North Central Regional Plant Introduction Station

2011

NCRPIS

Providing Plant Genetic Resources
for Agricultural Success
AMES, IOWA

NC7 Annual Report
January 1 – December 31 2011


Sunflowers


Germinations


Vegetables


Seed Storage


Brassica


Corn


Pollinations


Horticulture


GEM


Amaranth

USDA
United States Department of Agriculture
Agricultural Research Service

Iowa State University
of Science and Technology

NCRPIS ANNUAL REPORT - 2011

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NC-7 ANNUAL REPORT, JANUARY 1 - DECEMBER 31, 2011

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, 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	D. Francis
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; R. Hall	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	L. Chandler
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 - June, 2011– June, 2012:

Early retirements:
- Sharon McClurg, USDA-ARS Agr, Research Science Technician, 10/1/ 2011
- Dr. Mark Widrlechner, USDA-ARS Horticulturist, 9/1/ 2011
- Dave Kovach, USDA-ARS Agronomist, 12/31/2011

Other departures:
- Trent Moore, ISU Agricultural Research Specialist, September, 2011
- Rachael Beyer, USDA-ARS Germplasm Program Assistant, August, 2011
- Ashley Hall, USDA-ARS limited appointment Agr. Research Science Technician, December, 2011
- The Vice-Lively maize curation technician and Vice-McClurg entomology technician positions will remain vacant until the hiring process is authorized by ARS.

New Hires:
- Ashley Hall, temporary USDA-ARS Agricultural Research Science Technician, Maize, January, 2011
- Susan Siev, USDA-ARS Germplasm Program Assistant, August , 2011
- Brady North, ISU Agricultural Research Specialist, May, 2012
- Vivian Bernau, temporary USDA-ARS Agricultural Research Science Technician, Maize, June, 2012
- Re-directed Horticulturist Dr. Dan Barney filled the Vice-Widrlechner position in June, 2012, following closure of the Palmer, AK genebank

Management of Federal STEP (Student Temporary Employees):
USDA-ARS resources provided for 15 student labor or temporary positions in 2011. We limited equipment purchases and focused on increasing the availability of the collections and quality of associated information. The STEP 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, Rachael Beyer and Susan Siev managed the administrative aspects of all STEP hires, with support and guidance by Ames ARS HR Specialist Kim Grandon and Admin. Officer Carol Moran.

Budget:
Declining purchasing power of budgets and rising salary, energy and operational expenses continue to erode our ability to support core functions. The ARS CRIS project was funded at $2,158,781 in FY11, of which 92% was devoted to salaries and wages. In FY12, personnel costs made up 87% of the $2,113,364 allocated funding, prior to rescissions. Further reductions in funding will force a reduction in student hiring, necessary for executing our genebank's mission.

In FY10-11, Hatch funds ($522,980) were devoted to the salaries of our nine ISU staff and 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, re-covering and reglazing of Greenhouse #3 was completed, supported by Federal Hatch funds. The HVAC equipment in the Germplasm Enhancement of Maize (GEM) work area and technician offices was updated with high efficiency units. An improved cage furrow opener was designed and constructed. In FY12, we plan to re-cover two additional greenhouses.

Equipment:
Major purchases included 65 7×7×20 cage screens as part of ongoing investment in converting all legacy 5' tall cages to the 7' style, which offers advantages for plant management and improved ergonomics for workers in the cages.

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

(Part IV. summarizes the accomplishments and progress for calendar year 2011 presented in greater detail in the individual staff reports in the document.)

Acquisition and Documentation Highlights:
In 2011, (Appendix Table 1) 485 new accessions were acquired, nearly 1.0% of the previous collection holdings. Of these, 262 were received from within the NPGS through exploration and transfer. This compared with 516 new accessions in 2010, 521 in 2009, 564 in 2008, and 450 in 2007.

Newly acquired germplasm included: 85 accessions of ornamentals primarily of *Fraxinus* from New York, Pennsylvania and Albania, and from donations by scientists from North Dakota State University, Ohio State University, and USDA-ARS researchers at Corvallis, OR; wild populations of *Aronia* and of *Gymnocladus* (Kentucky coffeetree); 111 oilseed accessions including 38 accessions of cultivated *Helianthus* from the National Center for Genetic Resources Preservation (NCGRP) with expired Crop Science Registration (CSR), and 17 accessions of wild *Helianthus*; 180 *Zea mays*.

Other accessions received with expired PVP certificates from the NCGRP include five *Brassica napus*, one *Foeniculum vulgare*, and 66 *Zea mays*. The rest of the new 180 maize accessions include 54 GEM releases, and 51 inbred lines.

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 208 accessions in 2011. Taxonomic re-identification was completed for 51 accessions; 162 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 2011, 717 accessions were newly grown for regeneration and 963 were harvested, as compared to 1,096 accessions grown for regeneration and 1,017 harvested in 2008. An additional 73 perennials are growing in permanent plantings. About 1,132 accessions were made available to the public. Accessions backed up at the NCGRP in Ft. Collins in 2011 numbered 792, compared with 2,388 in 2010 and 1,848 in 2009. Backup at the NCGRP increased by 1% from 2010, to 80% of the NCRPIS collections (Appendix Table 2). Overall collection availability is 75%, despite 5% growth in collection size since 2006. An additional 354 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 36 maize accessions. GEM Project Coordinator Michael Blanco provided resources in Puerto Rico to increase 5 expired PVP inbreds, as the maize curation project did not have the resources for a winter nursery in 2011.

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

Distribution:
2011 external distributions included 38,402 items of 18,634 unique accessions to fulfill 1,501 orders from 1,180 requestors. This compares with 2010 distribution 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 45% were

distributed internationally and 55% to domestic researchers, a huge shift from the 28% sent internationally in 2010 (Appendix Table 3A). A detailed listing of distributions by site crop can be found in Appendix Table 5. 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 always larger than for other crops. An additional 8,649 items were distributed within the NCRPIS for all internal genebank activities (Appendix Table 3B).

Curator	Collection Size 2011	% of Total Collections	% of 2011 Distributions	% of 2010 Distributions
Brenner	8963	17	23	12
Marek	11406	22	20	23
Medicinals	498	1	1	1
Millard	20639	40	34	44
Reitsma	7613	15	20	19
Widrlechner	2602	5	2	1
Totals	**51,721**	**100**	**100**	**100**

Research demand for our plant genetic resources collections continues to be very high; requests for biofuel applications and health and nutrition contribute increasingly to these increases, as well as for basic research applications, disease and insect resistance, photoperiod response, and an array of performance traits. Demand for *Zea mays*, *Helianthus*, Brassicaceae, and *Daucus* for evaluation and characterization were particularly high.

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 2011, the NCRPIS utilized 7,570 accessions for internal observation, evaluation and characterization for a wide array of descriptor information, viability testing, pathology tests and back up (Appendix Table 3B). About 2,600 of these were for the maize inbred phenotyping / genotyping effort.

About 40,200 observations associated with 7,266 accessions (Appendix Table 4) were entered in the GRIN database (http://www.ars.grin.gov/npgs/), more than double the number of observations entered in 2010. A total of 1,019 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. 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); however, P. Cyr has spent about 25% of his time advising system administrations in their international implementation efforts.

The Database Management Unit (DBMU) in Beltsville, MD hosts the GRIN system and has the lead responsibility for NPGS implementation. 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 and occasional beta tester. 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. Together with our international partners, we work to accomplish ambitious project objectives.

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

Germplasm's Viability and Health:
Over 2,020, or 4% of the NCRPIS collections, were tested for viability in 2011, significantly fewer than in prior years due to the need to direct student labor resources to other projects and the consequent labor constraints (Appendix Table 2). In order to realistically assess the condition of the NCRPIS accessions, effort will be devoted in 2012 to analyzing the proportion of the various crop collections that have been tested for viability within 5 years, 5-10 year, and greater than 10 year increments. It is important to devote resources to those species with relatively shorter shelf life. 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 GRIN that differentiates simple viability from 'pure live seed.' Dormant seeds that do not readily germinate should be considered in the context of accession viability.

The progress of after-ripening in *Calendula* was documented and published in order to better understand loss of seed dormancy in cold storage over time. Use of a thermal gradient table enabled D. Kovach to conduct a series of experiments comparing controlled temperature, light and humidity conditions to establish appropriate seed germination testing protocols for various crops. The technology also has been used by graduate student Ivan Ayala Diaz in his studies of *Thlaspi* and *Camelina*. Mr. Ayala is also evaluating stand establishment of pennycress under different planting-depth regimens.

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; 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. 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 published research findings comparing the ability of various PCR primer sets to detect the presence 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 379 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.

The staff continues to compare use of solid 'fondant' sugar with corn syrup for feeding the honey bees. While fondant sugar use decreases labor needs, honeybees cannot store this sugar as a resource for winter. During the summer months, food source did not impact nucleus hive strength. It is necessary to use corn syrup feed in the early spring to dispense medication and in the late summer to enable the bees to build honey stores for overwinter survival.

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 233 lines from 2001-2011, 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 400 DH lines will be jointly released by USDA-ARS and ISU in 2012.

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 331 visitors toured the NCRPIS during 2011, including a television film crew from Brazil's TV Globo network and local Congressional office staffers. 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 collection development needs. Crop collections for biofuels and medicinal/nutriceutical applications need to be enhanced; wise selection of targets for these efforts requires use of complex and varied sources of information. Climate

change is forcing researchers to renew efforts to identify superior forage cultivars as well, and interest has increased in collections of suitable species.

In 2011, our staff participated in collection expeditions that acquired *Fraxinus* and other ornamentals from Pennsylvania and New York. 2012 collecting efforts will be targeted to expand the *Fraxinus* 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; and *Helianthus* from the Southwestern US.

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) focus on *Daucus* characterization and taxonomy in 2009 - 2012. A major effort to phenotypically and genomically characterize the entire maize inbred collection was conducted in 2010-2011, and data analysis and publication is underway. 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 phenotype the *Camelina* and *Thlaspi* collections, and to assess their genetic diversity. 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. Please see Appendix Table 6 for a summary of the various CSREES (now NIFA) regions' order history, illustrating the demand for plant genetic resources to support research and educational activities. NC7 Region researchers typically account for nearly half of domestic plant germplasm distributions. 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.

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 20 sites involved in the NPGS; 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 of 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 2011 Annual Meeting include the following (from the meeting minutes):

- The 2011 RTAC meeting was hosted by Mike Stamm and Kansas State University 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.
- Development of the next five year plan for the NC7 project to focus on germplasm research accomplishments and impacts.
- The NC7 Committee Members recommended that the Plant Introduction Station leadership investigate the possibility of establishing cooperative agreements with key industry partners to support the on-going costs associated with filling requests for accessions from recently expired PVPs.
- Consideration should be given to increase internal (within each state) outreach for the Plant Introduction Station.

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 supervised or conducted 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 2011, 44 applications for hourly employment were received and reviewed. There were 28 interviews, resulting in 20 new or returning hourly employees hired. Currently there are Biological Science Aides (13.9 FTE) 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 project.

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 electrical upgrades to Greenhouse #3
2. Removed and replaced ceiling and light fixtures in farm conference room. Light fixtures were upgraded to more efficient T-8 type.
3. Designed and constructed a new improved cage furrow opener that mounts to the skidsteer.
4. Updated HVAC in GEM workroom and conference room with high efficiency Fujitsu units.

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

1. Z-turn mower
2. Sixty-five 7×7×20 Cage Screens
3. Skidsteer trencher
4. Saw Stop Safety Saw

Tours:
This past year, we organized and conducted 9 tours. There were approximately 331 visitors to the NCRPIS during 2011.

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 has been acting as the first-line of support for NCRPIS during 2011. Jesse is supervised by Pete Cyr, who has been managing a 4 year project to rewrite the GRIN Germplasm Management System. The following list outlines the progress made by the IT team during 2011 at NCRPIS.

Equipment:
As of December 2011 NCRPIS has 69 workstations installed for use by permanent staff members and part-time temporary student help. In 2011, 4 Dell Optiplex 745 and 755 workstations were deployed to replace aging equipment on curatorial staff desktops. Where possible, the displaced computers were re-commissioned for light duty work in other areas of NCRPIS.

The fileserver used for shared file storage was upgraded to Microsoft Windows Server 2008 R2 in order to provide enhanced search capabilities and performance. The new operating system was deployed on a newer server with more memory in order to allow the use of the 64 bit operating system. The drives for the file server were also upgraded to larger and faster drives in order to increase available space, performance, and utility.

A new camera system was installed allowing high resolution pictures of slides captured using an existing microscope in the germination lab. The processors, memory, and video cards on all four imaging room computers were upgraded in order to enhance performance. Twenty-five desktop and laptop computers received 4GB memory upgrades to improve speed and reliability. Three servers received memory upgrades to 8 GB. Installation and configuration of a new Cisco Adaptive Security Appliance 5510 was completed. New memory and an operating system upgrade were installed on the firewall to enhance performance and security. In conjunction with the firewall upgrade, the type of security provided to internal network users was enhanced and network address translation was implemented to protect the internal network users from attack. Forty-one pieces of obsolete equipment were transferred to excess property at the National Center for Animal Health. Installed, and configured two new lower cost Plustek scanners for life-cycle replacement. Implemented five used tablet computers (excess property acquired) for use in field data collection. One Allegro MX was purchased and implemented in order to improve field data collection.

Software:
Workstations at NCRPIS are operated on a combination of MS Windows 7, and Windows XP with Service Pack 3 installed for increased security and reliability. Frequent updates to anti-virus definitions and anti spy-ware definitions in

conjunction with regular full system scans help to ensure they remain free of vulnerabilities.

During 2011 all workstations and servers at NCRPIS received security updates from Microsoft every month (on the second Tuesday of the month). 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.

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 were restructured to allow the automatic mapping of shared drives and printers. All but a few select machines were upgraded to Windows 7 for desktops and laptops, and Windows Server 2008 R2 for Servers. A new internal Microsoft Server 2008 R2 DNS Server was set up in order to support the use of network address translation on the new firewall and to allow for name resolution of internal computers. All users were migrated to a new cloud based email system that replaced the old ARSNet email system.

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

Plans for 2012:
Relocate the servers and reconfigure the racks to make the best use of a new physical location within the NCRPIS.

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

Complete all Windows 7 and Windows Server 2008 R2 upgrades.

Identify and surplus excess hardware.

GRIN-Global:
The GRIN-Global project was a joint partnership between USDA-ARS NPGS, Global Crop Diversity Trust and Bioversity International. The project objective was to develop a replacement for the current legacy GRIN Germplasm Management System in such a way that it can be deployed on any size computer with a minimum amount of effort. The new Germplasm Management System (dubbed GRIN-Global) will support five different languages, four database systems and install on a single desktop computer. In 2011 the NCRPIS team completed development of GRIN-Global v1.0 and released it internationally in December. Some other noteworthy achievements from the GRIN-Global team during 2011 include: Enhancements to the public website and curator desktop applications (Curator Tool) for easier data

searching and editing; enhancements to the database schema to support requests from the test user community; enhancements to the Updater application used for automating the installation and upgrading of the GRIN-Global system software; upgrades to the Administrator Tool to ease the system administrator's job of managing the GRIN-Global server components; and optimizations to the search engine and web services (middle tier) for improved speed and reliability.

C. Seed Research and Computer Application Development (D. Kovach, M. Erickson)

Germination Testing:
During 2011, Maria Erickson and her crew conducted germinations on over 1,844 accessions.

Curator	Major Crop Tested (Accessions)	Total Accessions Tested
Brenner	Amaranth (332)	514
Marek	Flax (251)	295
Millard	Maize inbreds (320)	488
Carstens	Ornamentals (243)	397
Reitsma	*Cucumis melo* (55)	150
	Total:	**1844**

Maintenance Germinations have significantly decreased over the past thirteen years, from a high of 5416 in 1999 to 597 in 2011. The decrease in maintenance germinations can be attributed to the steady reduction in our student workforce, necessitated by limitations of the NCRPIS budget. Student help is crucial to operating in a manner that is consistent with our mission of maintaining viable, high quality seed for distribution to public and private entities who request our seed in order to conduct meaningful research. Appendix Table 7 indicates that 76% of the distribution lots have been tested for viability within the past 11 years.

Inability to generate maintenance germinations at predetermined intervals designed to identify accessions in which the viability of the seed is declining compromises our mission and also increases the likelihood that an accession's viability will deteriorate to the point from which it can no longer be conserved. This will be an area of renewed focus in the coming five years.

Research Assistance:
Assisted Medicinal Curator, Luping Qu, in an experiment on five accessions of *Prunella* to determine whether hot water treatments (compared 3-min and 5-min treatments at 66 °C; 1250 seed per trt) reduced the amount of mucilage produced by the seed when it comes in contact with room temperature or cold water without adversely affecting germination and/or dormancy. Germinators were set to 25 °C constant. Three replicates of each accession were then placed in a germinator set to 12 hrs of light and 12 hrs of dark. Three replicates of each accession were placed in a germinator wrapped in aluminum foil to simulate dark germination. Recorded all results in an Excel spreadsheet and submitted them to the Medicinal Curator.

Instruction and manual help was provided to set up a seed surface decontaminating test for *Daucus* due to inordinate amount of mold on several accessions.
6 accessions selected for seed treatment testing:
Ames 7674 09ncai01
Ames 25800 09ncai01
Ames 26413 09ncai01
Ames 26414 09ncai01
Ames 27395 09ncai01
PI 502347 09ncei01

Four packets of 200 seeds each for each accession were used.
One packet of each accession will be given the following treatments:
Control (no treatment)
Bleach (1:8 Clorox:water), 40 min.
Hot water (122 F/50 C) 15 to 20 min.
Trisodium phosphate (10% w/v; 1 pound per 1 gal of water) for 2 hours.

At the conclusion of the test it was found that there was no difference in any of the treatments including the control. None of the 2010 lots would need to be treated with Trisodium phosphate. The cause of the initial infestation was not determined.

