. I presented a poster and gave a short talk during the genetic and genomics resources panel presentation.

June: I attended the joint NPGS Curator's Workshop and PGOC meeting in Spokane, WA. I assisted in the program development for the Curator's Workshop. I made an afternoon visit to the University of ID to meet with Dr. Jack Brown's research and development group, one of few public *Brassica* breeding programs in the United States.

November: I attended the annual meeting of the Association for the Advancement of Industrial Crops in Sonoma, CA. Graduate student Ivan Ayala made an oral presentation about his work characterizing *Thlaspi arvense* and *Camelina sativa* for which I am a co-advisor.

Publications:
Marek LF, Block C, Gardner CAC 2012 (2012) Update: New sunflower genetic resources in the US National Sunflower Collection and potential use for crop improvement. In Proc 18th Int Sunflower Conf, Mar del Plata, Argentina, Intl Sunflower Assn, Paris, France. pp. 663-668.

Seiler GJ, Gulya TJ, Marek LF (2012) Collection and evaluation of wild perennial *Helianthus pumilus* achenes for oil concentration and fatty acid composition. In Proc 18th Int Sunflower Conf, Mar del Plata, Argentina, Int Sunflower Assn, Paris, France. Pp. 711-716.

Active Grants:
FY 2011 Southwestern US *Helianthus* collection trip proposal approved and funded $5212; postponed to 2012 due to drought in the collection region and recommendations from federal land managers (primary targeted species is listed by the USFWS as threatened). Role: PI

FY2010-2012 Plant Germplasm Evaluation proposal funded, "Evaluation of *Thlaspi* and *Camelina* Accessions", $15,000 (molecular and agronomic analyses). Role: PI

USDA-ARS Sclerotinia Initiative Research Project, seven separate grants, "Evaluation of Wild *Helianthus* Species for Resistance to Sclerotinia Stalk Rot", total $163,811; 2006 – 2013. Role: Co-PI.

Service Activities:
Journal peer review:
I served as a peer reviewer for submissions to Hort Science.

NCRPIS:
I serve on the NCRPIS Safety and Computer Committees.

PGOC:
I serve as a member of the *In situ* Conservation Subcommittee, the GIS and Geo-referencing Subcommittee and the Molecular Subcommittee. I participated in and served as secretary for a series of intensive teleconferences within the GIS and Geo-referencing Subcommittee working to prepare habitat and geographic referencing descriptors for DBMU and the new GRIN Global database.

Agronomy Department Activities:
After a two year hiatus, the Agronomy P&S group began semi-regular meetings again. I help organize these meetings.

G. Vegetables (K. Reitsma, L. Clark)

Collections curated by the Vegetable Project include *Cichorium* (NC7-chicory), *Cucumis sativus* (NC7-cucumis.cucs), *Cucumis melo* (NC7-cucumis.melo), *Cucumis* species (NC7-cucumis.wilds), *Cucurbita pepo* (NC7-cucurbita), *Daucus* (NC7-daucus), *Ocimum* (NC7-ocimum), and *Pastinaca* (NC7-parsnips). Statistics for accession numbers and availability for each site crop are found in the appendices in "Table 1: NCRPIS Accessions (Accs), Acquired, Available."

Acquisition:
Two expired/abandoned PVPs were received from NCGRP: *Cucumis melo* 'Stephanie' and *Cucurbita pepo* 'Happy'.

A second *Cucumis melo* accession reported to be resistant to *Podosphaere xanthii* race pxCH1 and susceptible to *Podosphaere xanthii* races S and SD was donated to the NPGS by Dr. L. Liu, Shanghai Academy of Agricultural Sciences, China via Dr. J. McCreight (USDA, ARS, Salinas, CA) as PI 134198. Although Dr. Liu believed it to be derived from PI 134198, it has been determined that Dr. Liu's seed is not PI 134198, *Cucumis melo* var. *flexuosus* and therefore the accession has been assigned a new number, Ames 31282.

Ninety-five accessions of *Daucus* were received in 2012 including two *Daucus pusillus* collected in California for the Seeds of Success project and donated by the Bureau of Land Management; 18 *D. carota* and two *D. pusillus* collected in California by Philipp Simon (USDA, ARS, University of Wisconsin, Madison); and 73 Daucus collected in Morocco by Drs. David Spooner and Philipp Simon, USDA-ARS, University of Wisconsin, Madison, WI. The Morocco collection included 50 *D. carota*, 11 *D. crinitus*, two *D. durieua*, eight *D. muricatus*, two *D.tenuisectus*. *D. durieua* and *D. tenuisectus* have not previously been available from the NCRPIS collection.

Maintenance:
Data for vegetable crop regenerations attempted and number of accessions harvested in 2011 are summarized in the appendices in "Table 2: NCRPIS Accessions (Accs) Germinated, Regenerated, Made Available, Backed Up."

Cucumis increases included both greenhouse and field regenerations of 65 *C. melo*, 33 *C. sativus*, and 4 wild *Cucumis* species. A significant number of transplants were lost due to an unusual event of Fusarium crown rot. The field was planted in corn

the previous year and the fungus attacked the hypocotyls of the new cucurbit transplants at the soil line, causing rapid wilting and death. This was the first time we have experienced this problem. Eleven *C. sativus*, 35 *C. melo*, and four wild accessions were successfully regenerated (sufficient population sizes resulting in the harvest of good seed quantities). Accessions where low seed quantities were harvested or those that failed to germinate will be regenerated again in 2013.

Cucurbita pepo field regenerations focused on accessions with low seed quantities or distribution lots 20+ years old. Eleven of 12 accessions in field cages were successfully regenerated while one accession failed to set fruit. Plants of one *Cucumis melo* and one *Cucurbita pepo* accession died when overnight temperatures dropped to 26° F in the entomology greenhouse due to a failure of a control panel and aspirator. It was also found that the phone line connected to the greenhouse alarm system was not functioning. Both systems were repaired.