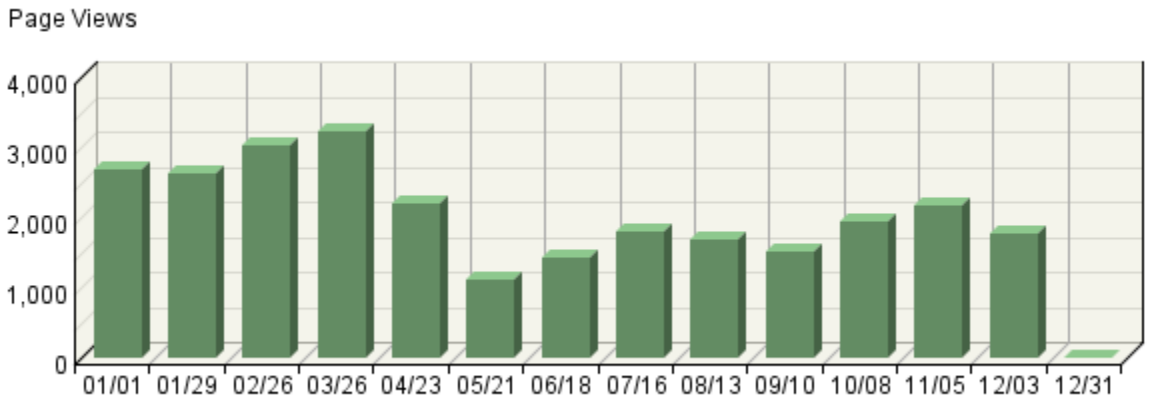
Internet website related:

- In 2011, David Kovach maintained the station's website (www.ars.usda.gov/mwa/ames/ncrpis),
- deployed a new NPGS Ash Conservation Website (www.ars.usda.gov/sp2UserFiles/Place/36251200/Ash_Project/HomePage.html),
- and upgraded the Ames Area Civil Rights Advisory Committee (AACRAC) Website (www.ars.usda.gov/sp2UserFiles/ad_hoc/36250000AACRAC/AACRAC_Project/HomePage.html).
- He also continued to post posters, PowerPoint presentations, updates of germination test methods, personnel biographic data, and other updates to the station's website as needed.

Page Viewing Summary for Year 2011
The following table summarizes the user activity of our public website.

Page View Summary	
Page Views for 2011 Year	27,140
Average per Day	74
Average Page Views per Visit	2.44

Page Viewing Trends for Year 2011 – All Categories



In 2011, 27,140 page views were reported. With an average of 74 views per day and 2.44 pages per visit, we averaged about 30 visitors per day.

Page Viewing Trends for Year 2011

Pages Visited (top 25 visited pages in 2010)	Number Visits
Home Page for NCRPIS	3171
Maps	1213
People & Places	705
Station Information	571
Maps	538
ARS Project: Proposal to Develop New Plant Hardiness Map Data for the United States (411584)	425
People & Places	417
Maps	325
Station Information	320
North Central Regional Plant Introduction Station, Ames, Iowa Products and Services	291
About Us	281
Germination Test Methods	278
People & Places	258
News & Events	252
ARS Project: Proposal to Develop New Plant Hardiness Map Data for the United States (411584) Annual Report	245
Germplasm Enhancement of Maize	241
Pollinators at PI	232
Maps	231
ARS : People & Places	228
Maps	221
Careers	219
Germination Test Methods	216
People & Places	191
Station Information	185

Cooperative efforts:
In 2011, David Kovach contributed to the following station-wide projects:

- Statistics
  - Station Statistics – these are reported in each year's annual report.
  - Modified Statistics Programs – adapted statistics programs to meet individual curator requests for data on specific groups of accessions.
- Special printing requests
  - Station Brochures (≈ 650 glossy and 200 paper).
  - Posters (, World and US Distribution Maps, Maize Genomic Project, AAIC-*Camelina*, CSSA-*Thlaspi*, ASA-GEM, ASA-*Camelina*, AISES-student outreach project, Maize-field maps, VEISHEA).
  - Large spreadsheet for vehicle quarterly repair and service chart.
- Special lighting for the thermal gradient table
  - Completed installation of red, far-red, and green safe light options.

In 2011, Maria Erickson contributed to the following projects:

- Chemical inventories
  - Inventoried chemicals used for seed-viability testing, and assisted in tracking other chemical inventories held at the station.

David Kovach retired December 31, 2011 and his position will be abolished.

D. Information Management-Germplasm Collections (R. Stebbins, R. Beyer)

Acquisition:
The North Central Regional Plant Introduction Station (NCRPIS) acquired 485 new accessions in 2011. Of these new accessions, 262 were received from within the National Plant Germplasm System (NPGS) through exploration and transfer. This included 85 accessions of ornamentals (66 from collection trips conducted by NCRPIS personnel), 77 accessions of *Zea mays* subsp. mays from the National Center for Genetic Resources Preservation (NCGRP), 33 accessions of crucifers (31 from the NCGRP), and 24 accessions of cultivated *Helianthus* (17 from the NCGRP).

The remaining 238 accessions received from outside the NPGS included 63 accessions of *Tripsacum* from the East Texas Plant Materials Center, 61 accessions of *Zea mays* subsp. *mays* from the Germplasm Enhancement of Maize project, and 43 accessions of *Zea mays* subsp. *mays* from various domestic sources.

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, 51 accessions received taxonomic re-identifications. Among these were 15 accessions of *Daucus* and 13 accessions of *Amaranthus*. Also, 162 accessions were nominated for inactivation, including 79 accessions of *Helianthus* and 46 accessions of ornamental crops. 17 accessions of *Melilotus* and 13 accessions of *Panicum* were inactivated due to duplication. The inventory lots of these accessions were integrated with lots of their respective duplicates.

Additionally, 208 accessions were assigned PI numbers including 109 accessions of *Helianthus*, 42 accessions of *Daucus*, and 34 accessions of ornamentals.

Projects:
I worked with Mark Widrlechner to prepare 34 accessions of mints and ornamentals for PI-number assignment. Any errors in GRIN were corrected, and reports were printed for a final check before requesting PI numbers.

In October, I began 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 worked with David Kovach to update and maintain the AACRAC website.

I am on 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.

I served on the selection committee for the Germplasm Program Assistant position vacated by Rachael Beyer, and also volunteered to work at the USDA exhibit at the Iowa State Fair in August.

Conclusions:
Compared to 2010, new accessions received at NCRPIS were 16 fewer than in 2011. Among the maintenance areas, re-identifications decreased by 96, nominations to the inactive file increased by 106, PI-number assignments were 154 higher, and 30 more duplications were resolved than in the previous year. The number of new accessions acquired and the totals for re-identifications, nominations to the inactive file, and PI-number assignments were all below their 16-year averages. Resolved duplications were above the 13-year average.

E. Order processing (R. Stebbins, R. Beyer)

During 2011, 2,035 orders were entered into GRIN, the second highest number of orders initiated in one year. These orders led to the external distribution of 38,402 items (primarily seed packets, but also vegetative samples) (Table 3A-1). Of these, 22,190 items (58%) were distributed within the United States, and 16,212 (42%) were sent to foreign requestors. Additionally, 6,778 items (Table 3B) were distributed within the NCRPIS, for such uses as regeneration, evaluation, germination and disease testing.

The number of orders entered into GRIN in 2011 was 257 higher than in 2010 (just below the record of 2,043 set in 2009); moreover, the number of items distributed was up by 12,779. The number of requests received electronically this year was 1,710, an increase of 254 from 2010.

In order to increase the depth of staff expertise and capacity to handle seed distributions, Candice Gardner requested that Robert mentor Rachael Beyer, and now her successor, Susan Siev, in all aspects of order processing, including the public GRIN request system, GRIN order-processing functions, methods used to communicate with the curators and plant pathologist, and those for US Mail and UPS shipping, internal filing, and the processing of international requests. As established in 2009, all germplasm requests that involved only accessions curated by Kathy Reitsma were processed by Rachael until her departure in August, 2011.

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

Two full-time, permanent federal employees (Lisa Burke and Lisa Pfiffner), and one part-time, temporary 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 2011, we stored 1920 inventory lots, including 631 original seed lots. Of the original lots stored, 229 were *Fraxinus* (Ash) , along with 166 *Zea* (maize), 46 *Helianthus* (sunflower), 50 *Daucus* (carrot), and 35 *Thlaspi* (pennycress). Of the increase lots, 986 Ames increases and 262 non-Ames increases were stored. During storage, 193 lots were bulked with previously regenerated samples to create 102 new bulked lots, 98 of which became available for distribution. Of all stored lots, 968 lots were made available for distribution. We split 66 original lots to make them available for distribution in smaller seed quantities. We reviewed 2474 inventory lots for seed quantity, and corrected any discrepancies in the GRIN database. 427 samples were prepared and transferred to a -20C freezer for long-term storage.

We filled 1609 seed orders in 2011, including those for distribution, observation, germination, transfer and backup. There were 613 lots sent to the National Center for Genetic Resources Preservation (NCGRP) in Ft. Collins, CO for backup, involving both accessions new to NCGRP and supplemental lots for previously supplied accessions. NCRPIS distributed 42936 packets (the majority filled by seed storage

personnel) to meet distribution and observation requests. This is a big jump compared with the 2010 distribution year when we filled 27099 packets. Eighty percent of all orders have 20 or fewer packets per order and 4.5% have 100 or more packets per order. 5262 packets were distributed to the Genetic Resources Division, National Institute of Agriculture Biotechnology, Rural Development, South Korea. 3092 Amaranth accessions were sent to for evaluation. 1296 *Cucumis sativus* accessions were sent for *Phytophthora capsici* evaluation. 1580 *Brassica* accessions were distributed to Brazil for crop research. We transferred 49 inventory lots to other NPGS sites. 36 germination orders were filled, involving 673 lots.

2011 saw the continuation of the prepacking program. With the aid of our student worker, we prepacked 15620 packets of 1166 inventory lots. A large portion of the prepacking program focused on recently acquired, expired PVP maize accessions. Most of these accessions are in high demand and tend to be requested as soon as they are received. Prior to regeneration, the distribution lots (original seed) are prepacked in 15-seed packets. Once the accession has been successfully regenerated, standard distribution amounts are prepacked from the new lot. In 2011, we received 80 expired maize PVP inventory lots from NCGRP, which in turn were distributed as 803 order items in 116 orders.

NCRPIS continued to send seed to the Svalbard Global Seed Vault in 2011, by preparing 354 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 maps in the farm headquarters hallway. New maps were printed at the start of 2011, and domestic and international distribution destinations were noted.

Scanning of original seed samples continues. In 2011, 364 scans were taken, mostly of original samples. 52 of those accessions were of *Fraxinus* from North American collections. We continue working with Jeff Carstens to streamline the imaging and storing process for *Fraxinus* seed.

Some imaged samples were new to the station while others were pulled for regeneration when the entire sample was needed. Creating a visual reference for expanded seed lots is an important tool to allow future comparisons with the increase lots by curators and storage personnel.

Seed storage personnel have been working on ways to extend the distribution life of an accession. Cucurbit distribution lots were reviewed for on-hand amounts and germination quality and 82 distribution lots were made available at a lower distribution level (25 seeds instead of 50 seeds per packet). The critical distribution level for these seed lots was dropped to 500 seeds from 1000 seeds (500 seeds were packaged separately and reserved for future regeneration). At an average increase of 14 accessions per year for *Cucurbita*, this reflects 5 years' regenerations by keeping

these accessions available beyond the traditional criteria used for managing Cucurbits at NCRPIS. Other crops will be evaluated for application of the method.

Lisa Burke continued to participate in the development of the GRIN Global database.

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

Lisa Burke continued as the station's CPR/AED/First Aid instructor and taught six classes in First Aid and three in First Aid/CPR/AED during 2011. Fifty-nine USDA-ARS employees from NCRPIS and campus units were trained during 2011, including both permanent and student workers.

VII. CURATORIAL AND SCIENTIFIC TEAM REPORTS

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

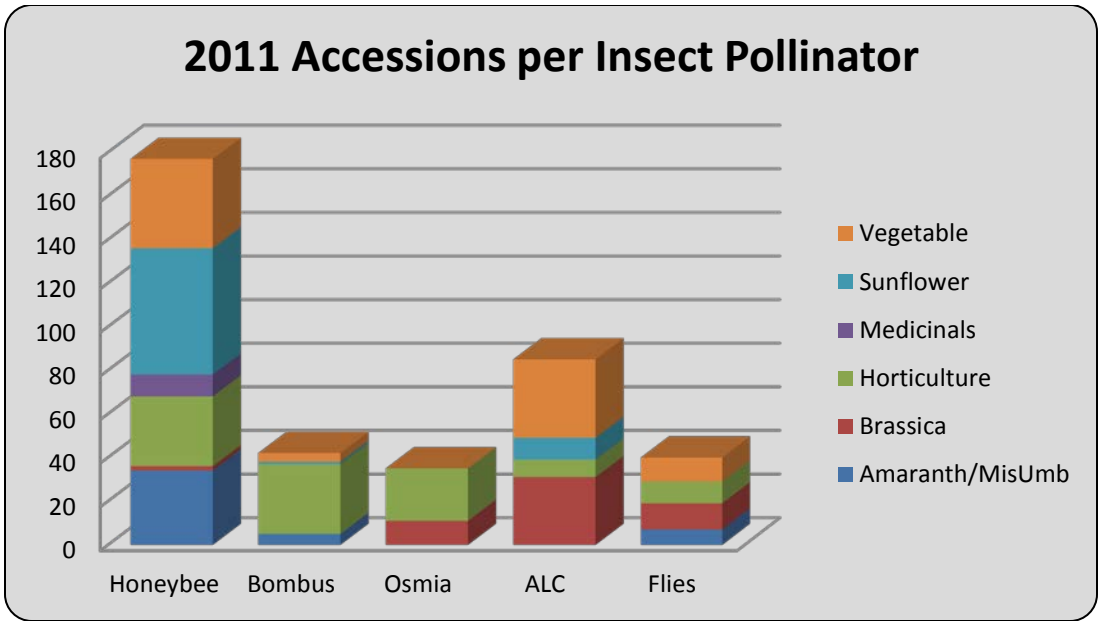
Summary of Pollinators supplied to 2011 regeneration cages

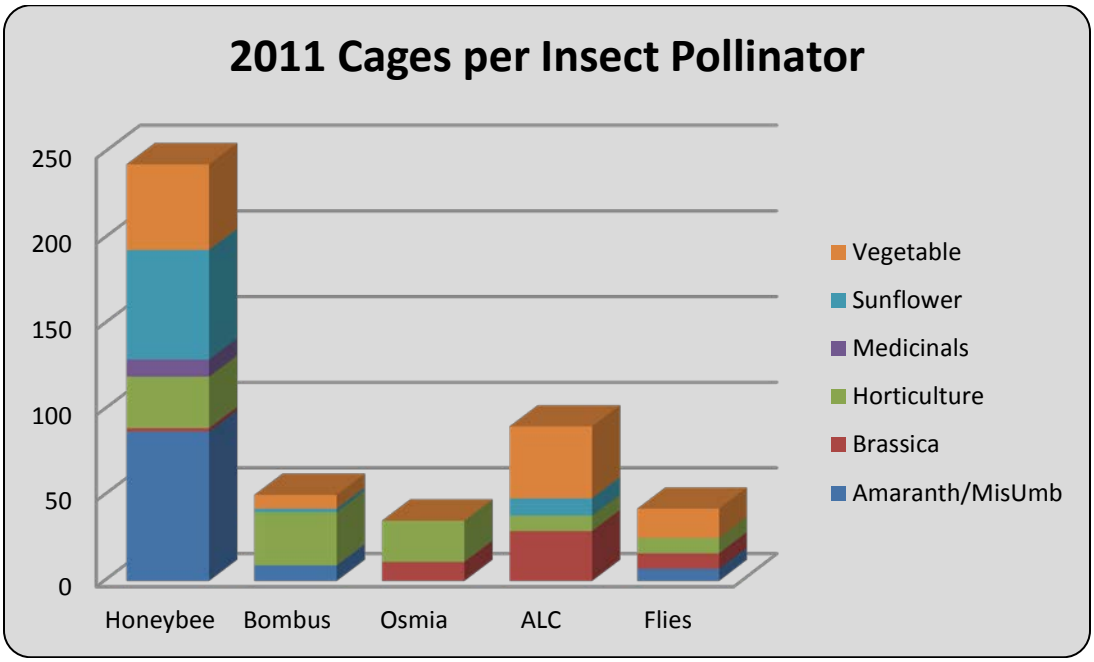
Number of Unique ACCESSIONS per pollinator

	Honeybee	Bombus	Osmia	Flies	ALC	TOTAL
Amaranth/MisUmb	34	5	0	7	0	46
Brassica	2	0	11	12	31	56
Horticulture	32	32	24	10	8	106
Medicinals	10	0	0	0	0	10
Sunflower	58	1	0	0	10	69
Vegetable	41	4	0	11	36	92
OVERALL	177	42	35	40	85	379

Number of TOTAL CAGES per pollinator

	Honeybee	Bombus	Osmia	Flies	ALC	TOTAL
Amaranth/MisUmb	87	9	0	7	0	103
Brassica	2	0	11	9	29	51
Horticulture	30	31	24	10	9	104
Medicinals	10	0	0	0	0	10
Sunflower	64	2	0	0	10	76
Vegetable	50	8	0	17	42	117
OVERALL	243	50	35	43	90	460





Progress:

Caged pollination:

Bee pollinators (minus the alfalfa leafcutting bee) were supplied a single time to 328 cages for controlled pollination of 254 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 (Hanlin):
Honey bees were used to pollinate 174 accessions in the field and 3 accessions in the greenhouse.

2011 Honeybee Pollinator Deliveries to Regeneration Cages

Crop Group	Total # of Accessions	# of Genera	# Accessions / Genera
Oilseeds	60	3	57 *Helianthus*, 2 *Brassica*, 1 *Cuphea*
Horticulture / Medicinals	42	10	11 *Cornus,* 10 *Prunella*, 5 *Staphylea*, 4 *Calendula*, 4 *Ligustrum*, 3 *Sanvitalia*, 2 *Dasiphora*, 1 *Rhus*, 1 *Potentilla*, 1 *Spiraea*
Vegetable	41	4	25 *Cucumis*, 14 *Cucurbita*1 *Daucus*, 1 *Ocimum*
Misc.Umbels	34	6	27 *Melilotus*, 2 *Ammi*, 2 *Angelica*, 1 *Erynigium*, 1 *Margotia*, 1 *Oenanthe*
Total	**177**	**23**	

Overwintering success: 55% of the 58 two story parent colonies of honey bees and 7% of the 41 double-story and 16 single-story nucleus colonies stored in the 2010 indoor wintering facility survived, comparable to the 66% and 8% from 2009.

We left 17 three-story parent colonies outside all winter at the station, wrapped in groups of two or three with 40 lb. tar paper; the survival rate was 33%. We had moderate snow and periods of below zero temperatures starting in December 2010 and lasting until early March. We removed all colonies and nucleus hives from the overwintering facility and unwrapped outside colonies on March 8, 2011. In the winter of 2011, we placed in the overwintering facility 72 double story nucleus hives, two single story nucs, 62 two story parent colonies and 25 three story parent colonies.

We purchased 32 "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 two pollen treatments. The queens were placed into nucleus boxes with two frames of brood and three frames of adhering bees.