Daucus regeneration efforts focused primarily on accessions collected in Portugal and Tunisia. Regenerations were attempted on 39 accessions including 12 biennials, 18 annuals, and nine exhibiting mixed (annual-biennial) life cycles. Annuals were direct seeded into field cages, but due to the irregular and sparse rainfalls of the 2012 growing season, germination and plant establishment was poor. No harvest was made on six accessions. Processing of seed harvests continues, but preliminary assessment suggests successful increases were obtained on 21 of the 39 accessions. Harvests on the remaining 12 accessions were not considered successful due to low plant populations. Many of these will be regenerated again in 2013 so that the resulting increase lots may be bulked in 2014. In addition to the *Daucus* regenerations in Ames, we received seed increases on six accessions each from Rosa Yzquierdo, Seminis Vegetable Seeds, Idaho and Rob Maxwell, Bejo Seeds, Idaho. Another six accessions each were sent to Seminis Vegetable Seeds and Bejo Seed for regeneration in the 2012-2013 growing season.

Two accessions of *Ocimum* with low seed quantities were successfully regenerated in the summer of 2011.

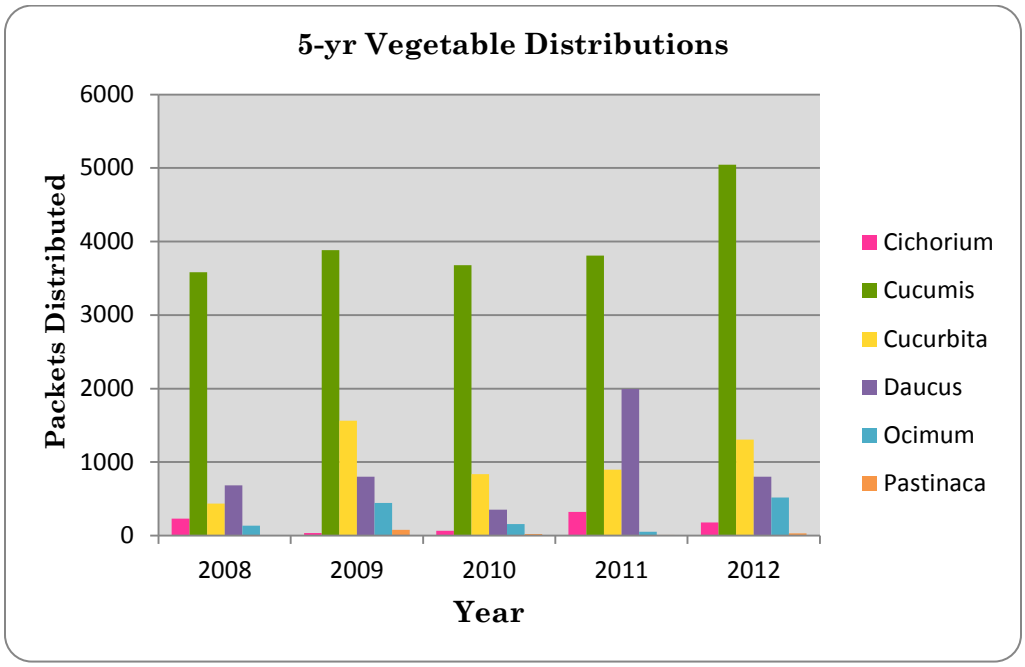
As NCRPIS accessions are regenerated, seed samples are sent to NCGRP for back-up. Overall, 83% of the accessions in the vegetable collections are backed up. Six of eight vegetable site-crops have 80% or more of their accessions backed up at NCGRP (Table 2).

One *Cucumis melo* accession was inactivated, and PI numbers were assigned to 20 Ames-numbered *Daucus* accessions collected by Dr. P. Simon in California in 2012.

In 2012, 195 vegetable collection accessions were tested for viability (Table 2), focused primarily on regeneration lots.

Distribution:
Packet and accession distributions for the vegetable collections are summarized in the appendices in "Table 3A: External NCRPIS Distributions", "Table 3B: Internal NCRPIS Distributions". In 2012, 7878 seed packets (items) involving 4487 accessions were distributed to fulfill 454 orders (393 domestic, 61 foreign) equaling 431 recipients. A five-year distribution history of the vegetable crops is shown in the

following chart and in "Table 5: Five-Year Summary of NCRPIS Accession Orders by Crop" in the appendices. In summary, requests for accessions in the vegetable collections make up 17% of the total NCRPIS orders, and 80% of the vegetable collection requests are for germplasm from the cucurbit collections (*Cucumis* and *Cucurbita*). [Note: An order for 2021 *Cucumis melo* accessions for South Korea was shipped to APHIS on 15 December 2011 for issuance of the required Phytosanitary certificate, but APHIS did not complete the shipping process until 1 February 2012 – the order and order items are attributed to the 2012 NCRPIS stats.] Non Research Requests (NRR), i.e., home gardener requests, made up 67% of the requests for accessions in the NCRPIS vegetable collections (up 9% from 2011) even following the Station's one-time-only distribution policy for such requests. Whenever possible, commercial sources are suggested as alternative sources for cultivated varieties or to replace accessions that we know do not suit the intended use as stated by the requestor. It is not often that we supply seed samples for all accessions requested in the NRR orders, and of the 432 NRR vegetable requests received in 2012, 93 "whole" orders were cancelled, and individual items were cancelled on some of the NRR orders that were shipped.



Vegetable requests received in 2012 included disease evaluation, breeding for specific traits and disease resistances, evaluation of various cucurbits for use as root stocks, genetic and molecular studies, and to build the collections of the South Korea germplasm system.

Characterization and Taxonomy:

Digital images, and basic notes for taxonomic identification and accession characterization, were recorded during regeneration. Data for approximately 17 descriptors (primarily fruit descriptors) were recorded at harvest for *Cucumis* and *Cucurbita*. Plant habit, flowering dates, and life-cycle notes were recorded for *Daucus*. Images taken of vegetable accessions in 2012 will be loaded to GRIN.

(NOTE: Images are taken to document plant, leaf, flower, fruit, or root characteristics.)