In mid-May we selected queens from resilient, over-wintered parent colonies to produce queens for nucleus hives during summer 2011 and set them up in cell builder colonies. Queen rearing throughout the summer 2011 produced an average of 50 queens per week. Nucleus hives were produced until early August; hives not used in cages for pollination were fed and strengthened for over-wintering.

In August, all strong double and single story nucleus hives were made into colonies. All medium-strength single story nucleus hives containing three to four frames of bees were doubled to prepare them for over-wintering. Any nuc with less than three

frames of bees was left as a single and kept in the over-wintering room for winter greenhouse pollination use.

Because of the low percentage of surviving over-wintered hives, a spring varroa mite count (see ARS Photo by Scott Bauer) was not taken in 2011. Sampling was done for mites starting in August using the powdered sugar roll method. Mite counts were between 0 to 14 with an average mite count of 5 mites per100 bees. These counts are lower than the recommended fall treatment threshold level of 30 mites per100 bees, so no treatment was administered in 2011. The mite control Mite-Away® (formic acid) was researched in late summer, however it was found to have some application health concerns and required certification of respirator use when applying, so it was decided not to go forth with purchasing this control. The mite control HopGuard ®, a biopesticide made of food grade materials, was purchased instead. This product was not used in the fall because of the low mite numbers, so will be used in spring 2012.

All parent colonies and nucleus hives were given two treatments of Fumagilin – B® in March/April 2011 for the prevention of dysentery (nosema). In early October, all hives being prepared for over-wintering were given three medicated feedings.

Tylan®, a new foul brood control, was used in the summer to replace Terramycin® (TM). Over the past five years, the state apiarist reported increased resistance of American Foul Brood to Terramycin. All hives received three fall treatments of Tylan.

We continue to use our syrup feeding system consisting of a 1,000 gallon polypropylene tank, a 30 gallon poly "mixing" tank and a dish washer for cleaning syrup jars. To prevent crystallization of the high fructose corn syrup (HFCS) in the large interior storage tank, the contents were mixed with water and circulated for at least five minutes daily. Additional HFCS was purchased to supplement feeding of bees during the summer and into the spring of 2012.

All bee locations were re-registered with the Iowa Department of Agriculture and Land Stewardship (IDALS). An ISU location was eliminated from use and a new location was added. The IDALS registry assists pesticide applicators in locating bee-yards and assists in obtaining contact information of appropriate beekeepers prior to spraying.

<u>Bombus pollination (Hanlin)</u>:
Thirteen "mini-research" colonies of *Bombus impatiens* were purchased for from a commercial supplier and used to pollinate 50 field cages with 42 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.

2011 *Bombus* Pollinator Deliveries to Regeneration Cages

Crop Group	Total # of Accessions	# of Genera	# Accessions / Genera
Horticulture / Medicinals	32	10	19 *Baptisia*, 2 *Cornus*, 2 *Monarda*, 2 *Staphylea*, 2 *Symphoricarpos*, 1 *Caragana*, 1 *Cercis*, 1 *Diervilla*, 1 *Pycnanthemum*, 1 *Symphytum*
Misc. Umbels	5	1	5 *Melilotus*
Vegetable	4	1	4 *Cucurbita* (2 hives/cage)
Oilseeds	1	1	1 *Helianthus*
Total	**42**	**13**	

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 (Hanlin): *Osmia* were used to pollinate a total of 34 field cages and one greenhouse cage with 35 accessions.

2011 *Osmia* Bee Pollinator Deliveries to Regeneration Cages

Crop Group	# of Cages*	Total # of Accessions	# of Genera	# Accessions / Genera
Horticulture / Medicinals	24/0	24	1	24 *Aronia*
Brassica Oilseeds	10/1	11	1	11 *Brassica*
Total	**34/1**	**35**	**2**	

*field/greenhouse

In the 2010 growing season, we obtained an increase of ca. 1732 *Osmia* pupae which could be used for pollination and increase during the 2011 pollination season. We were unable to purchase commercial cells in the spring to supplement our increases.

The 1732 pupae were used to fill 121 domiciles; of these, 68 were two-inch domiciles used in pollination cages, 33 two-inch domiciles were used at "increase" sites and 20 three-inch diameter domiciles were used for increase.

We collected ca. 2113 pupae from domiciles in 2011 for use in the spring of 2012, which should be adequate to supply cage requests in 2012; however, there may be a reduction in the number of "increase" domiciles used.

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* (McClurg/Hanlin):
ALC bees were purchased as larvae in leaf cells from a single supplier for use in 2011, arriving in Ames, IA in Dec 2010. The bee cells were held in refrigerated storage until scheduled for transfer to 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 January through the end of December 2011.

In 2011, 688 total ALC deliveries were made to six fields and four greenhouses with 90 cages containing 85 accessions. One cage of Horticulture accessions was still undergoing pollination at the end of 2011 into 2012.

2011 Alfalfa Leafcutter Pollinator Deliveries to Regeneration Cages

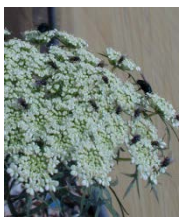
Crop Group	# of Deliveries	# of Cages	# of Locations	# of Accessions	# of Genera	Time Period
Brassica-Oilseeds	63	29	3	31	5	March – Aug
Horticulture	82	10	3	8	3	Jan – Dec
Sunflower	20	10	2	10	1	Oct
Vegetables	483	41	3	36	2	June – Sept
Total	**648**	**90**	**11**	**85**	**11**	**Jan - Dec**

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, but ALC use is productive outside of the normal time frame. From January through July, greenhouse cages were supplied weekly with bees. 2011 field requests for ALC bees started in mid-May and the number of weekly active cages increased rapidly through the first week of September.

In 2011 we received Canadian sourced cells, which have fewer parasites and parasitoids than domestic cells. The supplier shipped additional pupae for pollination use.

Because of a shortage of *Osmia* bees for spring pollination, ALC were used to supplement horticulture field requests in May. Cage requests ended by late September; however bee emergence continued to occur. Rather than discarding ALC, bees were used into mid- October in cages of *Helianthus*.

Flies (Blue Bottle Flies and Houseflies) (McClurg/Hanlin):
Fly pupae of two species (*Calliphoridae* and *Musca domestica*) were purchased from two suppliers and incubated for weekly use from Jan. – Oct. for caged plant pollinations in the greenhouse and field. In 2011, 448 fly deliveries were made to six fields and two greenhouses with 43 cages containing 40 accessions representing 19 genera.



2011 Fly Pollinator Deliveries to Regeneration Cages

Crop Group	# of Deliveries	# of Cages	# of Locations	# of Accessions	# of Genera	Time Period
Brassica – Oilseeds	151	9	2	12	6	Feb. – Sept
Horticulture	86	10	5	10	7	Feb. – Oct
Misc. Umbels	39	7	2	7	5	June – Oct
Vegetables	172	17	2	11	1	Jan – Sept
Total	**448**	**43**	**11**	**40**	**19**	**Jan – Oct**

An average of five greenhouse cages received flies weekly from January through early-July. Two cages received flies in Sept-Oct and a single cage received them late-November 2011 and into 2012.

Only blue bottle flies were distributed weekly in winter and spring greenhouse cages due to their ability to work at cooler temperatures. Both blue bottle flies and houseflies were distributed weekly to summer field cages. Re-supplying flies weekly to cages ensures continued pollinator activity. If appropriate and available, bee pollinators may be present in the same cages receiving flies.

Tests (Hanlin/McClurg):

Daucus observation plot study (Hanlin):

In 2010 the vegetable curatorial staff noticed several species of solitary bees that possibly could be used for controlled pollination. During summer 2011, several varieties of domiciles were placed in an undisturbed central strip in the field in order to determine if solitary bees that were present would establish in artificial housing. The plots and domiciles were observed daily for activity. Insect observations included several types of flies, beetles and bumble bees throughout the summer, however very few solitary bees were observed and no insect established itself in the domiciles. It was concluded that no native pollinators were observed that could be added to the pollination program.

Wax moth control in stored honey bee supers (Hanlin):

We stacked supers of frames (as in 2009/2010) either separated by newspaper or at right angles during the winter. Fermentation traps were placed at several locations near the stacks. Traps were revised by placing a one inch hole in the neck of the bottle and covering the top; however, no adult moth was trapped. In mid-summer, lights were left on during working hours five days a week. In late summer, adult moths were flying around the top of several stacks of supers, and cocoons were found between stacks and in stacks of supers positioned at right angle. A dead hive stored in the equipment room was found as a possible source of the infestation. Even though this non-chemical control method for wax moth does not guarantee 100% frame loss prevention, we will continue to use it because of the reduced hazard to humans and honey bees.

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, lights in the equipment room were left on during

working hours and several "fermentation traps" were placed around the stacks. The traps consisted of a plastic gallon container with a mixture of water, sugar, vinegar, and a banana peel. In August, adult moths were observed flying around lights and pupa was found in and between stacks of supers. Several one- gallon buckets of soapy water were placed near infested stacks as additional traps to attract adults. In winter, temperatures in the unheated storage room limit serious moth problems.

Safety:
Chemical Inventory:
In January 2011, S. McClurg and S. Hanlin updated the Entomology chemical inventory including obtaining updated MSDS.

Presentations and Outreach:
On January 11, 2011, S. Hanlin was contacted by R. Thornburg (ISU; Biochemistry Dept) about consulting on a 2012 grant proposal using honey bees to determine pollinator attraction to nectar peptides.

On February 7, 2011, S. Hanlin and S. McClurg gave a phone interview with S. Milius of Science News for an article about "non-Aphis pollinators".

On March 8, 2011, S. Hanlin acted as liaison between L. Marek (oilseed curator) and a Bakersfield CA beekeeper to recommend methods for extending the nucleus hive life for caged sunflower pollinations being done in Parlier CA.

S. Hanlin provided information to D. Peterson (USDA; ARS -Morris MN) about native plant pollination using honey and *osmia* bees.

On March 25, 2011, S. Hanlin assisted N. Cloud of McCubbin Industries for ordering and using *Bombus* for greenhouse pollination.

On April 1, 2011, S. Hanlin and L. Lockhart assisted E. Hellweg (a 7th grader from West Point IA) with a summer research project using honey bees and bumble bees to pollinate soybeans in a cage.

On August 17, 2011, Ethan and his parents visited S. Hanlin and S. McClurg about ordering and using alfalfa leafcutting bees for his 2012 cage research.

On May 11, 2011, S. Hanlin spoke to approximately 200 sixth grade students on honey bees and beekeeping at the Squirrel Hollow Outdoor Classroom held in Jefferson IA.

On August 24 and 25, 2011, S. Hanlin and S. McClurg gave a tour to Alfredo and Maria Alves (Brazil) describing the distribution and care of the pollinators used at PI, and queen-rearing.

S. Hanlin met and provided honey bees to R. Palmer (USDA) and A. Pappas (Post-Doc.) throughout the summer for honey bees "proboscis reflex tests", whereby honey bees attraction to male sterile lines of soybeans was tested.

Plans for 2012:
With the retirement of S. McClurg from the USDA; ARS, S. Hanlin will take over the emerging and distribution duties of ALC and flies in addition to the duties caring for and distributing honey bee, *Bombus* and *osmia* bees. S. Hanlin will also assist curatorial staff with any Pocket Pollinator issues that may occur during the summer of 2012.

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 staff members report bee sightings or observe increased populations of bees.

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

Field Research Activities:
2011 Maize field plots:
Stewart's wilt (*Pantoea stewartii*) disease resistance evaluations were conducted on 170 maize inbreds, with 120 acc. being tested for a second year, 15 new GEM entries, and 35 new PVPs. Disease development was excellent and we identified several highly-resistant (nearly-immune) accessions (Table 1). A score of $\leq$2.0 indicates highly resistant germplasm, and 1.0 indicates essentially no disease development.

Goss's wilt disease resistance trial. Forty-five maize inbreds of known Stewart's wilt response were tested for Goss's wilt (*Clavibacter michiganensis* subsp. *nebraskensis*) reaction to determine whether resistance to the two bacterial diseases is correlated. The same rating scale was used for both diseases because leaf symptoms are similar. Table 2 shows reactions of six top accessions and one susceptible check along with their corresponding Stewart's wilt ratings, showing a good correlation in resistance to the two pathogens.

Table 1. Stewart's wilt resistance of selected maize inbreds from 2011.

Entry	Alternate ID	Other notes	2011 SW average score (1-9 scale of R to S)
PI 558533	Mo21R; resistant check	Resistant to northern corn leaf blight - *Exserohilum turcicum*.	1.0
PI 601689	WIL500	Developed by Wilson Hybrids from tropical germplasm population.	1.0
PI 601773	PHJ31	Expired PVP- Pioneer Hi-Bred.	1.2
PI 601774	PHJ33	Expired PVP- Pioneer Hi-Bred. Resistant to Goss's wilt	1.2
PI 601779	PHM57	Expired PVP- Pioneer Hi-Bred.	1.2
Ames 28949	CI 12	Accession developed - Missouri.	1.3
Ames 23507	C42, susceptible check	Yellow corn; Golden Bantam parentage.	8.8

Table 2. Goss's wilt reaction of Stewart's wilt-resistant inbreds.

Entry	Alternate ID	Other notes	Multi-Yr Avg. SW score (1-9 scale of resistant to susceptible)	Average Goss's score (1-9 scale of resistant to susceptible)
Ames 25559	H60	Highly resistant to Stewart's wilt.	1.6	1.0
PI 601037	G80	Highly resistant to Stewart's wilt.	1.8	1.0
Ames 27193	Va85	Highly resistant to Stewart's wilt.	2.0	1.0
Ames 19314	CI 64	Highly resistant to Stewart's wilt.	2.0	1.2
PI 558533	MO 21R; res. check	Highly resistant to Stewart's wilt.	1.2	1.3
Ames 26121	CI 28	Highly resistant to Stewart's wilt.	1.7	1.3
Ames 20140	C42; susc. check	Highly susceptible to Stewart's wilt.	8.2	7.8

Sclerotinia wilt resistance in wild sunflower (Helianthus):
We conducted greenhouse tests 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, Ames). *Helianthus* species tested included *H. ciliaris* (4 acc.), *H. eggertii* (5 acc.), and *H. grosseserratus* (37 acc.) and *H. tuberosus* (38 acc.) – 84 accessions total. All perennial species showed remarkable resistance, typically 90-100% plant survival. We also tested 31 SF inbreds and 57 annual x perennial backcrossed accessions – all with Sclerotinia tolerance or resistance mentioned in their passport data. Several promising accessions were identified. Nineteen accessions from five annual sunflower species were entered into an inoculated field trial at Staples, MN. The entries included *H. neglectus* (3 acc.), *H. debilis* (4 acc.), *H. argophyllus* (3 acc.), *H. annuus* (6 acc.) and *H. praecox* (3 acc.). Six to 8 replications of each accession were planted along with the susceptible check hybrid Cargill 270 and the resistant hybrid Croplan 305. Disease developed well, with the most resistant entries found in *H. argophyllus* (PI 649865), *H. debilis* (PI 468686), and *H. praecox* (PI 435849).

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 317 field plots (maize curation) for disease presence and severity, similar to the 320 plots inspected in 2010. 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. More than 1500 pathogen records were added to GRIN. Similarly, 2400 entries of GEM lines were inspected for the same diseases, a large increase in inspection numbers compared to the 875 entries in 2010. In terms of typical diseases of interest for export, none were found – no Stewart's wilt, Goss's wilt, crazy top or any downy mildew disease, head smut, or southern corn leaf blight were observed.

Sunflower:
Multiple field inspections of sunflower (~200 rows and 50 cages) were carried out for downy mildew, viruses, and phytoplasmas. No downy mildew (the main phytosanitary issue) was present and no unusual disease problems were identified.

Cucurbits:
The cucurbit transplants were monitored 2X per week in the greenhouse for bacterial fruit blotch and none was found for the seventh consecutive year. Routine disease testing for squash mosaic virus was conducted on all seedlings prior to transplanting. Thirty-eight accessions with 908 plants were sampled, with four SqMV-infected plants detected 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. Three disease inspections were made during July and Aug on the field plantings of cucumber, melon and squash (38 acc.). The major disease problem was powdery mildew, with a low level of anthracnose present in a few cages. Periodic fungicide sprays were applied to keep these diseases in check.

Table 3: Squash mosaic virus testing results for 2011.

Species	Accessions tested	Accessions with infected plants	Plants tested	# of SqMV infected plants
Cucumis spp. (*melo, sativus, misc.)*	23	0	530	0
Cucurbita pepo	15	1	378	4
Total	**38**	**1**	**908**	**4**

Seed Health Testing/Seed Treatment:
We carry out a seed health testing and fungicide seed treatment program to verify freedom from plant pathogens of phytosanitary interest to support international seed shipments – 218 laboratory tests were run, 87% for maize and 13% on other crops. Approx. 240 packets (sunflower plus maize) were treated with fungicides for international seed orders.

Laboratory research activities:
We began a project to evaluate nine published PCR primer sets for their ability to specifically detect *Pantoea stewartii*, the causal agent of Stewart's bacterial wilt of corn, and for potential cross reactivity (false positives) with other *Pantoea* species. Six conventional PCR primer sets and three real-time TaqMan primer sets were compared using 60 bacterial isolates that included representatives from *Pantoea stewartii*, *Pantoea agglomerans*, *Pantoea ananatis*, and non-*P. stewartii* isolates from maize. While all of the primer sets successfully amplified DNA from all *P. stewartii* cultures tested, none of the sets was 100% specific. Each primer set also amplified DNA from more than one non-*P. stewartii* isolate, yielding a false-positive reaction. Research is ongoing to characterize several of these non-*P. stewartii* isolates using biochemical tests, DNA sequencing and phylogenetic analysis.

Publications:
Wechter, W.P., Levi, A., Ling, K-S, Kousik, C., and Block, C.C. 2011. Identification of resistance to *Acidovorax avenae* subsp. *citrulli* among melon (*Cucumis* spp.) Plant Introductions. HortScience. 46:207–212.

Block, C.C., Gulya Jr., T.J., Marek, L. 2011. Evaluation of wild *Helianthus* species for resistance to Sclerotinia stalk rot. 9th Annual Sclerotinia Initiative Meeting. p. 13. (Abstract).

Block, C.C., Shepherd, L.M., and Munkvold, G. 2011. Comparison of nine PCR primer sets designed to detect *Pantoea stewartii* subsp. *stewartii* in maize. Phytopathology (Abstract) 101:S16.