The 2012 *Daucus* observation planting was to be the third and final planting in collaboration with Dr. David Spooner (USDA-ARS, University of Wisconsin, Madison, WI) for his work to develop a monograph for the genus *Daucus*. Seventy-five *Daucus* accessions (40 biennial, 35 annual) and nine allied Apiaceae species were transplanted into field plots to verify taxonomy, collect characterization data and herbarium specimens, and to capture digital images of plants, flowers, and foliage. Dr. Spooner visited Ames June 27 to 30 to assist with collecting data and herbarium specimens. Due to an early and extensive infestation of aster yellows causing significant distortion of plant characters and plant deaths, data collection on the accessions in the planting were abandoned at the end of June. Two herbarium specimens each of 83 accessions were collected at Dr. Spooner's request, and these specimens are being held by him in Madison, WI. Dr. Spooner wants a third year of descriptor data to add to the 2010 and 2011 data sets for comparative analyses, so the 2012 observation planting will be replanted in 2013.

Collecting descriptors and images on roots of accessions planted in the *Daucus* observation fields presented numerous challenges. We often found roots were distorted or stunted due to soil conditions. In order to capture root data and images, a wooden 8' x 3' x 24" box was constructed in the greenhouse and filled with sand. Seeds of ten accessions were sown in two rows each, seedlings were thinned to 20 per accession, and fertilized weekly with a commercial liquid fertilizer (NPK 20-10-20). Roots were allowed to grow until bolting initiated or up to 15 days before harvesting for characterization and imaging. Resulting roots were easily harvested from the sand beds without being distorted or stunted. The "sandbox" method worked so well, (especially for the very long, thin tap-root types) that a second sandbox was built allowing us to grow at least 60 accessions for root characterization each year. We will work through our backlog of Daucus accessions for which root data and images are lacking, focusing on accessions planted as part of the observation fields for Dr. Spooner's research.

Sandbox in Farm Greenhouse 3 used to grow *Daucus* for root notes and images.

Sample images of *Daucus* roots from sandbox plantings in greenhouse.

Taxonomic identities are reviewed and confirmed as each accession is regenerated or grown in observation plots. The 2012 re-identifications included three *Cucumis melo* re-identified to *C. sativus*, one *C. spp.* to *C. anguria* var. *longaculeatus*, one *C. spp*. to *C. metuliferus*, one *Daucus aureus* to *D. carota,* one *Cichorium endivia* to *C. intybus*, two *C. intybus* to *C. endivia*, and two *C. pumilum* to *C. calvum*. The Cichorium taxonomic changes were made based on unpublished data from work employing chloroplast and nuclear microsatellite markers to distinguish between species and varieties in the genus *Cichorium* as ongoing research associated with the Compositae Genome Project in Dr. Rick Kesseli's lab at the University of Massachusetts-Boston.

Evaluation/Utilization:

Dr. Charles Block (NCRPIS Pathologist) continues to screen all *Cucurbita* and *Cucumis* seedlings grown for regeneration for the presence of Squash Mosaic Virus, by using ELISA protocols before seedlings are transplanted to the field. Seedling screening has been done since 1993. He also visually inspects all cucurbit field plantings for disease during the growing season. Seed-borne diseases are of specific interest, with bacterial fruit blotch in *Cucumis melo* being of greatest concern. Phytosanitary issues have prevented the distribution of *Cucumis* germplasm to some countries. Please refer to the Plant Pathology Project section of this report for more information.

Publications/Posters:

K. R. Reitsma (Iowa State University, North Central Regional Plant Introduction Station, Ames, IA) is collaborating on a manuscript regarding evaluation of NPGS *Cucurbita* for Downy Mildew resistance with Ales Lebeda (Palacky University, Olomouc-Holice, Czech Republic) and Mark Widrlechner and Charlie Block (USDA-ARS, North Central Regional Plant Introduction Station, Ames, IA.)

The manuscript titled "Reassessment of Practical Species Identifications of the USDA *Daucus carota* Germplasm Collection: Morphological Data" by David Spooner

and Phil Simon (USDA-ARS, University of Wisconsin, Madison, WI) M. Widrlechner, K.R. Reitsma, D. Palmquist (USDA-ARS, Peoria, IL) was been submitted to Crop Science for publication April 2013.

Plans for 2013:

Regenerations:

In October 2012, 24 biennial *Daucus* accessions were planted in pots in the greenhouse for regeneration in field cages in the summer. Depending upon the status of the station's budget and resource allocations, we would like to regenerate approximately 75 *Cucumis* accessions, focusing on accessions that failed in 2012 due to Fusarium crown rot. We may also regenerate five *Cucurbita* accessions having low seed quantities. Regenerations of wild *Cucumis* species and hard-to-handle *Cucumis* will continue in the greenhouse as time, space, and other resources permit.

Germinations:

Viability tests will be performed on the 2012 cucurbit regeneration seed lots in April 2013 and on the 2012 *Daucus* regeneration seed lots in the summer of 2013. Ten-year germination testing of distribution lots will be done as resources allow.

Characterization:

As mentioned previously, the failed 2012 *Daucus* observation planting will be replanted for the summer of 2013. Accessions will be grown for characterization, taxonomic verification, and herbarium specimens. This plot will be in collaboration with Drs. David Spooner and Philipp Simon (USDA-ARS, University of Wisconsin, Madison, WI) to evaluate diversity in the genus *Daucus*. These data and images will be useful in Dr. Spooner's work to develop a monograph for the genus *Daucus*.

Review of accession passport data will continue on the cucurbit collections in preparation for assigning PI numbers to many of the Ames-numbered accessions in the collections (414 *Cucumis*, 91 *Cucurbita*, and 99 *Daucus*). Labeling embedded in digital images of these accessions will be updated with the new PI numbers before they are loaded to GRIN.

Evaluation:

Collaboration continues on improving the year-round cage and insect-pollinator program for regenerating vegetable crops.

The Plant Pathology Project will continue to collaborate in monitoring the effectiveness of the cage program in reducing the incidence of and/or delaying the transmission of Squash Mosaic Virus and other insect-vectored diseases of cucurbits. They will also continue the greenhouse survey of the *Cucumis melo* distribution lots for the presence of *Acidovorax avenae* ssp. *citrulli*.