Qi, L., Gulya, T.J., Block, C.C., Vick, B.A. 2011. Deployment of novel sources of Sclerotinia stalk rot resistance in sunflower. Presentation at the National Sunflower Association Research Forum, January 12-13, 2011, Fargo, ND. Available: http://www.sunflowernsa.com/research/research-forum-presentations/2011.

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-five accessions were acquired (Table 1), including 8 *Amaranthus*, 2 grasses, 9 legumes, 2 *Melilotus*, 1 *Perilla*, 1 *Setaria*, 1 *Monolepis*, and 1 *Foeniculum*.

An accession of *Melilotus dentatus* (Ames 31033) was segregated from Ames 24112 because of its unusually erect growth habit.

The NCGRP transferred an accession of *Foeniculum vulgare* (PI 601795), an expired PVP from the D'Arrigo Brothers Company of California; PVP was issued in 1993.

Douglas Johnson of the USDA-ARS in Logan, Utah donated 11 accessions collected in southern Russia: eight accessions of *Galega* (Ames 30986 to 30993), two accessions of *Nardus stricta* (Ames 30995 and Ames 30996), one accession of *M. albus* (Ames 30994). These accessions are from a 2010 collection trip with participating scientists from the Vavilov Forage Crops Genetic Resources Department (VIR) and the Smithsonian Institution.

An accession of *Perilla frutescens* (PI 664495) was segregated from (PI 664494). This new accession has unusually wavy leaves unlike the flat-leaved accession it was segregated from.

An accession of *Monolepis nuttalliana* (PI 664500) was segregated from Ames 29797. The *Monolepis* was a seed mixture in a *Chenopodium* accession from Wyoming.

Eight new *Amaranthus* were accessioned. Dr. Robert Myers donated six grain breeding lines. Claire Costom donated a grain variety 'Red Utopia'. An accession of *Amaranthus*, PI 664489, was segregated from PI 649603. This new accession is a dwarf genetic stock that grows about 10 cm tall and has dark green wrinkled foliage. We do not know the genetic basis for its unusual form.

On the left, PI 664489 is a new dwarf genetic stock with wrinkled leaf blades. On the right Ames 2221 with a stem that is brightly colored because of lacking chlorophyll. Both are *Amaranthus*.

An accession of *Setaria italica* subsp. *viridis* (Ames 31045) was donated by Thomas Brutnell and Hui Jiang. This accession is used as a model organism for C4 photosynthesis research since it has simple growth requirements and a rapid growth cycle. Four related research publications are already cited in GRIN.

Maintenance and distribution:
Many home-gardener seed distribution requests were refused. Home gardener seed requests are routinely referred to commercial sources, especially for spinach because the seed lots are small, can be difficult to maintain, and are in demand for research purposes.

The overall availability for these crops increased from 84% to 86% (7,553 to 7,686 available). We made good progress with regenerating and cleaning seeds.

The number of accessions of these crops tested for germination (Table 2), 322 (4%) is greater than the 2.5% tested in 2010. Numbers fluctuate depending on station priorities, labor availability, inventory lot age, and normal scheduling variations.

Amaranthus:
The number of accessions distributed in 2011 is extraordinarily high because of one order for 3,092 accessions. The order was for a private-sector, trait-exploration project.

Availability improved by 1% when harvests of 89 accessions were stored. Some of these new seed lots replaced older distribution lots.

I anticipate reducing the collection size in 2012 by eliminating duplicated acccessions detected via data entry and assessment of secondary identifier information in GRIN, and through comparative grow-outs.

Chenopodium:
Availability improved by 13% when harvests of 92 accessions were stored. Many of the newly stored seed lots are of wild species collected in the Western US.

Miscellaneous Legumes:
Two *Dalea leporina* accessions were regenerated for us by the National Arid Land Plant Genetic Resources Unit in Parlier, California, and ten more accessions are planned for regeneration there in 2012. This new success in Parlier with *Dalea* regenerations represents substantial progress since many *Dalea* are not adapted to Iowa.

Melilotus:
Thirty *Melilotus* accessions were harvested in 2010. Seventeen accessions were planted in our cool greenhouse (Farm Greenhouse 2) in October 2011, transplanted into filed cages in the spring 2012 for honey bee pollination, and harvested in mid 2012. Sixty-one seed lots harvested from other years awaiting cleaning before storage in 2012.

Millets:
There were small improvements in availability from storing increases and resolving taxonomic or similar issues.

Miscellaneous Umbelliferae:
Our colleagues at the National Arid Land Plant Genetic resources Unit in Parlier, California successfully regenerated a cumin accession (Ames 27774) direct seeded into the field in December 2010. This method was by far our most successful with cumin after many years of experimenting. The winter environment in Parlier is much better for cumin than the other environments we have tried. More accessions were sent to Parlier for an expanded effort in 2012.

Spinacia and allied genera:
In June 2011, 30 accessions of *Spinacia* were sent to Salinas, CA for regeneration by Sakata and the USDA-ARS. The seeds were harvested in early 2012.

Four *Monolepis nuttalliana* accessions were regenerated.

Characterization/evaluation/taxonomy:
Two hundred eleven accessions of *Amaranthus blitum*, *A. graecizans*, and *A. tricolor* were grown for observation in the fall greenhouse. This planting allowed us to image, check identities, and revise descriptors. Most of these accessions are cultivated vegetable market-types described in publications. Descriptors for 12 of these market-type, added to GRIN with bibliographic citations. Two-hundred-eighty-seven new market-type observations were loaded. Also, most of the 427 new amaranth images came from this fall planting. A similar planting should be done for the African vegetable category of the *Amaranthus cruentus* collection.

Four thousand-three new amaranth observations were loaded into GRIN in 2011, including flower and stem color data collected in 2007. Also 10,173 seed weight

observations were updated in the GRIN inventory. There are now 45,163 amaranth observations in GRIN.

Five hundred nine *Melilotus* observations were loaded to GRIN during 2011including flowering time and other traits recorded during the 2010 and 2011 field seasons.

Samuel Flomo loaded images of 509 accessions in the GRIN database.

One hundred six close-up images of diagnostic taxonomic traits were posted for 70 accessions. These images may become the basis for illustrated keys.

Examples of new close-up images to illustrate diagnostic features. On the left the fruits of *Bifora testiculata* (PI 325872), and on the right a stipular spine of *Amaranthus spinosus* (PI 619325).

Improving passport data was a priority in 2011. Two hundred forty-five accession actions were entered in GRIN to document many incremental passport additions and improvements.

For the second year evaluation data on *Setaria* accessions were returned to us by Jiří Hermuth at Praha Ruzyně in the Czech Republic. His observations on height, adaptation, and seed maturity before winter were loaded into GRIN. It is unusual for cooperators to return data formatted in a manner that is so well suited for GRIN.

Fall Establishment of *Melilotus* Pilot Study:

We are searching for accessions adapted to late-season planting for use as cover crops in rotation with corn or soybeans. Thirty-three accessions of *Melilotus* were planted in 2.1 m (7ft) rows on September 16, 2011. Over-wintering survival was patchy; some accessions over-wintered better than others. The percent-survival data will be loaded into the GRIN SWEET-CLOVER observations descriptor STAND2YR. This data will be used to select check varieties with varying over-wintering performance for use in an expanded study.

Taxonomy:

In 2011, David Brenner made 27 taxonomic changes, involving eight different genera. In addition, 27 existing taxonomic determinations were confirmed and entered in GRIN's Annotation area.

Enhancement and/or utilization:

Seeds of *A. cruentus* line DB 2006306 and *A. tricolor* line DB 2003889 were regenerated at AVRDC-RCA, Arusha, Tanzania in preparation for regional trials at AVRDC stations across Africa. Both of these are NCRPIS plant breeding products.

Publications and presentations:
David Brenner, August 7, 2011, Germplasm Botany: Finding and Saving Plants the World Needs. Unitarian Universalist Fellowship of Ames. Ames, Iowa. Oral presentation.

David Brenner and Samuel Flomo participated in the VEISHEA (Iowa State University festival) presentation of fragrant seeds in the Agronomy display tent.

Conferences:
We hosted an Amaranth Institute meeting October 6-8, 2011 in Ames, Iowa, and tours of the station, Amaranth field, and the amaranth greenhouse on campus.

The meeting exceeded expectations for validating our work with amaranth and inspiring us to continue. The participants mentored and encouraged each other. Of the participants that could be classified, 10 were from NGOs, 3 private sector, and 16 university researchers from eight Universities. Our germplasm and influence is benefitting starving people in Africa and elsewhere.

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).

Responsibility for two of our crops, Miscellaneous Umbels and *Perilla*, has been transferred from the New Crops CGC to the newly established Medicinal and Essential Oil Crop Germplasm Committee (MEO CGC) and will be incorporated into the next MEO CGC report.

Professional society participation:
In October 2011, David Brenner's term as President of the Amaranth Institute concluded and he assumed the role of Past President.

Some research publications derived from use of our germplasm or associated information:
Steffensen, S. K., Å. Rinnan, A. G. Mortensen, B. Laursen, R. M. de Troiani, E. J. Noellemeyer, D. Janovska, K. Dusek, J. Délano-Frier, A. Taberner, C. Christophersen, I. S. Fomsgaard. 2011. Variations in the polyphenol content of seeds of field grown Amaranthus genotypes. Food Chemistry. 129:131-138.

Dzunkiva, M., D. Janovska, P. H. Cepkova, A. Prohaskova, and M. Kolar. 2011. Glutelin protein fraction as a tool for clear identification of Amaranth accessions. Journal of Cereal Science 53:198-205.

Hunt, H.V., M.C. Campana, M.C. Lawes, Y. Park, M.A. Bower, C.J. Howe, M. K. Jones. 2011. Genetic and phylogeography of broomcorn millet (Panicum miliaceum L.) across Eurasia. Molecular Ecology. 20:4756-4771.

Nolan, C., A. Noyes, A. Bennett, R. Hunter, and K.L.Hunter. 2010. Inter simple sequence repeats (ISSR) reaveal genetic variation among Mid-Atlantic populations of threatened *Amaranthus pumilus* and phylogenetic relationships. Castanea. 75:506-516.

Oke, O.A. and T.I. Ofuya. 2011. Relationship between population of Cletus fuscescens (Walker) (Hemiptera: Coreidae), planting dates, lines, and grain amaranth (Amaranthus spp.) phenology. Journal of Entomology. 8:566-573.

Sedivec, K.K., D. A. Tober, W.L. Duckwitz, and J.R. Hendrickson. 2011. R-794 (Revised) Grass varieties for North Dakota**.** North Dakota State University, Fargo, ND.

Tober, D.A., and W.L. Duckwitz. 2011. Prairie sandreed (*Calamovilfa longifolia*) and sand bluestem (*Andropogon hallii*) performance trials North Dakota, South Dakota, and Minnesota. USDA, NRCS Plant Materials Center, Bismark, ND.

Research indirectly related to our germplasm:

Jacobsen, S. E. 2011. The situation for quinoa and its production in southern Bolivia: from economic success to environmental disaster. Journal of Agronomy and Crop Science. 197:390–399.

McMullan, P.M. and J. M. Green. 2011. Identification of a tall waterhemp (*Amaranthus tuberculatus*) biotype resistant to HPPD-inhibiting herbicides, atrazine, and thifensulfuron in Iowa. Weed Technology. 25:514-518.

Ortiz-Ribbing, L. M., Glassman, K. R., Roskamp, G. K., Hallett, S. G. 2011. Performance of two bioherbicide fungi for waterhemp and pigweed control in pumpkin and soybean. Plant Disease. 95:469-477.

Reduron J. 2007. Ombelliferes de France. (in five volumes) Societe Botanique du Centre-ouest. Nercillac, France.

Schirrmacher, G., T. Skurk, H. Hauner, and J. Grabmann. 2010. Effect of *Spinacia oleraceae* L. and *Perilla frutescens* L. on antioxidents and lipid peroxidation in an intervention study in healthy individuals. Plant Foods and Human Nutrition. 65:71-76.

Tian, B., J. Wang, L. Zhang, Y. Li, S. Wang, and H. Li. 2010. Assessment of resistance to lodging of landrace and improved cultivars in foxtail millet. Euphytica. 172:295-302.

Webster C. G., Kousik C. S., Roberts P. D. 2011. Cucurbit yellow stunting disorder virus detected in pigweed in Florida. Plant Disease. 95:360.

Yang Xin, Zhang Xiangrong, Zhang Mingju, Guo Wenchao, Tian Yingchuan, Xia Qizhong and Wu Jiahe**.** 2011. Transgenic potato overexpressing the *Amaranthus caudatus* agglutinin gene to confer aphid resistance. Crop Science. 51:2119-2124.

Plans for 2012:
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 prepare a plant exploration grant proposal for collecting plants related to spinach (*Micromonolepis*, and *Monolepis*) in Nevada during 2013.

The *Portulaca* collection will be integrated into our operations as the newest crop. All ten accessions were transferred from the Ornamental Plant Germplasm Center in March of 2012.

The passport data for the millet collection should be improved by entering in GRIN the remaining proso millet identity (IPM) numbers written on seed packets received from Nebraska in the1980's. These IPM numbers will facilitate linkages to and comparisons with information from research published in the 1970s. For *Amaranthus*, the remaining Asian Vegetable Research Center identifiers should be entered from documents on-hand.

Extra millet seed-increase lots from the 1980's will be used in studies to determine if particular lots should be discarded or segregated as new accessions.

We want to indentify accessions of *Amaranthus* that initiate flowering following unusual environmental cues such as long-day, day length neutral, or temperature sensitive. Identifying an array of flowering adaptations will be useful for plant breeding. This goal is modeled on a recently published project with pearl millet (H. D. Upadhyaya, K. N. Reddy, Mohd Irshad Ahmed, Naresh Dronavalli and C. L. L. Gowda. 2012. Latitudinal variation and distribution of photoperiod and temperature sensitivity for flowering in the world collection of pearl millet germplasm at ICRISAT genebank. Plant Genetic Resources. 10:59-69).

D. Horticulture (M. Widrlechner, J. Carstens)

Acquisition:
During 2011, we worked with Robert Stebbins to enter information for 106 new accessions of ornamentals and mint-family plants into the GRIN database. Curation efforts focused on *Fraxinus* acquisition and seed processing, with a total of 210 mother tree samples obtained. The largest group of these accessions comprised samples of *Fraxinus* collected in New York and Pennsylvania by Jeff Carstens, Andrew Schmitz (Brenton Arboretum), and Michael Dosmann (Arnold Arboretum). Additional genera collected in New York and Pennsylvania included *Diervilla, Cornus, Viburnum,* and *Carya.* A small number of wild-collected *Fraxinus* accessions were donated by Dr. Joseph Zeleznik (North Dakota State University). Other important accessions were obtained during a collecting trip to Albania and donated by John Preece and Joseph Postman, including *Cornus mas*, *Euonymus europaeus*, and *Fraxinus excelsior*.

Plans for the acquisition of *Fraxinus* germplasm from North America continue to move forward. The USDA-ARS Plant Exchange Office supported reconnaissance and collection trips to New York and Pennsylvania in 2011. Support was also approved to execute a collection trip throughout Iowa, Illinois, and Indiana in 2012 specifically to obtain germplasm of *Fraxinus quadrangulata.* 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 late in 2011 with the help of David Kovach, and now includes all recently obtained accessions. Mark Widrlechner presented information about the *Fraxinus* conservation project at the Eastern Region IPPS meeting in Louisville, KY in October and by publishing an article in the Summer 2011 issue of "Public Garden."

In 2011, two additional plant exploration proposals from our project were submitted to the USDA-ARS Plant Exchange Office, for which funding was approved.

1. Plant Exploration in Iowa to collect *Cornus rugosa*
2. Plant Exploration in Southern Iowa, Northwestern Missouri, and Northeastern Kansas to collect *Gymnocladus dioicus.*

Maintenance:

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. Initial results in comparing the amount of time managing permanent plots with a warm-season groundcover (sideoats grama) versus a cool-season groundcover (fescue/bluegrass mix) indicated that approximately 4 and 26 hours, respectively, were needed to maintain plantings. In addition, approximately 14 gallons of glyphosate were applied in the cool-season plots compared to the warm-season plots, to which no pesticides were applied. Future observations will be made to ensure that the length of time an accession needs to generate successful regeneration quantities in warm-season plots is not significantly longer than that in cool-season plots.

Availability:

During 2011, approximately 46% of the ornamental collections and 69% of the mint-family plants were available for distribution (Table 1); these figures are slightly lower than those reported in 2010 (46 and 74%).

Regeneration:

Maintenance efforts continued in 2011, emphasizing the regeneration of shrubs in cages. This was the fifth year for one cage field of woody shrubs, focused on *Cornus*, *Rhus*, *Ligustrum*, *Staphylea*, *Aronia*, and *Physocarpus.* Additional efforts resulted in the establishment and regeneration of 10 accessions of *Calendula* and 5 accessions of *Sanvitalia.* Out of a total of 40 *Aronia* accessions that were established in 2009 and 2010, 21 accessions were isolated and increased.

Regeneration efforts in 2011 focused on established, caged shrubs, on seed germination for future regeneration cycles, and on caged *Calendula* accessions. The harvests listed in Table 2 include 76 cage increases of shrubs and herbaceous perennials and 15 woody-ornamental seed increases from isolation. Through these activities and those from the previous year, along with efforts to obtain large, original seed samples, 70 accessions were made available for distribution in 2011 (Table 2).

Viability Testing:
In 2011, seedlots of 2,455 accessions were tested for germination (Table 2). This included the completion of tests initiated late in 2010, periodic re-tests for stored distribution lots, and new tests on bulked samples. We also conducted cut-tests of more than 140 lots of newly received *Fraxinus* seeds to assess initial quality.

Back-up:
Approximately 44% of the ornamental collections and 76% of the mint-family plants are duplicated at NCGRP (Table 2), figures slightly above those reported in 2010 (41% and 76%).

Distribution:
As summarized below (and in Table 3), requests for accessions of ornamental germplasm were higher than in 2010 but lower than in 2009. The 599 "order items" included all plant shipments for the NC7 Trials (described in the following section), along with plants, cuttings, budwood sticks, and seed packets, distributed to fulfill external requests for ornamental plant germplasm. Those most in demand were *Alcea*, *Calendula*,*Glebionis*, *Fraxinus*, *Potentilla*, *Salix*, *Sanvitalia*, and *Spiraea.*

Demand for mint-family germplasm was higher than in 2010.

Historical Summary of External Distribution Activity:

Crop	Year	No. of Orders	No. of Recipients	No. of Items Distributed	No. of Accessions Distributed
Ornamentals	06	89	76	436	322
	07	75	71	268	196
	08	92	83	352	249
	09	110	95	607	390
	10	82	73	301	248
	11	**114**	**95**	**599**	**405**
Mint Family	06	19	19	55	37
	07	10	10	54	47
	08	14	14	88	64
	09	33	31	179	92
	10	22	22	54	34
	11	**34**	**32**	**125**	**79**

Characterization/taxonomy:
Accessions being regenerated were checked to verify identifications. In all, four ornamental accessions were re-identified. During 2011, Lisa Pfiffner captured seed images of 75 ornamental and mint-family accessions for our local database, and Jeff Carstens imaged an additional 75 accessions. These are named following our standard protocol. In 2011, 192 images were loaded to GRIN (Table 4), by using the mass-loading system for images developed by Pete Cyr.

Evaluation:
Evaluations first reported in the 2008 NCRPIS Annual Report are ongoing for two ornamental shrub genera curated in our project: *Aronia* and *Spiraea*. In 2011, Dr. Mark Brand (Univ. of CT) conducted biochemical analyses of over 30 wild accessions of black/purple chokeberry fruits, and has shown that some genotypes possess oxygen radical absorbance capacity (ORAC), phenolic content, and anthocyanin levels that are nearly twice those found in the most common commercial cultivar, 'Viking'. These genotypes may prove to be valuable *per se*, or they could be useful in breeding programs to develop new, superior chokeberry cultivars. Brand's lab has captured morphological data including stem, leaf, flower, fruit, and whole plant characteristics, and also phenological data on flowering, fruit ripening, and peak fall color. Data is currently being organized in order to post to GRIN.

Dr. Mike Mickelbart's lab completed an evaluation of light requirements and pruning regimens on the form and landscape performance of *Spiraea alba* and *S. tomentosa*, at Purdue University from 2008 to 2011. One-year-old container-grown plants that were pruned to 3 cm in the spring had low growth, few inflorescences, and symmetry was not improved compared to plants that were not pruned. In the landscape, pruning to 15 cm generally resulted in good plant size and form, compared to pruning to 3 cm. These species can be grown in shade (full, morning, or afternoon), but growth and inflorescence production are higher in full sun. Soils in the native habitats of both *S. alba* and *S. tomentosa* are typically slightly acidic. *S. alba* and *S. tomentosa* can be grown in neutral pH soils without an effect on plant appearance, but plant size will be less than at pH levels closer to the native soils for these species. Despite the fact that some micronutrients were present at lower concentrations at the neutral pH, leaf greenness was not affected, again suggesting that these plants may perform suitably outside of their native habitat pH range. This research resulted in the following publications:

Mickelbart, M.V., M.J. Gosney, J. Camberato, and K.M. Stanton. 2012. Soil pH effects on growth and foliar nutrient concentrations of *Spiraea alba* Du Roi and *Spiraea tomentosa* L. HortScience. In press.

Stanton, K.M., S. Weeks, M.N. Dana, and M.V. Mickelbart. 2010. Effect of light level on growth of *Spiraea alba* and *Spiraea tomentosa*. HortScience. 45:1912-1916.

Stanton, K.M., S. Weeks, M.N. Dana, and M.V. Mickelbart. 2010. Pruning of meadowsweet and hardhack. HortTechnology. 20:700-704.

Studies on water stress tolerance and media pH tolerance are being prepared for publication this year.

Enhancement:
There was no major progress to report with enhancement activities in 2011. One 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. After culling a number of specimens in 2011, 10 seedlings remain at the NCRPIS farm, which have shown varying degrees of minimal, winter injury.

Coordination of the NC-7 Regional Ornamental Trials:
Plant Distribution - In 2011, Mark Widrlechner and Jeff Carstens distributed 237 plants of six accessions to 17 sites for long-term evaluation, with an additional 79 plants of these accessions provided to 6 public gardens. All accessions were shipped dormant and bare-root.

In 2007, Jeff Carstens and Pete Cyr began working on a web-based program to capture evaluation data for woody ornamental accessions being distributed through the Regional Ornamental Trials Program. Through the 2010 field season, the planting, one, and five-year web-based planting reports have been completed, while the ten-year reporting form remains to be converted to the web-based format However, in 2011, the planting, one, and five year web-based planting reports were not available, due to upgrades to the Iowa State University infrastructure which did not support this web-based database.

A brief paragraph with an overview of the NC-7 Regional Ornamental Trials Program has been added to GRIN for the six accessions distributed in 2011.

Germplasm activities in crops other than those curated:
Since 2002, Iowa State University and the University of Iowa were awarded two grants from the National Institutes of Health (NIH) to support a Center for Research on Botanical Dietary Supplements, which has made much progress in studying the health-related effects of *Echinacea, Hypericum*, and *Prunella*. Mark Widrlechner continued his involvement with the Center by overseeing a subcontract to ARS (through its closeout in May 2011), which supported the curation and distribution of the Station's *Echinacea, Hypericum,* and *Prunella* germplasm collections so they could be evaluated for chemical composition, genetic diversity, and bioactivity.
During 2011, Mark Widrlechner was involved with a number of other collaborative germplasm activities including:

1. service with David Kovach (NCRPIS), Dr. Philip Dixon and Allan Trapp, II (ISU) on a project initiated as part of Allan's M.S. thesis and expanded upon for his Ph.D. dissertation to coauthor a manuscript that was submitted to the "Journal of Agricultural, Biological and Environmental Statistics" that describes the development and validation of a Bayesian model that predicts maize seed longevity from historical, long-term viability test results;

2. collaboration with Kathy Reitsma on taxonomic verification of *Daucus* germplasm, as part of a larger project involving Drs. Philipp Simon and David Spooner (USDA-ARS, Madison, WI), which should ultimately result in the development of a monograph for the genus;
3. collaboration with Aleš Lebeda (Palacký University, Olomouc, Czech Republic), Kathy Reitsma, and Charlie Block to expand research that refines differential sets for cucurbit reaction to various mildew taxa; and
4. collaboration with Peter Bretting (ARS Office of National Programs) and Karen Williams (ARS Plant Exchange Office) in the completion of a Country Report for the United States on plant genetic resources for food and agriculture that was submitted to, and published by, the FAO.

Research products:
In 2011, collaboration with Terry Isbell (NCAUR, Peoria, IL) resulted in the assessment of seed-lipid composition for 78 *Calendula* accessions which has been posted to public GRIN and summarized as an oral presentation at the 2011 annual meeting of the Association for the Advancement of Industrial Crops, in Fargo, ND.

Mark Widrlechner's other research and training activities:
Collaboration with Pauline Drobney (USF&WS, Neal Smith NWR, Prairie City, IA) continued regarding to the potential invasiveness of Japanese raspberry (*Rubus parvifolius*), which resulted in co-authorship of a paper accepted for the" Proceedings of the 22nd North American Prairie Conference," Cedar Falls, IA.

Collaborations continued with Emily Kapler, Jan Thompson, Jeff Iles, and Philip Dixon at ISU to validate existing, and develop new, regional risk-assessment models to predict the likelihood that non-native woody plants will naturalize in the Midwest. An analysis of data recently collected on non-native plant species that naturalized in Iowa but overlooked in our earlier work to create models was accepted for publication in the "Journal of Environmental Horticulture." Results of an extensive survey of Iowa stakeholders who frequently interact with invasive plants was conducted and analyzed, with the results accepted for publication in "Invasive Plant Science & Management." Research continued on the analyses of data sets collected for southern Minnesota and northern Missouri and on a more comprehensive, regional Midwestern data set, focusing on the development of models using the Random Forest technique.

Until his retirement at the end of September 2011, Mark Widrlechner continued his service as chair of a national Technical Review Team that provides technical direction and oversight to an ARS project to update the USDA Plant Hardiness Zone Map (PHZM) by using the best available technologies and make the next version of the map accessible via the Internet. As part of that service, he continued to assist ARS personnel in Beltsville in refining plans for an external contractor to establish a high-volume website to host the PHZM and worked closely with the PRISM group at Oregon State University and other researchers by coauthoring two manuscripts that describe the technical aspects of map development, the results of that effort, and potential horticultural applications. These papers have been accepted for publication in "Journal of Applied Meteorology and Climatology" and

"HortTechnology." He served as ADODR on a Specific Cooperative Agreement with Oregon State for that project.

Other Horticultural project-training and staff-development activities:
In 2011, Mark Widrlechner and Jeff Carstens attended the Iowa Shade Tree Short Course.

Manuscript and Proposal Review:
Mark Widrlechner continued his service on the Editorial Review Boards of "Genetic Resources and Crop Evolution," the "Journal of the American Rhododendron Society," and the "Journal of Environmental Horticulture." He served as a peer reviewer for the Proceedings of the North American Prairie Conference and for manuscripts submitted to five other scientific journals.

Posters, Presentations and Seminars:
Widrlechner, Mark. 2011. Building and comprehensive collection of ash germplasm before it's too late. Oral presentation to the Eastern Region IPPS Annual Meeting, Louisville, KY, 21 October.

Widrlechner, Mark P., and Terry A. Isbell. 2011. Variation in seed lipids in *Calendula* germplasm. Oral presentation made to the 23rd Annual Meeting of The Association for the Advancement of Industrial Crops, Fargo, ND, 11-14 September, Abstracts p. 47.

Publications (other than those involving the Medicinal Plant Collections) which appeared in print (or online) in 2011:
Bretting, Peter K., Allan K. Stoner, Mark P. Widrlechner, and Karen A. Williams (Compilers). 2011. Country Report on the State of Plant Genetic Resources for Food and Agriculture – United States of America. FAO. p. 44. Available online at http://www.fao.org/fileadmin/templates/agphome/documents/PGR/SoW2/country_reports/americas/US.pdf.

Lebeda, A., I. Doležalová, M. Kitner, A. Novotná, P. Šmachová, and M.P. Widrlechner. 2011. North American continent – a new source of wild *Lactuca* spp. germplasm variability for future lettuce breeding. Acta Horticulturae. 918:475-482.

Widrlechner, Mark P. 2011. Personal note at end of: Biographical notice – Professor Aleš Lebeda at sixty. Plant Protection Science. 47:79-82. (my contribution on page 82).

Widrlechner, Mark P. 2011. Mobilizing resources to conserve ash species in response to Emerald Ash Borer. Public Garden. 26(Summer):27-29.

Departmental Activities:
Until his retirement in September, Mark Widrlechner continued as an active member of the faculty overseeing the Plant Breeding and Genetics major of the Agronomy Department at Iowa State University. He also served on Agronomy Department's Greenhouse & Growth Chamber Committee and the faculty of the Horticulture Department. He continued to serve as a member of the POS

Committees for Ph.D. candidates in Natural Resources Ecology & Management (NREM), Agronomy, Statistics, Horticulture, and Genetics, and as a member of the POS Committees for an M.S. student in NREM (who graduated in 2011) and another in Interdisciplinary Graduate Studies.

Conclusions and Plans for 2012:

Curation:

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 Illinois and Indiana in 2012 is being planned specifically to obtain accessions of *Fraxinus quadrangulata.* Jeff will continue efforts initiated in 2011 to work with David Ellis on integrating ash seed collections from various sources currently held in black-box storage, when the passport and seed-quality data warrant and donors permit.

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. Due to poor seed production in 2011, a collection trip that was scheduled to occur in March 2012 for areas in Missouri and Kansas was cancelled. Plans have been developed to execute this trip in March 2013. A collection proposal will be submitted in 2012 to obtain germplasm from populations in Indiana, Ohio, and Kentucky, which would also be executed in March of 2013, if funded. NCRPIS currently holds thirty-seven accessions of *Gymnocladus dioicus* represented as seed collections from native populations.

Regenerations in 2012 will focus on producing control-pollinated seeds from the large number of shrub accessions now established in field cages, including *Aronia, Cornus, Staphylea,* and *Dasiphora.*

An extensive collection of reports on the evaluation of NC7 Trial plants was published from the 1960s until about 1980. These reports are not widely available. During 2002, Kyle Cavanaugh scanned these reports and created PDF files. These reports have been indexed, but still need to be linked to accession records in GRIN.

Ames-numbered, ornamental and mint-family accessions that are currently available for distribution will be considered as candidates for the assignment of PI numbers in 2012, which involves passport-data proofing, identity verification, and duplication checks.

Evaluation:

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

In addition, morphological seed measurements on recently collected *Fraxinus* accessions will be obtained using computer software and subsequently loaded to GRIN. This information may prove useful for updating taxonomic keys for North American *Fraxinus* and as an aid in identifying accessions that are potentially polyploids. Variability of seed morphology both within and across *Fraxinus* populations will be revealed and documented.

Research:
Research efforts for the coming year (for crops other than medicinal plants) will focus on:

1. breaking dormancy in *Calendula*
2. pollination and reproductive biology of *Gymnocladus*
3. documenting the benefits in utilizing a portable seed dryer during seed collection trips
4. determining the potential variability, or lack thereof, in seed viability between winged and dewinged *Fraxinus* seeds

Staff Development:
Plans for staff development for 2012 will focus on training experiences for Jeff Carstens, which are likely to include attendance at the Iowa Shade Tree Short Course, ArcGIS skills, and safety training. Jeff Carstens also plans to attend the 2012 curators' workshop and give a presentation on domestic germplasm collection.

E. Maize Curation (M. Millard)

Personnel:
Technical staff resignations caused disruption in FY '11. In December 2010, Bruce Hall left his term federal technician position to take a full time position with Jodie Edwards' federal corn breeding project in Ames, Iowa. This work was picked up on a limited appointment (LA) by Ashley Hall, who departed at the end of her employment term in December, 2011. In May, 2011 Mathew Lively resigned the federal technician position to pursue a business opportunity. This position is awaiting clarity on ARS-wide hiring before being filled. Two recent rounds of early retirement offers in ARS and mandated ARS location closings have delayed Agency hiring. In September 2011, Iowa State University state maize agricultural specialist Trent Moore resigned to take a position with Pioneer Hi-Bred. This position, funded by the NC7 Multi-state Project, filled in May, 2012. Another LA position was approved, and Vivian Bernau will started in this position in June, 2012. We wish those who have left success. Suffice it to say that it will take some time to get new staff to fill their shoes.

Research Progress:
Efforts continued on large genotyping / phenotyping nursery of all Ames available inbreds. A 2011 two-rep 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.

In review, in 2010 this project involved planting all available NCRPIS inbreds in 2010 for genotyping and phenotyping at four locations; North Carolina, J. Holland; Missouri, S. Flint-Garcia; New York; E. Buckler; and Iowa, C. Gardner. In all over 2,500 entries are in the project. A term federal technician was hired to assist with the additional work required for DNA sampling and phenotyping. Leaf tissue sampling was done at Ames and Missouri and shipped to Dr. E. Buckler's lab for DNA processing and SNP data acquisition. Plant phenotyping was performed at all four locations in the field with a focus on maturity. Ears were selfed at Missouri for later lab analysis. Open-pollinated ears were harvested in Missouri and brought to Ames where shanks, husks, and ears were phenotyped in winter 2010. These activities were supported in large part by funds provided by E. Buckler. Phenotype data will be added to GRIN after another year, following research publication. Genotyping of the 2,500+ lines was completed and is being analyzed (Buckler lab).

Maria Cinta Romay's (postdoc with Buckler lab) genomic data analysis has already pointed to two mis-identification errors in the collection. Two lines that were deposited as Mo17 conversions (many years ago) were identified as B73-type, using genomic information. Material grown in the field this year, the seed in storage, and the original seed provided were examined following Cinta's inquiry, and all appeared to be B73-type rather than Mo17-type. The originator was contacted to determine whether the original seed deposited was an error. These materials have been distributed and used in published research, posing additional challenges. Use of genomic together with phenotypic information will be helpful in enhancing the quality of the maize collection.

GRIN-Global V1.0 was released in December, 2011. The project has been 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. In FY '11 his primary tasked involved heavy testing before final release and assisting in training of future international GRIN-Global testers. On Nov. 15-22, 2010 he assisted training of 10 students from Mexico, Brazil, Colombia, Brazil, Italy and NPGS-US. During Oct. 31-Nov. 10, he provided assistance via Skype phone for GRIN-Global PROCINORTE-NORGEN workshop held at the new National Genetic Resources Center (CNRG) in Tepatitlán de Morelos, Jalisco, Mexico. This workshop was primarily for Spanish speaking genetic resource workers. Over two dozen students were present during different sessions. Pete Cyr, project leader, and Martin Reisinger, documentation specialist, were the primary trainers with the able help of

Tito Franco from Bioversity International of Colombia. Please see the project website at http://www.gringlobal.org for additional information.

Public US stakeholders will be asked to participate in GRIN-Global development as it is refined and enhanced for NPGS usage. A generic GRIN-Global public website can be accessed via http://www.gringlobal.org on the "Public Website" link. Remember, this is a generalized website that can be tailored to any country's needs. Another link to download the software is located on this page. As NPGS moves towards implementation of GRIN-Global, additional links will appear that will be specific to U.S. GRIN users. The opinion of the members of the maize CGC would be of special value to the maize curator and the rest of the GRIN-Global team as we move forward. For now, you can send comments to feedback-grin.global@ars.grin.gov.

In 2012, the maize curator will be less involved with the international release of the software. Helping NPGS and NCRPIS prepare for implementation and conversion to GRIN-Global will begin after January 1, 2012. During the testing of GRIN-Global, the maize curator has been using a regularly updated full version of the current GRIN database consisting of over 800,000 accession records and all other associated data. Routines regularly performed on current GRIN are replicated as often as possible on this "full" GRIN-Global database. This "parallel testing" lays the groundwork for NPGS usage and will provide a better product for international users.

Acquisition:
In 2011, 180 new accessions were received. These included 54 GEM lines and 66 expiring PVP lines. We received the seven remaining surviving Iowa Stiff Stalk lines from Iowa State that had not yet been included in the collection. Twenty-nine lines with various Rp resistance genes were received from Dr. S. Hulbert, Dr. J. Brewbaker and Dr. J. Pataky. Twelve CML lines were received from the CIMMYT under the SMTA. Thanks to all parties for their donations.

Regeneration:
There were 475 (2.3% of the collection) Zea accession regeneration attempts in 2011. This compares with 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 received in 2011 or shipped in 2011 for 2012 receipt are as follows:

1. A smaller Ames nursery of 260 accessions was attempted during the 2011 summer season compared to 280 in 2010 (2,009 vs. 2,576 25-foot rows). Of these attempts, the majority were inbred lines consisting of 104 expired PVPs and 95 other miscellaneous inbred lines. Only 61 populations were grown to reduce labor requirements.