H. Research Leader Activities (C. Gardner)

Administration and Leadership Activities:

C. Gardner administers the five-year project plan objectives for the USDA-ARS Plant Introduction Research Unit's two CRIS Projects, Plant Introduction Research and the Germplasm Enhancement of Maize (GEM) Project, and contributes to the

coordination and execution of activities which support those objectives. Gardner serves as the Coordinator of the Hatch-funded Multistate NC7 Project. In 2012, the five year project plan for the ARS CRIS projects were submitted and approved, and the renewal of Hatch NC007 Project for the next five years became official. Budgetary anomalies due to shifting Congressional and Agency priorities continue to command more time and resources. Because of delays in release of funds to the management unit, each year we deal with uncertainty and making timely decisions for work plans many taxa that require germination and vernalization treatments in the winter are challenging. This also led to conservative student labor hiring decisions, all of which impact regeneration and other activities. The GEM Project CRIS is being leveraged to support maize curatorial activities as well, and this cannot continue indefinitely.

About 5% of her time in 2012 was devoted to assisting GRIN-Global System development team members. International implementation of the GRIN-Global system is in progress, following the release of V1.0 in December, 2011, and focus is now directed to 'gap analysis' efforts with the DBMU and key GRIN users at the NPGS sites to ensure a smooth migrated to / implementation of the GRIN-Global System in the U.S. in the next 12 months.

Pete Cyr, our Software Applications and Network Systems Information Specialist, serves as the development lead for the Curator Tool and Business Tier. Other Ames personnel include Mark Millard, our maize curator who serves as systems analyst for the project; Lisa Burke, our seed storage manager who serves as a primary beta tester, and Candice Gardner. NCRPIS development efforts will be primarily devoted to this critically important project for another year. Together with personnel from the ARS Corvallis, OR, National Clonal Germplasm Repository, the ARS GRIN Database Management Unit (DBMU) personnel, National Program Leader (and Project PI) Peter Bretting, our Global Crop Diversity Trust and Bioversity partners, we look forward to maturation and NPGS deployment of the system.

Research Activities:
Graduate student Ivan Ayala-Diaz, a Fulbright Fellow from Colombia, will complete his Ph.D. research on *Thlaspi* and *Camelina* in 2013 under the guidance of Dr. Mark Westgate, ISU, and Dr. Gardner, and in collaboration with NCRPIS Oilseeds Curator, Dr. Laura Marek. This includes a Camelina mapping population developed in collaboration with Sustainable Oils, Montana (now Targeted Growth, Inc.).

Adam Vanous returned to ISU and startede a Ph.D. project which deals with phenomena associated with generating haploid and doubled haploid (DH) lines from exotic maize.

Andrew Smelser, GEM Project technician, is also working on an M.S. project evaluating the efficacy of the various races for haploid induction and subsequent doubling.

The RL has been very involved in the phenotyping / genotyping project for the inbred lines of the maize collection with Curator Mark Millard, USDA-ARS scientist Edward Buckler, Cornell Univ. scientist Maria Cinta Romay, and numerous colleagues. These efforts were submitted for publication (see below).

As an outcome of Vanous' MS project dealing with methods to double chromosome numbers of haploid lines, thousands of doubled haploid lines were generated from B73 and from Oh43. In 2012 we grew these lines for observation, curious about whether DH lines derived from an inbred line would vary. A significant number of lines showed phenotypic variation for morphology, plant and ear height, flowering date, and kernel traits. In 2013 a replicated, multi-location trial will be conducted of a subset of these lines. If the data shows that differences observed in 2012 are repeatable, a whole series of new questions may be generated about inherent variability in conventionally derived inbred lines, whether the haploid or induction processes are responsible for genetic or epigenetic changes, etc.

Presentations and Publications:

In 2012, outreach efforts by C. Gardner included invited presentation at Kansas State University, the Elmer Heyne Memorial, Lecture; a presentation at the Am. Phytopathological Society meetings about the GRIN-Global System and its development; two oral presentation at the 2012 CSSA meetings (GRIN-Global System, and the collaboration research resulting from the diversity analysis of the maize inbred collection; an oral presentation at the 2012 Illinois Corn Breeders' School on capturing useful alleles from diverse maize.

Berhow, M.A., Polat, U., Glinski, J.A., Glensk, M., Vaughn, S.F., Isbell, T., Ayala-Diaz, I., Marek, L., Gardner, C.A. Optimized analysis and quantification of glucosinolates from Camelina sativa seeds by reversed-phase liquid chromatography. Submitted to Industrial Crops and Products. 2012.

Romay, M.C., Millard, M.J., Glaubitz, J.C., Peiffer, J.A., Swarts, K.L., Casstevens, T.M., Elshire, R.J., Acharya, C.B., Mitchell, S.E., Flint-Garcia, S., McMullen, M.D., Holland, J.B., Buckler IV, E.S., and Gardner, C.A. Comprehensive genotyping of the US national maize inbred seed bank: genetic structure, diversity, and genome-wide association studies of a global treasure. Submitted to Genome Biology. 2012.

Year 2012 Table 1 **NCRPIS Accessions (Accs), Acquired, Available**

01/01/2012 to 12/31/2012

CURATOR	GENUS_CROP	Number Accs	Number Accs Acquired	Percent Acquired	Number Available	Percent Available	Percent Avail Last Year
Barney	NC7-medicinals	499	8	2	366	73	71
	NC7-mints	174	18	10	127	73	69
	NC7-ornamentals	834	51	6	530	64	47
	Total:	**1507**	**77**	**5**	**1023**	**68**	**52**
Brenner	NC7-amaranth	3345	1	0	3197	96	95
	NC7-celosia	56	0	0	35	63	60
	NC7-echinochloa	306	0	0	269	88	88
	NC7-grasses	130	3	2	82	63	65
	NC7-legumes	247	1	0	114	46	46
	NC7-melilotus	1002	0	0	765	76	77
	NC7-panicum	934	1	0	910	97	98
	NC7-perilla	25	0	0	22	88	92
	NC7-portulaca	8	7	88	6	75	0
	NC7-quinoa	357	2	1	262	73	75
	NC7-setaria	1014	0	0	940	93	93
	NC7-spinach	410	1	0	398	97	97
	NC7-umbels	1151	7	1	711	62	61
	Total:	**8985**	**23**	**0**	**7711**	**86**	**86**
Carstens	NC7-woody.landscape	1709	91	5	766	45	0
	Total:	**1709**	**91**	**5**	**766**	**45**	**52**
Marek	NC7-asters	384	20	5	87	23	24
	NC7-brassica	2012	3	0	1868	93	92
	NC7-brassica.pvp	6	0	0	0	0	0
	NC7-crucifers	1219	24	2	1028	84	83
	NC7-crucifers.pvp	1	0	0	0	0	0
	NC7-cuphea	639	0	0	513	80	80
	NC7-euphorbia	209	1	0	87	42	42
	NC7-flax	2834	0	0	2823	100	100
	NC7-flax.wilds	134	17	13	94	70	79
	NC7-sun.cults	1855	27	1	1734	93	95
	NC7-sun.wilds.ann	1405	31	2	1326	94	96
	NC7-sun.wilds.per	848	15	2	626	74	68
	NC7-sun.wilds.sp	2	0	0	0	0	50
	Total:	**11548**	**138**	**1**	**10186**	**88**	**88**
Millard	NC7-corn.kin	100	1	1	6	6	6
	NC7-maize.gems	184	8	4	169	92	61
	NC7-maize.inb	2526	8	0	1975	78	77
	NC7-maize.pop	17089	2	0	11220	66	65
	NC7-maize.pvp	341	21	6	300	88	86
	NC7-maize.wilds	439	0	0	89	20	20
	NC7-zea.totals	20579	39	0	13753	67	66
	Total:	**20679**	**40**	**0**	**13759**	**67**	**66**
Reitsma	NC7-chicory	279	2	1	216	77	78
	NC7-cucumis.cucs	1379	0	0	1311	95	95
	NC7-cucumis.melo	3202	2	0	2296	72	71
	NC7-cucumis.wilds	321	0	0	174	54	54
	NC7-cucurbita	976	2	0	770	79	79
	NC7-daucus	1369	95	7	1054	77	80
	NC7-ocimum	98	0	0	91	93	93
	NC7-parsnips	71	0	0	51	72	72
	Total:	**7695**	**101**	**1**	**5963**	**77**	**78**
NCRPIS Total:		**52123**	**470**	**1**	**38385**	**74**	**75**

Year 2012 Table 2 **NCRPIS Accessions (Accs) Germinated, Regenerated, Made Available, Backed Up**