   Cool temperatures and wet soils delayed planting until the second week in May. After planting, growing conditions were good but a bit cool. As pollinations started, the crop was in excellent condition. A wind event in the second week of July resulted in some green snap, but most inbreds suffered little damage. One

round of stand-stomping on the populations and by the end of July, it was not apparent that any wind event occurred. As the peak pollination season arrived the week of July 18, so did the heat. The crew was unable to keep up, even with voluntary pre-sunset sessions. At harvest it was apparent that success during that week was poor. Most seed quality was good if pollinated before or after the July 17-24 period. Most scatter-grain occurred during that period. Growing conditions into the fall were dry and the harvest season weather was good. Harvest was slow as student applications were slow to come in and technical support reduced, but dry weather and a later than average killing frost allowed for the harvest to be completed long before cold weather. **No Stewart's wilt was observed in any increases, as was true in 2010.** That means no ELISA testing is necessary on 2011 Ames increase lots to meet phytosanitary requirements. All factors considered, the 2011 Ames summer maize regeneration is rated as below average.

2. Monsanto shipped a nursery of 150 accessions in April, 2011 that was planted in the fall of 2010 and hand pollinated. These 2-row increases targeted accessions in extra low supply of unproven adaptation to winter Oahu, Hawaii conditions. Monsanto grew, pollinated, harvested and shipped a nursery of 50 tropical populations from Oahu, Hawaii grown between March and July 2011. This nursery targeted 100 females per population of mainly lowland tropical adaptation. Many thanks to all at Monsanto who assisted in these large tropical nurseries.
3. Dr. Terry Foley managed the regeneration of 14 expired PVPs at various locations. Thanks for his effort.

4. Five PVP inbreds that were poor in the 2010 Ames nursery were planted at ICIA in the GEM winter nursery and received from there in 2011. Many thanks to Mike Blanco and Andy Smelser.

5. Greenhouse increases included five teosintes and five tropical inbreds.

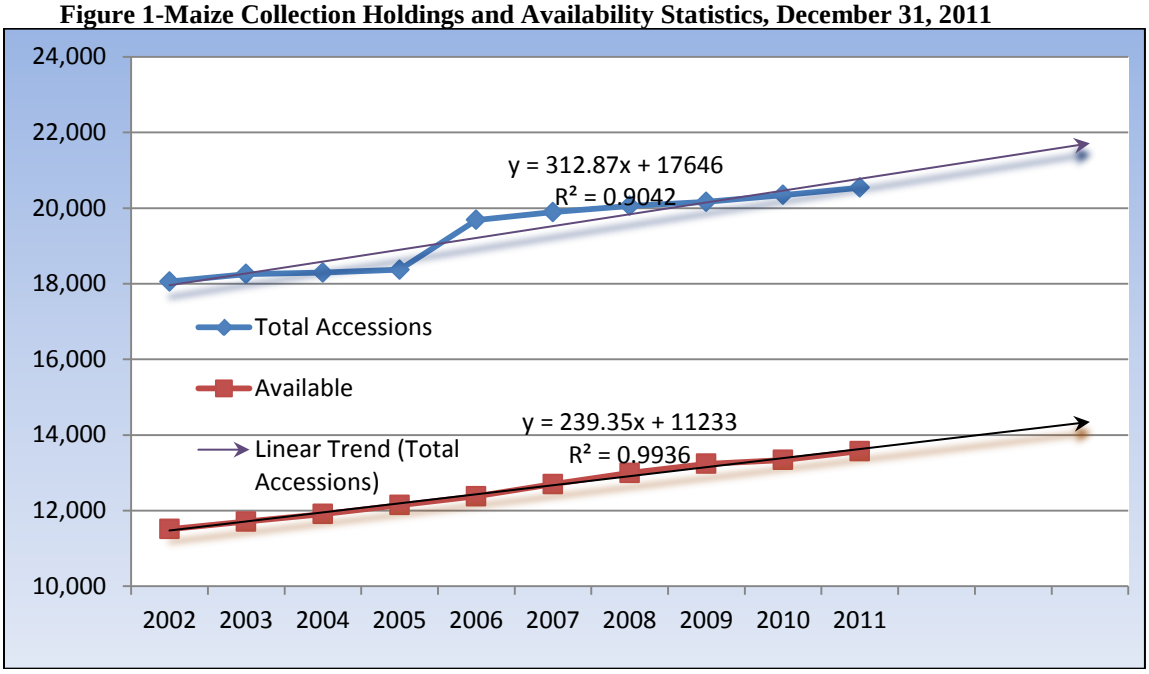
6. Thirty-six tropical inbred accessions by ARS in St. Croix. These were mainly NAM parents or Goodman-Buckler diversity set inbreds in high demand.

7. Five expired PVPs by GEM team in Puerto Rico that were poor in Iowa.

8. Nurseries destined for 2012 harvest that have been planted as of this 2011 report are: 150 accessions by Monsanto on Oahu, Hawaii, 53 tropical inbred accessions by ARS in St. Croix, 5 late maturing inbreds by GEM team in Puerto Rico.

Maintenance:
There were 20,540 accessions of *Zea* held at the NCRPIS as of December 31, 2011. This represents a .9% increase over the 20,347 held at the NCRPIS at the end of 2010. Teosinte, GEMs, and expiring PVPs made up the majority of the additions. The maize curator maintains an additional 99 accessions from the *Coix* and *Tripsacum* genera.

Figure 1-Maize Collection Holdings and Availability Statistics, December 31, 2011



There were 13,572 available accessions at the end of 2011 (66.1% of total) compared to 13,338 (65.6%) at the end of 2010 and 12,239 (65.7%) at the end of 2009. Progress in this area continues to be steadily positive, but slowed temporarily by hiring delays. Progress would not be possible without in kind regeneration assistance of Monsanto, the GEM programs in North Carolina and Iowa, and others.

This table indicates that maize 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**
2002	**18,057**	**11,509**	**63.7%**	**335**
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

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

Viability testing in 2011 follows the pattern in recent years of fewer tests done each year as resources dwindle. There were 508 accessions tested representing 2.5% of the collection done in 2011. 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 2011, 126 accessions were backed up at the NCGRP compared to 105, 71, and 368, and 1,027 in the 2010, 2009, and 2008 respectively. The percent backup held at 73% in 2011.

Distribution:

Orders for all accessions maintained by the maize curator including those of the genera Tripsacum and Coix increased 14% over 2010. 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 a replanting of the entire collection of 2,480 available inbred lines (now known as the 'Ames Panel') for tassel phenotyping in Ames for Dr. Torbert Rocheford, Purdue University, Indiana. Most of this set was also sent to Dr. Tianyu Wang of the Chinese Academy of Agricultural Sciences, Beijing, China for phenotyping and genotyping.

Orders for expired PVPs were sent to 158 requestors (34% of all total requestors). Expired PVPs made up some portion of 35% of all orders shipped. Packet distribution of these expired PVP inbreds was similar to the previous year probably because of a similar number expiring. 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**

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
2007	15,063	1,749	6,823	903	580	79	387	71
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	**16,630**	**4,087**	**4,479**	**2,477**	**748**	**78**	**545**	**67**
Averages '07-'11	16,543	2,079	5,536	1,219	678	74	467	65

* Includes normal distribution orders, non-research orders, and orders planted for observations

Figure 2-Maize Collection types

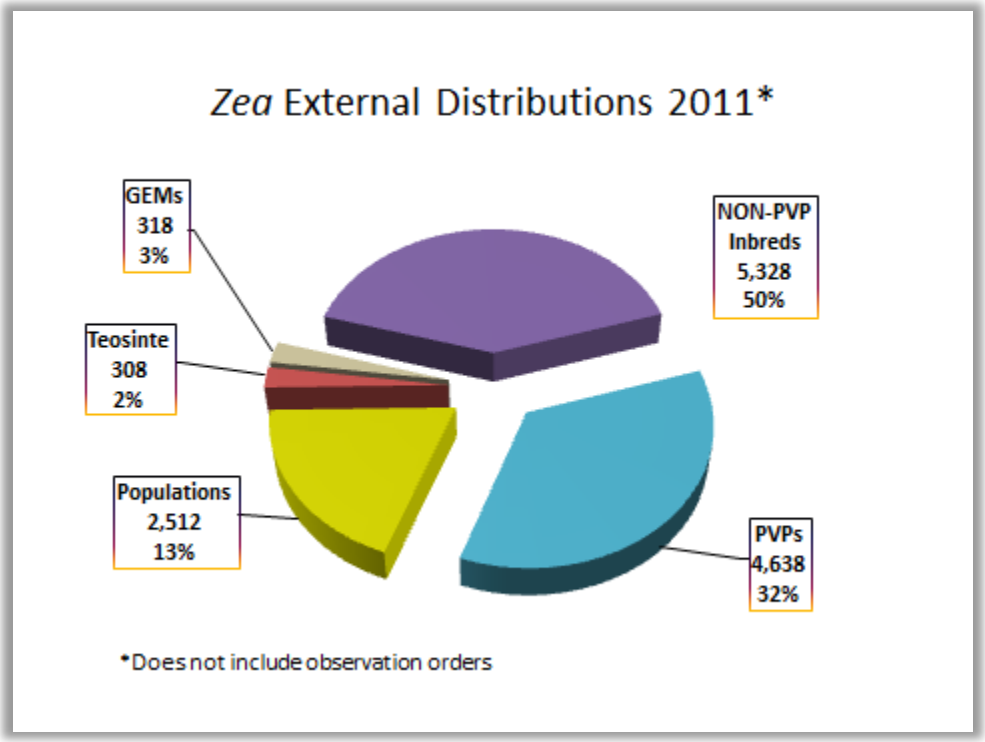
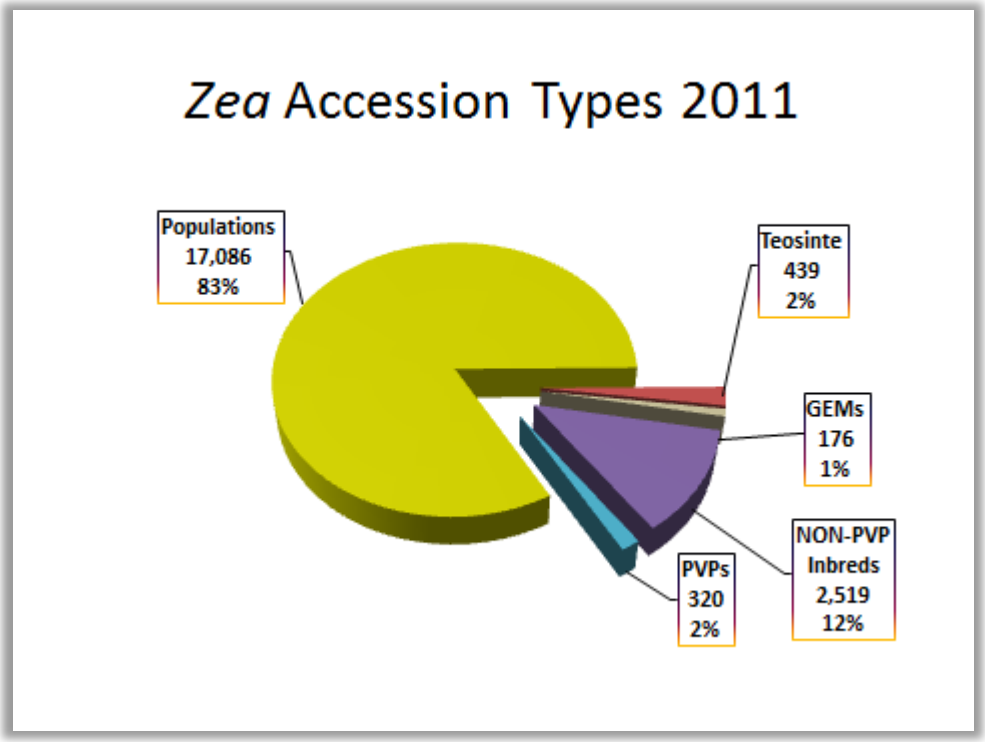


Figure 3-Maize Collection Type Distributions



Characterization:
There were 14,607 data points loaded into GRIN on 2,807 accessions in 2011 compared to 8,217 data points loaded into GRIN on 885 accessions in 2010; 10,242 data points loaded into GRIN on 821 accessions in 2009; and 15,641 data points on 2,026 accessions in 2008.

We imaged 699 accessions in 2011 compared to 520, 599 and 1,378 in 2010, 2009 and 2008 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 remained to be phenotyped in 2012. The phenotypic data will be available on GRIN after publication. The SNP data was made available to the curator in late 2011.

Evaluation:
Two disease screening nurseries were sent out in 2011. Dr. Bill Dolezal, Pioneer Hi-Bred/DuPont, screened 250 accessions for northern leaf blight resistance and diplodia ear rot screening. 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.

Communication:
In 2011, several hundred visitors toured our station, including a television film crew in September from TV Globo, a Brazilian network that was developing a comprehensive program about corn production, biotechnology, and the biofuels industry in the U.S. The GEM field days also bring a number of scientific contacts interested in using the collections.

Plans for 2012:
Attending to regenerations and regeneration processing must take precedence in 2012. Permanent technical staff needs to be hired and trained. Student labor staffing is not expected to increase. The GRIN-Global project continued taking the maize curator's time in 2011 but must take much less time in 2012. Due to the GRIN-Global workload, many of the projects listed below are carryovers from previous years' reports. Regeneration remains this curator's first priority because without viable seed, distribution and resulting research cannot be done.

Data will continue to be collated on the 2,500+ inbred phenotyping/genotyping project. We will assist in analysis and publication of the results. Utilization of this data to enhance collection quality and decision making is a high priority objective.

Assisting NPGS migration from GRIN to GRIN-Global will be on the agenda. Enhancement of the international version for deployment in the U.S. is anticipated to begin in 2012.

Monsanto continues to regenerate tropical accessions on Oahu, Hawaii. Currently 50 tropical accessions are being grown there. The big challenge for the maize staff will be to process these increases with reduced staffing.

Funding has been allocated for a winter 2012 tropical nursery. The GEM project continues to assist in regenerating a few "high priority items".

Continue acquiring germplasm from public collections.

Ames numbered accessions will be reviewed and PI numbers assigned; it is estimated that over 1,200 Ames-numbered accessions and 400 currently available NSL-numbered accessions could be assigned permanent PI numbers. This process is a 2012 priority after GRIN-Global work.

More GEM accessions will be released for distribution by the NCRPIS in 2012.

I will continue to augment the collection of images currently on GRIN of 5,000 accessions with images of additional accessions in 2012.

F. Medicinal Plants (M. Widrlechner and L. Qu)

Medicinal germplasm curation in 2011 was supported by internal (ARS) support. Luping Qu was employed until mid-summer and all remaining projects were completed by Mark Widrlechner and Jeff Carstens. Historically the medicinal project has been supported by an NIH grant awarded to Iowa Center for Research on Botanical Dietary Supplements (Botanical Center), ISU, which ended in the summer of summer of 2010.

Acquisition:
During 2011, we received and/or collected 5 new accessions of medicinal species, which represents 1% of the current collection (Table 1). The collection currently consists of 498 accessions.

Availability and Backup:
Seventy-one percent of the NC7 medicinal accessions are currently available (Table 1). In 2011, 51 seedlots of these accessions were made available and 40 accessions were backed up, with 370 accessions now backed up in Fort Collins, representing 74% of the total collection (Table 2).

Regeneration and Maintenance:
In 2011, seeds from 12 accessions (1 *Echinacea,* 10 *Prunella,* and 1 *Actaea*) regenerated in field cages were harvested and processed for storage. Approximately 100 accessions have been identified for future PI number assignment. Initial paperwork was pulled in order to verify passport data and check for duplication.

Viability Testing and Seed Germination Investigation:
Seedlots of 56 accessions were tested for germination in 2011 (Table 2). The testing included recently acquired original samples and those recently regenerated.

Distribution:
In 2011, 125 items were distributed; of these, 90% were domestic and 10% were foreign distributions (Table 3A). Along with seed distribution, fresh material of

Prunella vulgaris subsp. *asiatica* (A29995) was provided to Olga Zabotina at Iowa State University.

Characterization and Taxonomy:
No accessions were imaged, characterized, or re-identified in 2011.

Pathogen Observations:
Since there were only accessions of *Prunella* growing in 2011, no monitoring for disease was necessary.

Vernalization of Young *Prunella* Seedlings for Promoting Reproductive Development:
In 2010, Luping Qu experimented with growing accessions of *Prunella* in late winter in hopes to achieve flowering and viable seeds within one growing season. Accessions were grown until plants had greater than one pair of true leaves and received approximately 30 days of chilling before transplanting. This procedure resulted in successfully harvesting 7 accessions from a total of 22 accessions attempted. Following the 2010-2011 winter season, only 10 of the remaining 15 accessions that did not flower in 2010 overwintered successfully. Initial observations seem to directly correlate the poor overwintering success to accessions originating from the Pacific Northwest. To possibly improve the successful percentage of accessions being regenerated in one season, increasing the length of time seedlings are chilled is recommended. This procedure was described in greater detail in the 2010 annual report.

Medicinal Plant Publications by Mark Widrlechner and Luping Qu for 2011:
Qu, L. and M.P. Widrlechner. 2011. Variation in the Breeding System of *Prunella vulgaris* L. HortScience. 46:688-692. PMID: 3138140.

Oh, ChoonSeok, Jason Price, Melinda Brindley, Mark P. Widrlechner, Luping Qu, Joe-Ann McCoy, Patricia Murphy, Catherine Hauck, and Wendy Maury. 2011. Inhibition of HIV-1 infection by aqueous extracts of *Prunella vulgaris*. L. Virology Journal. 8:188 (10 pages) doi:10.1186/1743-422X-8-188. Available online at http://www.virologyj.com/content/8/1/188. PMID: 21513560.

Qiang, Zhiyi, Zhong Ye, Cathy Hauck, Patricia A. Murphy, Joe-Ann McCoy, Mark P. Widrlechner, Manju B. Reddy, and Suzanne Hendrich. 2011. Permeability of rosmarinic acid in *Prunella vulgaris* and ursolic acid in *Salvia officinalis* extracts across Caco-2 cell monolayers. Journal of Ethnopharmacology. 137:1107-1112. Available online at http://dx.doi.org/10.1016/j.jep.2011.07.037.

Ramasahayam, Sindhura, Hany N. Baraka, Fatma M. Abdel Bar, Mark P. Widrlechner, Khalid A. El Sayed, and Sharon A. Meyer. 2011. Effects of chemically characterized fractions from aerial parts of *Echinacea purpurea* and *angustifolia* on myelopoiesis in rats. Planta Medica. 77:1883-1889. Available online at http://dx.doi.org/10.1055/s-0031-1279990, PMID: 21870322.

Plans for 2012:
Regeneration:
There will be no new plantings in 2012.

Characterization and Evaluation:
There are no plantings to be evaluated in 2012.