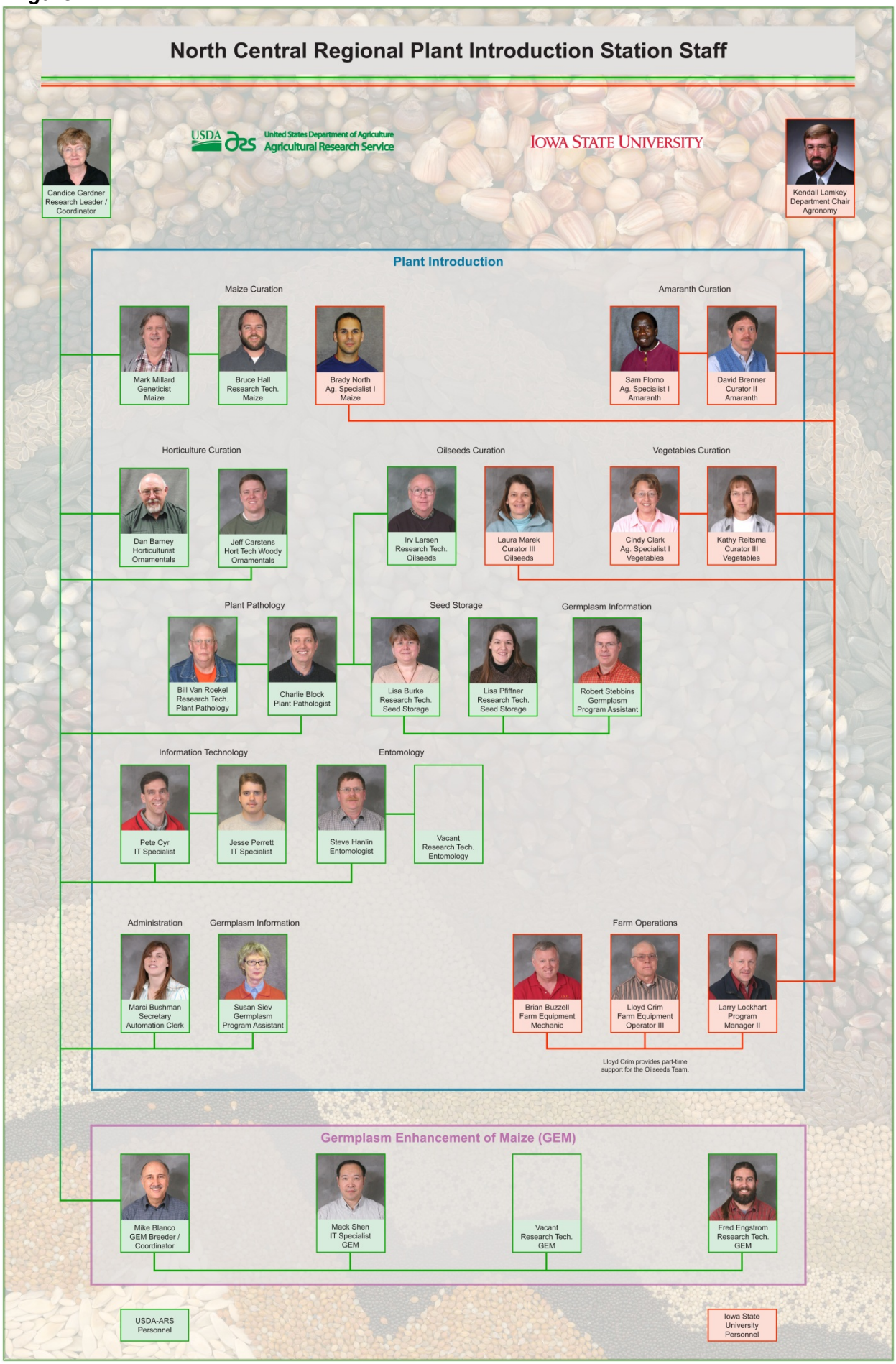
01/01/2012 to 12/31/2012

CURATOR	GENUS_CROP	# Accs	# Accs Germed	% Accs Germed	# Attempted Regen	# Harvested Regen	# Perm Perennial	# Accs Made Avail	# Accs Backed Up for YR	Total # Accs Backed Up	% Accs Backed Up
Barney	NC7-medicinals	499	12	2	0	0	0	15	65	384	77
	NC7-mints	174	6	3	0	1	0	19	27	142	82
	NC7-ornamentals	834	130	16	0	18	0	40	67	533	64
	Total:	**1507**	**148**	**10**	**0**	**19**	**0**	**74**	**159**	**1059**	**70**
Brenner	NC7-amaranth	3345	1	0	13	11	0	5	4	3236	97
	NC7-celosia	56	1	2	1	0	0	1	1	35	63
	NC7-echinochloa	306	0	0	17	13	0	0	4	266	87
	NC7-grasses	130	0	0	1	0	0	0	0	88	68
	NC7-legumes	247	0	0	11	2	0	0	0	176	71
	NC7-melilotus	1002	1	0	33	17	0	0	0	843	84
	NC7-panicum	934	0	0	1	1	0	0	0	911	98
	NC7-perilla	25	22	88	4	3	0	0	0	23	92
	NC7-portulaca	8	6	75	1	0	0	6	3	6	75
	NC7-quinoa	357	4	1	28	27	0	4	20	290	81
	NC7-setaria	1014	0	0	8	3	0	0	0	968	95
	NC7-spinach	410	2	0	2	32	0	8	3	396	97
	NC7-umbels	1151	23	2	50	33	0	25	26	718	62
	Total:	**8985**	**60**	**1**	**170**	**142**	**0**	**49**	**61**	**7956**	**89**
Carstens	NC7-woody.landscape	1709	78	5	33	83	409	98	50	657	38
	Total:	**1709**	**78**	**5**	**33**	**83**	**409**	**98**	**50**	**657**	**38**
Marek	NC7-asters	384	0	0	0	0	0	0	0	119	31
	NC7-brassica	2012	16	1	19	16	0	16	4	1982	99
	NC7-brassica.pvp	6	0	0	0	0	0	0	0	6	100
	NC7-crucifers	1219	27	2	31	26	1	47	30	1048	86
	NC7-crucifers.pvp	1	0	0	0	0	0	0	0	1	100
	NC7-cuphea	639	2	0	0	0	0	3	0	583	91
	NC7-euphorbia	209	0	0	0	0	0	0	0	85	41
	NC7-flax	2834	0	0	0	0	0	1	122	2832	100
	NC7-flax.wilds	134	1	1	0	0	0	1	0	109	81
	NC7-sun.cults	1855	59	3	78	79	0	59	33	1783	96
	NC7-sun.wilds.ann	1405	13	1	25	18	0	16	38	1347	96
	NC7-sun.wilds.per	848	32	4	52	46	13	66	81	622	73
	NC7-sun.wilds.sp	2	0	0	0	0	0	0	0	0	0
	Total:	**11548**	**150**	**1**	**205**	**185**	**14**	**209**	**308**	**10517**	**91**
Millard	NC7-corn.kin	100	0	0	0	1	1	0	1	10	10
	NC7-maize.gems	184	31	17	11	11	0	69	0	71	39
	NC7-maize.inb	2526	485	19	74	119	0	108	35	1549	61
	NC7-maize.pop	17089	136	1	62	210	0	145	22	13117	77
	NC7-maize.pvp	341	91	27	68	68	0	60	44	341	100
	NC7-maize.wilds	439	0	0	0	1	0	0	0	44	10
	NC7-zea.totals	20579	743	4	215	409	0	382	101	15122	73
	Total:	**20679**	**743**	**4**	**215**	**410**	**1**	**382**	**102**	**15132**	**73**
Reitsma	NC7-chicory	279	0	0	0	0	0	0	0	244	87
	NC7-cucumis.cucs	1379	12	1	30	16	0	12	12	1309	95
	NC7-cucumis.melo	3202	20	1	54	40	0	18	8	2578	81
	NC7-cucumis.wilds	321	6	2	13	4	0	7	2	175	55
	NC7-cucurbita	976	13	1	12	12	0	14	10	818	84
	NC7-daucus	1369	56	4	25	41	0	53	61	1105	81
	NC7-ocimum	98	88	90	2	2	0	1	26	91	93
	NC7-parsnips	71	0	0	0	0	0	0	0	48	68
	Total:	**7695**	**195**	**3**	**136**	**115**	**0**	**105**	**119**	**6368**	**83**
NCRPIS Total:		**52123**	**1374**	**3**	**759**	**954**	**424**	**917**	**799**	**41689**	**80**

Year 2012 Table 3			External NCRPIS Distributions - Includes both DI (research and education) and NR (home gardner) order types											
01/01/2012 to 12/31/2012			External Domestic Distributions				Foreign Distributions				External Domestic and Foreign Distributions			
CURATOR	GENUS_CROP	Number Accs in Collection	Number Accs	Number Orders	Number Recipients	Number Items	Number Accs	Number Orders	Number Recipients	Number Items	Number Accs	Number Orders	Number Recipients	Number Items
Barney	NC7-medicinals	499	86	28	25	140	22	4	4	26	97	32	29	166
	NC7-mints	174	28	26	26	43	38	3	3	38	58	29	29	81
	NC7-ornamentals	834	65	43	42	84	22	6	6	22	86	49	48	106
	Total:	**1507**	**179**	**81**	**76**	**267**	**82**	**12**	**12**	**86**	**241**	**93**	**88**	**353**
Brenner	NC7-amaranth	3345	382	54	52	703	199	18	18	266	512	72	70	969
	NC7-celosia	56	6	7	7	9	8	4	4	9	12	11	11	18
	NC7-echinochloa	306	31	5	5	31	5	3	3	6	34	8	8	37
	NC7-grasses	130	4	7	7	8	2	1	1	2	6	8	8	10
	NC7-legumes	247	19	4	4	20	2	1	1	2	20	5	5	22
	NC7-melilotus	1002	140	27	24	185	99	1	1	99	186	28	25	284
	NC7-panicum	934	33	10	10	47	9	3	3	9	39	13	13	56
	NC7-perilla	25	7	7	7	11	23	2	2	27	23	9	9	38
	NC7-portulaca	8	3	2	2	3	0	0	0	0	3	2	2	3
	NC7-quinoa	357	193	76	72	465	196	13	12	233	236	89	84	698
	NC7-setaria	1014	811	16	14	901	51	8	8	73	813	24	22	974
	NC7-spinach	410	111	15	14	129	190	0	0	245	239	15	14	374
	NC7-umbels	1151	83	72	70	120	452	12	11	619	477	84	81	739
	Total:	**8985**	**1823**	**254**	**239**	**2632**	**1236**	**56**	**52**	**1590**	**2600**	**310**	**291**	**4222**
Carstens	NC7-woody.landscape	1709	108	41	38	139	26	6	5	27	131	47	43	166
	Total:	**1709**	**108**	**41**	**38**	**139**	**26**	**6**	**5**	**27**	**131**	**47**	**43**	**166**
Marek	NC7-asters	384	24	15	15	29	11	2	2	11	28	17	17	40
	NC7-brassica.pvp	6	1	1	1	1	0	0	0	0	1	1	1	1
	NC7-brassica	2012	1149	58	57	1635	1010	28	27	1200	1525	86	84	2835
	NC7-crucifers	1219	409	54	50	701	564	19	17	839	668	73	67	1540
	NC7-crucifers.pvp	1	0	0	0	0	0	0	0	0	0	0	0	0
	NC7-cuphea	639	55	14	14	73	19	5	4	19	68	19	18	92
	NC7-euphorbia	209	10	3	3	11	0	0	0	0	10	3	3	11
	NC7-flax	2834	11	14	14	19	1500	2	2	1501	1503	16	16	1520
	NC7-flax.wilds	134	7	4	4	7	5	3	3	6	12	7	7	13
	NC7-sun.cults	1855	792	65	64	1055	1454	21	20	2891	1522	86	84	3946
	NC7-sun.wilds.ann	1405	405	42	35	525	1116	17	17	1623	1168	59	52	2148
	NC7-sun.wilds.per	848	98	38	36	136	378	9	8	534	395	47	44	670
	NC7-sun.wilds.sp	2	0	0	0	0	0	0	0	0	0	0	0	0
	Total:	**11548**	**2961**	**244**	**224**	**4192**	**6057**	**81**	**69**	**8624**	**6900**	**325**	**293**	**12816**
Millard	NC7-corn.kin	100	6	7	7	19	3	2	2	4	6	9	9	23
	NC7-maize.gems	184	176	31	23	627	43	9	8	62	176	40	31	689
	NC7-maize.inb	2526	2021	252	197	7618	700	59	53	1155	2027	311	250	8773
	NC7-maize.pop	17089	1545	346	309	2457	379	29	26	446	1763	375	335	2903
	NC7-maize.pvp	341	303	234	138	5011	294	35	30	1726	303	269	168	6737
	NC7-maize.wilds	439	177	65	59	536	17	11	10	19	177	76	69	555
	NC7-zea.totals	20579	4222	708	527	16249	1433	98	88	3408	4446	806	615	19657
	Total:	**20679**	**4228**	**713**	**532**	**16268**	**1436**	**100**	**88**	**3412**	**4452**	**813**	**620**	**19680**
Reitsma	NC7-chicory	279	41	24	21	83	90	2	2	94	115	26	23	177
	NC7-cucumis.cucs	1379	268	123	123	435	844	27	24	1233	909	150	147	1668
	NC7-cucumis.melo	3202	455	122	119	631	1983	22	21	2572	2076	144	140	3203
	NC7-cucumis.wilds	321	40	17	16	50	74	12	10	123	86	29	26	173
	NC7-cucurbita	976	409	127	126	634	480	13	13	671	625	140	139	1305
	NC7-daucus	1369	451	118	116	652	150	4	4	150	569	122	120	802
	NC7-ocimum	98	91	65	64	337	78	4	4	183	91	69	68	520
	NC7-parsnips	71	16	15	15	30	0	0	0	0	16	15	15	30
	Total:	**7695**	**1771**	**393**	**378**	**2852**	**3699**	**61**	**53**	**5026**	**4487**	**454**	**431**	**7878**
NCRPIS Total:		**52123**	**11070**	**1341**	**1095**	**26350**	**12536**	**291**	**249**	**18765**	**18811**	**1632**	**1344**	**45115**