Image loading:
Digital images taken in 2010 growth season are ready to be loaded in GRIN.

Transition:
As the medicinal project awaits future guidance and support from ARS as to how to continue to develop and maintain the medicinal collection, no future regenerations will be attempted. The current collection is 74% available and 71% backed up. Additional accessions not represented in the medicinal collection will be acquired when opportunities arise during future collection trips focused on other NPGS taxa.

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

Project management:
L. Crim continues to work on the oilseeds project half-time.

Acquisitions:
We received 111 new oil seed accessions in 2011.

Helianthus:
Thirty-eight cultivated *Helianthus annuus* accessions with expired or expiring intellectual property rights protection (CSR, Crop Science Registration) were received from NCGRP, Ft Collins. Fifteen of the new cultivated accessions were regenerated in 2011; the remainder will be grown in 2012. Seventeen new wild *Helianthus* accessions were received in 2011. Eleven wild accessions, six different species filling geographic gaps in the NPGS collection, were received from a research program at the University of Georgia. USDA weed scientist Charles Bryson, now retired, Stoneville, MS, collected three accessions of wild *Helianthus annuus* in the unique Mississippi Delta region in northern Mississippi and donated the seeds to the NPGS. One accession each was collected in western NM (by M. Widrlechner), eastern LA (by K. Williams, immature population identified during 2010 Marek-led collection trip) and TX (requested from NCGRP, previously donated by the Lady Bird Johnson Wildflower Center)

Brassicaceae:
Five new *Brassica napus* accessions with expired plant variety protection (PVP) were received from NCGRP, Ft. Collins. Fifty-one new crucifer accessions were received during 2011: thirty-six new *Thlaspi arvense* accessions (31 from Colorado, one from IL, one from IA, two from SD and one from Chile), 14 new camelina accessions (two *C. sativa* and 12 *C. microcarpa*, from the Republic of Georgia), and one new *Lepidium perfoliatum* accession (collected in NE).

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 or flat operating budgets. Selected details for oil seed accessions increased during 2011 are noted below.

Helianthus, Ames regenerations:
Cultivated *H. annuus* accessions are 96% available. We are managing our increases to maintain a high level of availability and to ensure that core collection accession and other specific groups of interest are available. In 2011, 69 *H. annuus* cultivated accessions were regenerated in the field. 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 2010 -2011. Wild annual *Helianthus* accessions are 97% available and wild perennial accessions are 64% available (20% available seven years ago). We caged three wild annual *Helianthus* accessions and harvested seed from all three accessions. Seed was harvested from 19 of 20 caged perennial accessions, 17 of which had been previously established in the field.

Helianthus, Parlier alternate grow-out site regenerations:
We continue to work with NPGS Parlier, CA personnel to increase 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 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 2011, we sent seedlings for 26 new accessions, four plots established in 2010 were maintained and re-caged, and all 30 plots were harvested. The 2011 harvested material arrived in Ames in December and is being processed.

The Parlier group 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 2011, Mr. Larsen, oilseeds project technician and I, traveled to Parlier to record descriptor information and to take images.

Brassicaceae regenerations:
Brassicaceae accessions are 89% available. In 2011, populations for 38 Brassicaceae accessions, 24 *Brassica* and 14 miscellaneous crucifers, were established in the field. Seed was harvested from 26 of the field established accessions. Six accessions died from black rot infestation and will be re-grown in 2011 after pre-germination seed treatments, and six accessions did not flower. Eleven greenhouse maintained Brassicaceae accessions were harvested in 2011 (three *Brassica* and eight miscellaneous crucifers). Three additional greenhouse maintained accessions did not flower. Five of the 31 new 2010 *Thlaspi arvense* accessions without enough seed

to allow distributions were started in fall 2011 for winter 2011-2012 greenhouse regeneration.

Linum regenerations:
Cultivated flax accessions are 99.5% available, and no regenerations were attempted in 2011. Wild flax accessions are 79% available. Four wild flax accessions were established in the field in 2011, of which two were harvested. Three populations remain in the field to overwinter to 2012.

Cuphea regenerations:
No Cuphea regenerations were attempted in 2011. 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 78% available.

Miscellaneous asters regenerations:
The miscellaneous asters are 24% available, and no regenerations were attempted in 2011.

Euphorbia regenerations:
The *Euphorbia* collection is 42% available, and no regenerations were attempted in 2011.

Inactivations/PI re-numbering:
During 2011, 79 non-viable *Helianthus* accessions were inactivated and 323 *Helianthus* accessions (109 cultivated and 214 wild) were re-numbered from Ames or NSL numbers to permanent PI numbers.

Distributions:
General statistics about oil seed collection distributions are presented in Table 3 in the appendix.

Helianthus:
In 2011, 25% of the sunflower accessions sent out to support genetic and genomic related research targeted genetic mapping and sequencing efforts (790 items). Another 28.5% of distributed sunflower packets were sent to support breeding efforts, including over 400 accessions sent to a research program examining all cytoplasmic male sterility restorers in the collection. Accessions were also sent to several ornamental breeding programs. 14% of distributed items were sent to support disease research, including 226 accessions for an association mapping project involving phomposis and sclerotinia responses, and 112 items sent to support a PhD project examining rust resistance response. Another 13% of the distributed items were sent to support research about herbivore defense traits in wild species.

Brassicaceae:
The diversity in the Brassicaceae collection (accessions of 262 taxa from 21 genera) supports a wide range of research purposes. Almost 25% of the 2011 distributed items (662 items) were for two orders for genetic mapping projects. Other molecular characterization research topics supported by 2011 distributions included

development of molecular genetic markers able to distinguish between different *Brassica* species and studies about RNA editing and drought related gene expression. Seeds were distributed to support development of a transformation system in camelina as well as to support work developing biofuel and oil production in camelina. Breeding and disease research programs received 26% of the brassicaceae distributions. Phytoremediation remains a topic of research interest using brassicaceae germplasm.

Linum:
Cultivated and wild flax accessions were distributed to support breeding programs in both fiber and oil production as well as to support general educational purposes (156 items).

Cuphea:
The majority of Cuphea requests in 2011 were for material to support fatty acid research (39 of 64 distributions). Twenty-four accessions were distributed for evaluation for ornamental potential.

Euphorbia:
Euphorbia accessions were distributed during 2011 primarily to supply material for archaeobotany (12 items) and ornamental breeding (21 of 40 distributions).

Miscellaneous asters:
Miscellaneous asters accessions were distributed to support lipid metabolism research and as a *Helianthu*s near relative for genome sequencing.

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. Since 2008, the Oilseeds project has been cooperating with Dr. Charles Block, USDA-ARS and NCRPIS pathologist, and Dr. Thomas Gulya, USDA Sunflower Research Unit Pathologist, Fargo, ND to select and supply germplasm for their greenhouse (Block) and field (Block and Gulya) evaluations. An initial goal was to screen all untested cultivated accessions in the field. Field evaluations are labor intensive and subject to variable weather conditions. A second goal has been to develop a greenhouse screen that successfully predicts field response so that only the most promising accessions would require field testing. Dr. Block has been evaluating wild sunflower accessions in the NCRPIS greenhouse fall through late spring to identify potentially valuable germplasm for incorporation into cultivated breeding lines. In 2011, 172 wild and cultivated accessions were screened. Nineteen wild annual accessions (five species) were tested in the field and field results validated greenhouse testing. Please see the Pathology section of this annual report for more details.

Brassicaceae:
Thlaspi and camelina agronomic characteristics: *Thlaspi arvense* and *Camelina sativa*, Brassicaceae weed species commonly associated with agricultural production

world-wide, have remarkable cold tolerance and interesting seed oil characteristics. Both species complete their life cycles by late spring or early summer suggesting use as a non-food or feed biodiesel component in a double cropping system. Ivan Ayala-Diaz, a Fulbright sponsored ISU PhD. student, has continued work started in 2008 to characterize *T. arvense* and *C. sativa*. During 2011, field work included planting, evaluating and harvesting seed from a 500 member mapping population derived from a cross between high and low oil parental lines, germplasm from Sustainable Oils, LLC, MT USA. In addition, during summer 2011 Mr. Ayala and the Oilseeds Project helped direct George Washington Carver Intern, Adeola Olayiwola, from Western Illinois University. The Oilseeds Project provided significant field support for Mr. Ayala, planting, weeding, recording observations, harvesting, and processing as well as sorting materials for analyses in our on-going partnership with the National Center for Agricultural Utilization Research (NCAUR) Research Unit, USDA-ARS in Peoria, IL. Mr. Ayala traveled to Peoria and completed Near Infrared Reflectance Spectroscopy (NIRs) and nuclear magnetic resonance (NMR) oil analyses in laboratories there.

Professional Activities:
Meetings and Presentations:
January: I attended the 19th Annual Plant and Animal Genome Conference, San Diego, CA as co-author on two posters, derived from the 2009-2011 USDA/DOE Genomics of Biomass Feedstocks grant for which I was co-PI directing sunflower phenotypic research at the NCRPIS summers 2009-2010.

July: I traveled to Athens, GA to meet with the USDA/DOE Genomics of Biomass Feedstocks grant group (Dr. John Burke, Dr. Steve Knapp, Dr. Jennifer Ellis-Mandel, Dr. Jessica Barb, Dr. Lisa Donovan, Dr. Savithri Nambeesan).

September: I attended the annual meeting of the Association for the Advancement of Industrial Crops, Fargo, ND presenting a crop status report to the New Crops CGC and co-authoring graduate student, Mr. Ivan Ayala's two posters about ongoing research in the new brassicaceae crops, *Thlaspi* and *Camelina*.

November: I attended the annual ASA/CSSA/SSSA meeting, San Antonio, TX and presented a talk "Wild Helianthus Species: Collection of a Native Son to Provide a Diverse Germplasm Resource" in the CSSA C-08 Plant Genetic Resources session for co-author Gerald Seiler who was attending a FAO meeting in Turkey.

November: I attended the Annual Compositae Workshop, Davis, CA upon invitation by the organizers.

Publications:
Mandel, J.R., J.M. Dechaine, L.F. Marek, and J.M. Burke. 2011. Genetic diversity and population structure in cultivated sunflower and a comparison to its wild progenitor, *Helianthus annuus* L. Theor Appl Genet. 123(5): 693-704.

Grant support:
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).

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

Service Activities:
AAIC:
From March 2010 through January 2011, I served as a guest editor for a special issue of the Journal of Industrial Crops and Products handling the Oilseed Division submissions from the AAIC annual meeting in Chile, November 2009. Final Oilseed paper revisions were completed in January 2011.

Journal peer review:
I served as a peer reviewer for submissions to the European Journal of Lipid Science and Technology (2) and for the Journal of Heredity (1).

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.

H. 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:
Seeds of seven cultivars were received from NCGRP and include four *Cucumis melo*, two *Cucumis sativus*, and one *Pastinaca* ('Arkansas Little Leaf' cucumber and 'Andover' parsnip were expired PVPs). Eight new accessions of *Daucus* were received in 2011 and included five *D. pusillus* collected in Texas by Susan Stieve and Pablo Jordan of the Ornamental Plant Germplasm Center, Columbus, OH; one *D. carota* collected in Iowa by Lucinda Clark of the NCRPIS; 1 *D. carota* subps. *gadecaei* and *D. carota* subsp. *halophilus* from France donated by Drs. David Spooner and Philipp Simon, USDA-ARS, University of Wisconsin, Madison, WI.

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 17 *C. melo*, 15 *C. sativus*, and 10 wild *Cucumis* species. Twelve *C. sativus*, 13 *C. melo*, and five wild accessions were successfully regenerated (sufficient population sizes resulting in the harvest of good seed quantities). Accessions where low seed quantities were harvested (three *C. melo*, two wilds) or those that failed to germinate (one *C. melo*, three *C. sativus*, three wilds) will be regenerated again in 2012.

Cucurbita pepo field regenerations focused on accessions with low seed quantities or distribution lots 20+ years old. Ten of 16 accessions were successfully regenerated. The six unsuccessful regenerations included two accessions that failed to germinate, one that failed to flower, and three with low fruit set. One accession was re-identified to *Cucurbita moschata* and will be transferred to Griffin, GA. Ten accessions should be available for distribution after viability testing in April 2011.

Daucus regeneration efforts focused on newer accessions from Tunisia. Thirty-seven accessions were started by Dr. Phil Simon (USDA-ARS, Madison, WI) in El Centro, CA. Roots were dug from the field and shipped to Ames, IA for vernalization. After vernalization, the roots were transplanted into the field for pollination in cages using insect pollinators. Though the roots appeared to have survived vernalization, they failed to grow and thrive after transplanting. Harvests were made on only 11 of the 37 accessions, and all had insufficient plant populations so will need to be regenerated again before the accessions can be made available for distribution. Dr. Simon indicated that roots of these same populations sent from El Centro, CA to Madison, WI also failed.

In addition to the *Daucus* regenerations in Ames, we received seed increases from Rosa Yzquierdo, Seminis Vegetable Seeds, Idaho (four accessions), and Roger Freeman, Nunhems, Oregon (three accessions). Another six accessions each were sent to Seminis Vegetable Seeds and Bejo Seed for regeneration in the 2011-2012 growing season. (Dr. Maxwell has since left Seminis for a position with Bejo Seed in Idaho, but will continue to regenerate *Daucus* for the NPGS as resources allow.)

One accession of *Ocimum* with low seed quantity was 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 vegetable collections are backed up. Six of eight vegetable site-crops have 80% or more of their accessions backed up at NCGRP (Table 2).

No vegetable accessions were inactivated, and no PI numbers were assigned to Ames-numbered accessions in 2011.

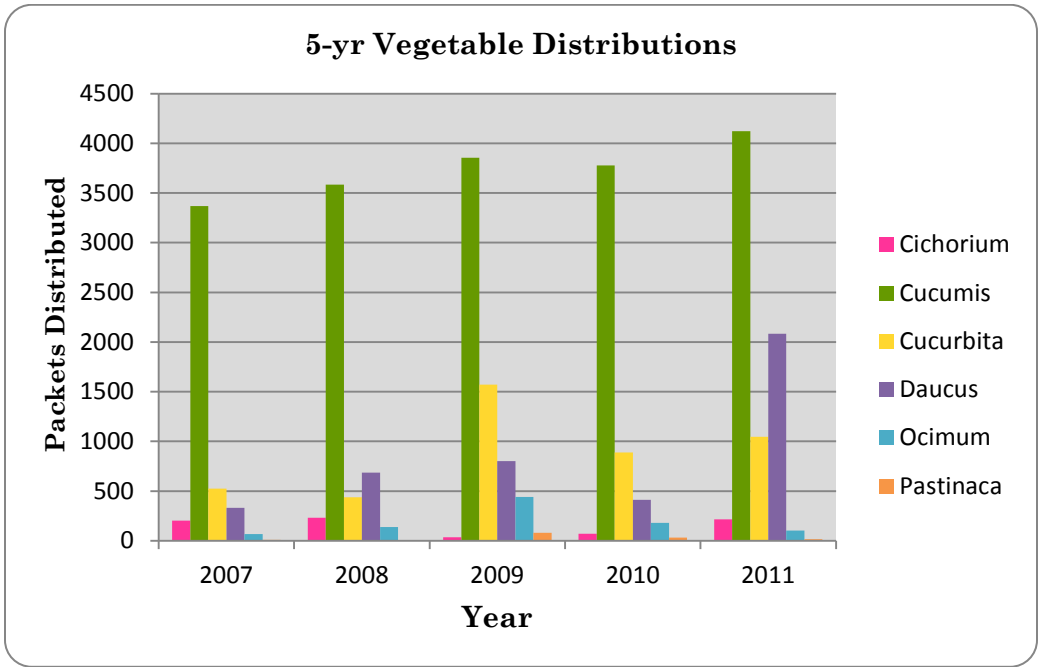
In 2011, 150 vegetable collection accessions were tested for viability (Table 2), focused primarily on regeneration lots. Viability tests performed on some of the 2009 Daucus regeneration seed lots had extremely high mold levels such that their viabilities could not be determined. An experiment was performed to determine whether these seed lots would benefit from some form of surface disinfestation. With Maria Erickson's assistance, six accessions having the highest mold levels on the original viability tests were retested using the following seed treatments:

- Control (no treatment)
- Bleach (1:8 Clorox:water), 40 minutes
- Hot water (122 F/50 °C) 15 to 20 minutes
- Tri-sodium phosphate (approx. 10% w/v; 1 pound per 1 gallon of water) for 2 hours

Little or no difference in seed viability was found between the four treatments at the conclusion of the test. Test results showed no mold infestation on any of the treatments – even the controls were clean. Thus, it was determined that none of the seed lots would be treated for mold because of concern for effects such treatments might have on the long-term viability of these distribution lots. The cause of the initial mold infestation was not determined.

Distribution:

Packet and accession distributions for the vegetable collections are summarized in the appendices in "Table 3A: External NCRPIS Distributions" and "Table 3B: Internal NCRPIS Distributions." In 2011, 7697 seed packets (items) involving 3859 accessions were distributed to fulfill 340 orders (278 domestic, 62 foreign) equaling 318 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 20% of the total NCRPIS orders, and 62% 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 will be attributed to the 2012 NCRPIS stats.] Non Research Request (home gardener requests) make up 58% of the requests for accessions in the NCRPIS vegetable collections 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 232 NRR vegetable requests received in 2011, 47 orders were cancelled. We may limit the accessions available to a select few from each of the NCRPIS vegetable collections for NRR requests.



Vegetable requests received in 2011 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 2011 will be loaded to GRIN. (NOTE: Multiple images are taken of an accession to document plant, leaf, flower, fruit, or root characteristics.)

In 2011, 59 biennial *Daucus* accessions were transplanted into an observation plot and 32 annual *Daucus* and 11 allied Apiaceae species were direct seeded into the plot to verify taxonomy, collect characterization data and herbarium specimens, and to capture digital images of plants, flowers, foliage, and roots. Dr. David Spooner (University of Wisconsin, Madison, WI) visited Ames June 27 to July 7, August 1 - 11, and November 14 - 17 to assist with data and herbarium specimen collections. These data, specimens, and images will be used in his work to develop a monograph for the genus *Daucus*. Thus far, 4135 and 4970 observation records have been loaded from the 2010 and 2011 *Daucus* observation plots, respectively. Images from the 2011 plot will be loaded to GRIN

The Entomology Project made use of the plot to observe insect pollinator activity on the flowering plants during the growing season primarily to determine which native insect pollinators visited the *Daucus* and allied Apiaceae in the planting. (For more information, please refer to the Controlled Insect Pollination Service Program in Section VII. Curatorial and Scientific Team Reports.)