Year 2012 Table 4		NCRPIS Accessions (Accs) Observations (Obs) in GRIN, Images in GRIN								
01/01/2012 to 12/31/2012		Number Accs in Collection	Number of Accs Obs Trials	Number Obs in GRIN for Year	Number Acc Obs in GRIN for Year	Number Acc Obs In GRIN Last Year	Number Acc Obs in GRIN (all years)	Number of Accs Imaged	Number Acc Images in GRIN for Year	Number Acc Images in GRIN (all years)
CURATOR	GENUS_CROP									
Barney	NC7-medicinals	499	0	0	0	18	307	0	1	289
	NC7-mints	174	0	3	1	4	28	1	2	49
	NC7-ornamentals	834	0	2	2	112	219	2	3	278
	Total:	**1507**	**0**	**5**	**3**	**134**	**554**	**3**	**6**	**616**
Brenner	NC7-amaranth	3345	97	2060	340	3341	3343	112	115	875
	NC7-celosia	56	1	128	56	5	56	0	3	18
	NC7-echinochloa	306	1	12	11	16	303	5	11	56
	NC7-grasses	130	0	4	4	0	21	2	6	25
	NC7-legumes	247	0	524	244	4	244	8	18	29
	NC7-melilotus	1002	6	68	67	92	993	2	64	168
	NC7-panicum	934	18	20	19	39	929	18	21	125
	NC7-perilla	25	0	72	25	6	25	1	2	8
	NC7-portulaca	8	1	0	0	0	5	0	3	3
	NC7-quinoa	357	5	848	350	16	354	2	21	121
	NC7-setaria	1014	27	19	19	121	1003	19	19	154
	NC7-spinach	410	0	135	126	9	410	1	1	16
	NC7-umbels	1151	1	2677	1137	56	1137	25	40	188
	Total:	**8985**	**157**	**6567**	**2398**	**3705**	**8823**	**195**	**324**	**1786**
Carstens	NC7-woody.landscape	1709	9	0	0	150	721	132	146	763
	Total:	**1709**	**9**	**0**	**0**	**150**	**721**	**132**	**146**	**763**
Marek	NC7-asters	384	0	0	0	0	4	0	2	25
	NC7-brassica	2012	10	0	0	0	1901	3	0	333
	NC7-brassica.pvp	6	0	0	0	0	0	0	0	0
	NC7-crucifers	1219	0	0	0	0	821	30	0	340
	NC7-crucifers.pvp	1	0	0	0	0	1	0	0	0
	NC7-cuphea	639	0	5	3	0	368	0	0	14
	NC7-euphorbia	209	0	0	0	0	0	0	0	0
	NC7-flax	2834	0	4	1	1	2826	0	0	1
	NC7-flax.wilds	134	0	0	0	0	82	0	3	17
	NC7-sun.cults	1855	8	2372	70	55	1750	95	64	198
	NC7-sun.wilds.ann	1405	7	140	13	15	1284	17	3	69
	NC7-sun.wilds.per	848	162	391	38	62	574	81	5	116
	NC7-sun.wilds.sp	2	0	0	0	0	0	0	0	0
	Total:	**11548**	**187**	**2912**	**125**	**133**	**9611**	**226**	**77**	**1113**
Millard	NC7-corn.kin	100	0	0	0	0	0	64	0	0
	NC7-maize.gems	184	74	484	109	8	134	69	0	103
	NC7-maize.inb	2526	268	5320	1578	2099	2354	150	0	589
	NC7-maize.pop	17089	0	5738	3172	427	14483	111	3	4206
	NC7-maize.pvp	341	107	1670	337	274	339	99	0	219
	NC7-maize.wilds	439	0	0	0	0	264	63	0	107
	NC7-zea.totals	20579	449	13212	5196	2808	17574	492	3	5224
	Total:	**20679**	**449**	**13212**	**5196**	**2808**	**17574**	**556**	**3**	**5224**
Reitsma	NC7-chicory	279	0	2	2	65	276	2	2	256
	NC7-cucumis.cucs	1379	0	6	6	18	1374	16	6	886
	NC7-cucumis.melo	3202	0	28	20	15	3117	39	20	496
	NC7-cucumis.wilds	321	0	0	0	12	287	6	7	61
	NC7-cucurbita	976	0	22	16	10	970	13	16	114
	NC7-daucus	1369	42	1291	264	219	1169	128	263	415
	NC7-ocimum	98	0	0	0	0	98	2	0	0
	NC7-parsnips	71	0	0	0	0	70	0	0	0
	Total:	**7695**	**42**	**1349**	**308**	**339**	**7361**	**206**	**314**	**2228**
NCRPIS Total:		**52123**	**844**	**24045**	**8030**	**7269**	**44644**	**1318**	**870**	**11730**

Figure 1


North Central Regional Plant Introduction Station Staff
USDA United States Department of Agriculture Agricultural Research Service
IOWA STATE UNIVERSITY
Candice Gardner Research Leader / Coordinator
Kendall Lamkey Department Chair Agronomy
Plant Introduction
Maize Curation
Mark Millard Geneticist Maize
Bruce Hall Research Tech. Maize
Brady North Ag. Specialist I Maize
Amaranth Curation
Sam Flomo Ag. Specialist I Amaranth
David Brenner Curator II Amaranth
Horticulture Curation
Dan Barney Horticulturist Ornamentals
Jeff Carstens Hort Tech Woody Ornamentals
Oilseeds Curation
Irv Larsen Research Tech. Oilseeds
Laura Marek Curator III Oilseeds
Vegetables Curation
Cindy Clark Ag. Specialist I Vegetables
Kathy Reitsma Curator III Vegetables
Plant Pathology
Bill Van Roekel Research Tech. Plant Pathology
Charlie Block Plant Pathologist
Seed Storage
Lisa Burke Research Tech. Seed Storage
Lisa Pfiffner Research Tech. Seed Storage
Germplasm Information
Robert Stebbins Germplasm Program Assistant
Information Technology
Pete Cyr IT Specialist
Jesse Perrett IT Specialist
Entomology
Steve Hanlin Entomologist
Vacant Research Tech. Entomology
Administration
Marci Bushman Secretary Automation Clerk
Germplasm Information
Susan Siev Germplasm Program Assistant
Farm Operations
Brian Buzzell Farm Equipment Mechanic
Lloyd Crim Farm Equipment Operator III
Larry Lockhart Program Manager II
Lloyd Crim provides part-time support for the Oilseeds Team.
Germplasm Enhancement of Maize (GEM)
Mike Blanco GEM Breeder / Coordinator
Mack Shen IT Specialist GEM
Vacant Research Tech. GEM
Fred Engstrom Research Tech. GEM
USDA-ARS Personnel
Iowa State University Personnel