With the assistance of Dr. Mark Widrlechner (NCRPIS Horticulturist), taxonomic identities are reviewed and confirmed as each accession is regenerated or grown in observation plots. The 2011 re-identifications included two *Cucumis* species identified to *C. anguria* var. *anguria* and *C. myriocarpus* subsp. *myriocarpus*; and 15 *Daucus* to other *Daucus* species, subspecies, or varieties including four accessions identified as hybrids of *D. carota* × *D. guttatus*. Also, 11 accessions of *Ocimum americanum* var. *pilosum* have undergone a nomenclature change and are now known as *Ocimum* x *africanum*.

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, since 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:
Dhillon, N. P.S., Monforte, A. J Pitrat, M. Pandey, S., Praveen K. S., Reitsma, K. R., Garcia Mas J., Sharma, A., McCreight, J. D., Melon. 2011. Landraces of India: Contributions and Importance. Plant Breeding Reviews. 35:85-150.

Plans for 2012:
Regenerations:
In October 2011, 20 biennial *Daucus* accessions were planted in pots in the greenhouse and five annual accessions will be started in the greenhouse in March 2012 for regeneration in field cages in the summer. If we have extra roots of these populations, they will be included in the 2012 *Daucus* observation planting. Depending upon the status of the station's budget, we would like to regenerate approximately 100 *Cucumis* accessions, focusing on accessions that produced

insufficient seed quantities in 2011 and those with low seed quantities. We will also regenerate approximately 15 *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 2011 cucurbit regeneration seed lots in April 2012 and on the 2011 *Daucus* regeneration seed lots in the summer of 2012. Ten-year germination testing of distribution lots will be done as resources allow.

Characterization:
In October 2011, 48 *Daucus* accessions were sown in pots in the greenhouse, for vernalization prior to transplanting into the 2012 *Daucus* Observation Plot in mid to late April. In March 2012, 41 annual accessions will be started in the greenhouse for transplanting into the 2012 observation plot. These 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*.

I. 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. 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, many taxa that require germination and vernalization treatments in the

winter were not started. This also led to conservative student labor hiring decisions, all of which impact regeneration and other activities.

About 5% of her time in 2011 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 deployment of the System.

Research Activities:
Graduate student Ivan Ayala-Diaz, a Fulbright Fellow from Colombia, is conducting his Ph.D. research on *Thlaspi* and *Camelina* 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, completed his M.S. project dealing with GEM Project germplasm and methods to generate dihaploid lines from introgressed maize racial materials.

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 is very involved in the phenotyping / genotyping project for the inbred lines of the maize collection with USDA-ARS scientist Edward Buckler and numerous colleagues. Postdoc Maria Cinta Romay (Buckler lab) presented findings in March at the Maize Genetics Meetings. Since then, four requests for the 'Ames Panel,' as the 2500+ inbred lines used are called, have been received at the station.

Professional Interactions:
CSSA C8 Division: Served as Chair in 2011, and was responsible for the C8 sessions at the annual Crop Science Meetings in San Antonio in October, 2011.

Presentations and Publications:
2011 – Invited presentations were given to the graduate students at the University of Minnesota on plant genetic resource conservation, the mission

of the NPGS and the NCRPIS, and associated activities, and also to the Retired Agricultural Men's Club of Minnesota.

In 2012, outreach efforts by C. Gardner will include invited presentations at Kansas State University, the Am. Phytopathological Society, and CSSA.

Year 2011 Table 1. NCRPIS Accessions (Accs), Acquired, Available

01/01/2011 to 12/31/2011

CURATOR	GENUS_CROP	Number Accs	Number Accs Acquired	Percent Acquired	Number Available	Percent Available	Percent Avail Last Year
Brenner	NC7-amaranth	3352	8	0	3202	96	95
	NC7-celosia	57	0	0	34	60	60
	NC7-echinochloa	306	0	0	269	88	84
	NC7-grasses	127	2	2	82	65	61
	NC7-legumes	246	9	4	112	46	46
	NC7-melilotus	1002	2	0	768	77	77
	NC7-panicum	933	0	0	910	98	95
	NC7-perilla	25	1	4	23	92	96
	NC7-quinoa	350	0	0	261	75	62
	NC7-setaria	1015	1	0	940	93	92
	NC7-spinach	406	1	0	393	97	97
	NC7-umbels	1144	1	0	695	61	57
	Total:	8963	25	0	7689	86	84
Carstens	NC7-medicinals	498	5	1	353	71	65
	NC7-mints	157	3	2	109	69	74
	NC7-ornamentals	2455	83	3	1156	47	46
	Total:	3110	91	3	1618	52	47
Marek	NC7-asters	364	0	0	87	24	24
	NC7-brassica	2010	5	0	1852	92	91
	NC7-crucifers	1195	51	4	990	83	86
	NC7-crucifers.pvp	1	0	0	0	0	0
	NC7-cuphea	639	0	0	512	80	80
	NC7-euphorbia	208	0	0	87	42	42
	NC7-flax	2834	0	0	2820	100	100
	NC7-flax.wilds	117	0	0	93	79	76
	NC7-sun.cults	1829	38	2	1729	95	93
	NC7-sun.wilds.ann	1374	6	0	1326	97	95
	NC7-sun.wilds.per	834	11	1	569	68	62
	NC7-sun.wilds.sp	1	0	0	0	0	50
	Total:	11406	111	1	10065	88	87
Millard	NC7-corn.kin	99	64	65	6	6	17
	NC7-maize.gems	176	54	31	113	64	88
	NC7-maize.inb	2519	51	2	1955	78	78
	NC7-maize.pop	17086	9	0	11134	65	65
	NC7-maize.pvp	320	66	21	281	88	88
	NC7-maize.wilds	439	0	0	89	20	21
	Maize.totals	20540	180	1	13572	66	66
	Total:	20639	244	1	13578	66	65
Reitsma	NC7-chicory	277	0	0	217	78	79
	NC7-cucumis.cucs	1376	2	0	1307	95	94
	NC7-cucumis.melo	3200	4	0	2298	72	71
	NC7-cucumis.wilds	321	0	0	173	54	52
	NC7-cucurbita	975	0	0	770	79	78
	NC7-cucurbits.misc	1	0	0	0	0	0
	NC7-daucus	1294	7	1	1022	79	77
	NC7-ocimum	98	0	0	91	93	93
	NC7-parsnips	71	1	1	51	72	72
	Total:	7613	14	0	5929	78	78
NCRPIS Total:		**51731**	**485**	**1**	**38879**	**75**	**74**

Year 2011 Table 2 NCRPIS Accessions (Accs) Germinated, Regenerated, Made Available, Backed Up

01/01/2011 to 12/31/2011

CURATOR	GENUS_CROP	Number Accs	Number Accs Germed	Percent Accs Germed	Number Attempted Regen	Number Harvested Regen	Number Perm Perennial	Number Perennial Harvested (Vegetative)	Number Accs Made Available	Number Accs Growing	Number Accs Backed UP for YR	Total Number Accs Backed Up	Percent Accs Backed Up
Brenner	NC7-amaranth	3352	122	4	46	74	0	0	76	0	217	3243	97
	NC7-celosia	57	1	2	1	1	0	0	0	0	0	35	61
	NC7-echinochloa	306	12	4	0	1	0	0	12	0	2	266	87
	NC7-grasses	127	16	13	0	0	0	0	8	0	5	85	67
	NC7-legumes	246	2	1	4	2	0	0	2	0	0	175	71
	NC7-melilotus	1002	0	0	17	30	0	0	0	0	0	843	84
	NC7-panicum	933	13	1	1	10	0	0	12	0	8	910	98
	NC7-perilla	25	0	0	0	0	0	0	0	0	0	23	92
	NC7-quinoa	350	90	26	2	6	0	0	81	0	48	285	81
	NC7-setaria	1015	12	1	4	6	0	0	12	0	11	969	95
	NC7-spinach	406	0	0	31	6	0	0	0	0	0	391	96
	NC7-umbels	1144	54	5	16	13	0	0	41	0	32	700	61
	Total:	8963	322	4	122	149	0	0	244	0	323	7925	88
Carstens	NC7-medicinals	498	56	11	3	12	8	1	51	0	40	370	74
	NC7-mints	157	98	62	5	4	0	0	0	0	1	120	76
	NC7-ornamentals	2455	102	4	18	102	51	2	70	0	53	1069	44
	Total:	3110	256	8	26	118	59	3	121	0	94	1559	50
Marek	NC7-asters	364	0	0	0	0	0	0	0	0	0	99	27
	NC7-brassica	2010	27	1	25	17	0	0	30	3	24	1981	99
	NC7-crucifers	1195	14	1	37	16	2	0	16	11	11	1011	85
	NC7-crucifers.pvp	1	0	0	0	0	0	0	0	0	0	1	100
	NC7-cuphea	639	4	1	4	0	0	0	0	15	0	583	91
	NC7-euphorbia	208	0	0	0	0	0	0	0	6	0	84	40
	NC7-flax	2834	251	9	0	0	0	0	0	0	0	2832	100
	NC7-flax.wilds	117	7	6	4	2	0	0	1	0	1	92	79
	NC7-sun.cults	1829	51	3	71	69	4	0	74	0	20	1756	96
	NC7-sun.wilds.ann	1374	43	3	16	13	1	0	17	0	24	1331	97
	NC7-sun.wilds.per	834	88	11	21	36	7	0	32	17	21	565	68
	NC7-sun.wilds.sp	1	0	0	0	0	0	0	0	0	0	0	0
	Total:	11406	485	4	178	153	14	0	170	52	101	10335	91
Millard	NC7-corn.kin	99	1	1	0	0	0	0	0	0	0	9	9
	NC7-maize.gems	176	6	3	2	2	0	0	0	0	0	71	40
	NC7-maize.inb	2519	166	7	100	126	0	0	132	0	5	1546	61
	NC7-maize.pop	17086	284	2	110	242	0	0	198	0	56	13114	77
	NC7-maize.pvp	320	52	16	104	105	0	0	87	0	65	298	93
	NC7-maize.wilds	439	0	0	0	0	0	0	0	0	0	44	10
	Zea.totals	20540	508	2	316	475	0	0	417	0	126	15073	73
	Total:	20639	509	2	316	475	0	0	417	0	126	15082	73
Reitsma	NC7-chicory	277	0	0	0	0	0	0	0	0	0	244	88
	NC7-cucumis.cucs	1376	27	2	15	12	0	0	29	0	16	1308	95
	NC7-cucumis.melo	3200	52	2	26	16	0	0	51	0	43	2571	80
	NC7-cucumis.wilds	321	13	4	5	7	0	0	13	0	10	174	54
	NC7-cucurbita	975	10	1	16	14	0	0	10	0	10	815	84
	NC7-cucurbits.misc	1	0	0	0	0	0	0	0	0	0	0	0
	NC7-daucus	1294	48	4	12	18	0	0	77	0	69	1047	81
	NC7-ocimum	98	0	0	1	1	0	0	0	0	0	91	93
	NC7-parsnips	71	0	0	0	0	0	0	0	0	0	48	68
	Total:	7613	150	2	75	68	0	0	180	0	148	6298	83
NCRPIS Total:		**51731**	**1722**	**3**	**717**	**963**	**73**	**3**	**1132**	**52**	**792**	**41199**	**80**

Year 2011 Table 3A-1 **External NCRPIS Distributions** - Includes both DI (research and education) and NR (home gardner) order types

01/01/2011 to 12/31/2011

			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
Brenner	NC7-amaranth	3352	3134	64	59	3764	805	16	16	947	3146	80	75	4711
	NC7-celosia	57	8	5	5	8	16	2	2	16	19	7	7	24
	NC7-echinochloa	306	6	2	2	6	47	7	5	52	50	9	7	58
	NC7-grasses	127	2	3	3	3	3	3	3	3	4	6	6	6
	NC7-legumes	246	14	4	4	14	3	1	1	3	16	5	5	17
	NC7-melilotus	1002	51	13	12	58	24	5	5	24	63	18	17	82
	NC7-panicum	933	23	8	7	26	129	8	7	138	144	16	14	164
	NC7-perilla	25	9	6	6	14	0	0	0	0	9	6	6	14
	NC7-quinoa	350	160	52	49	286	163	16	16	483	214	68	65	769
	NC7-setaria	1015	335	30	27	568	784	12	11	923	936	42	38	1491
	NC7-spinach	406	394	17	14	615	312	0	0	378	394	17	14	993
	NC7-umbels	1144	110	49	46	140	450	16	13	528	488	65	59	668
	Total:	8963	4246	206	185	5502	2736	69	64	3495	5483	275	249	8997
Carstens	NC7-medicinals	498	82	42	40	110	15	5	5	15	91	47	45	125
	NC7-mints	157	76	31	29	112	13	3	3	13	79	34	32	125
	NC7-ornamentals	2455	319	103	85	443	147	11	10	156	405	114	95	599
	Total:	3110	477	143	124	665	175	14	13	184	575	157	137	849
Marek	NC7-asters	364	13	11	11	18	8	4	4	9	21	15	15	27
	NC7-brassica	2010	1005	64	64	1273	1634	20	20	2095	1662	84	84	3368
	NC7-crucifers	1195	160	57	48	370	474	16	16	655	548	73	64	1025
	NC7-crucifers.pvp	1	0	0	0	0	0	0	0	0	0	0	0	0
	NC7-cuphea	639	52	8	5	63	0	0	0	0	52	8	5	63
	NC7-euphorbia	208	25	6	4	34	6	3	2	7	30	9	6	41
	NC7-flax	2834	75	19	19	94	37	2	2	37	107	21	21	131
	NC7-flax.wilds	117	9	2	2	9	8	2	2	8	16	4	4	17
	NC7-sun.cults	1829	566	69	63	757	649	16	15	757	970	85	78	1514
	NC7-sun.wilds.ann	1374	587	43	37	759	382	11	11	419	765	54	48	1178
	NC7-sun.wilds.per	834	197	38	33	240	121	7	7	134	268	45	40	374
	NC7-sun.wilds.sp	1	0	0	0	0	0	0	0	0	0	0	0	0
	Total:	11406	2689	249	213	3617	3319	60	58	4121	4439	309	271	7738
Millard	NC7-corn.kin	99	5	12	12	14	2	2	2	3	6	14	14	17
	NC7-maize.gems	176	118	14	12	248	67	4	4	70	119	18	16	318
	NC7-maize.inb	2519	918	241	191	2332	1998	53	44	2996	2027	294	235	5328
	NC7-maize.pop	17086	1614	298	262	2352	153	17	17	160	1692	315	279	2512
	NC7-maize.pvp	320	274	235	133	3806	227	20	19	832	277	255	152	4638
	NC7-maize.wilds	439	139	62	60	273	31	8	7	35	157	70	67	308
	Zea.totals	20540	3063	646	465	9011	2476	78	66	4093	4272	724	531	13104
	Total:	20639	3068	654	473	9025	2478	80	68	4096	4278	734	541	13121
Reitsma	NC7-chicory	277	27	8	8	29	215	2	2	300	216	10	10	329
	NC7-cucumis.cucs	1376	1303	96	93	1830	1169	20	20	1289	1303	116	113	3119
	NC7-cucumis.melo	3200	365	91	89	504	242	21	20	285	524	112	109	789
	NC7-cucumis.wilds	321	76	15	15	98	98	11	10	115	139	26	25	213
	NC7-cucurbita	975	244	99	96	453	552	15	12	592	602	114	108	1045
	NC7-cucurbits.misc	1	0	0	0	0	0	0	0	0	0	0	0	0
	NC7-daucus	1294	283	74	73	375	977	6	5	1708	1007	80	78	2083
	NC7-ocimum	98	37	42	42	75	27	2	2	27	52	44	44	102
	NC7-parsnips	71	16	7	7	17	0	0	0	0	16	7	7	17
	Total:	7613	2351	278	266	3381	3280	62	52	4316	3859	340	318	7697
NCRPIS Total:		**51731**	**12831**	**1237**	**949**	**22190**	**11988**	**264**	**231**	**16212**	**18634**	**1501**	**1180**	**38402**

Year 2011 Table 3A-2 NCRPIS Home Gardner Distributions

01/01/2011 to 12/31/2011

			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
Brenner	NC7-amaranth	3352	28	28	28	38	0	0	0	0	28	28	28	38
	NC7-celosia	57	1	1	1	1	0	0	0	0	1	1	1	1
	NC7-echinochloa	306	0	0	0	0	0	0	0	0	0	0	0	0
	NC7-grasses	127	0	0	0	0	0	0	0	0	0	0	0	0
	NC7-legumes	246	0	0	0	0	0	0	0	0	0	0	0	0
	NC7-melilotus	1002	4	4	4	4	0	0	0	0	4	4	4	4
	NC7-panicum	933	0	0	0	0	0	0	0	0	0	0	0	0
	NC7-perilla	25	0	0	0	0	0	0	0	0	0	0	0	0
	NC7-quinoa	350	17	19	19	32	0	0	0	0	17	19	19	32
	NC7-setaria	1015	1	1	1	1	0	0	0	0	1	1	1	1
	NC7-spinach	406	1	1	1	1	0	0	0	0	1	1	1	1
	NC7-umbels	1144	17	21	21	28	0	0	0	0	17	21	21	28
	Total:	8963	69	61	61	105	0	0	0	0	69	61	61	105
Carstens	NC7-medicinals	498	27	21	21	34	0	0	0	0	27	21	21	34
	NC7-mints	157	13	16	16	20	0	0	0	0	13	16	16	20
	NC7-ornamentals	2455	39	28	28	53	0	0	0	0	39	28	28	53
	Total:	3110	79	46	46	107	0	0	0	0	79	46	46	107
Marek	NC7-asters	364	4	3	3	5	0	0	0	0	4	3	3	5
	NC7-brassica	2010	24	25	25	38	0	0	0	0	24	25	25	38
	NC7-crucifers	1195	11	11	11	17	0	0	0	0	11	11	11	17
	NC7-crucifers.pvp	1	0	0	0	0	0	0	0	0	0	0	0	0
	NC7-cuphea	639	1	1	1	1	0	0	0	0	1	1	1	1
	NC7-euphorbia	208	0	0	0	0	0	0	0	0	0	0	0	0
	NC7-flax	2834	7	6	6	8	0	0	0	0	7	6	6	8
	NC7-flax.wilds	117	0	0	0	0	0	0	0	0	0	0	0	0
	NC7-sun.cults	1829	42	24	24	48	0	0	0	0	42	24	24	48
	NC7-sun.wilds.ann	1374	26	13	13	33	0	0	0	0	26	13	13	33
	NC7-sun.wilds.per	834	40	8	8	40	0	0	0	0	40	8	8	40
	NC7-sun.wilds.sp	1	0	0	0	0	0	0	0	0	0	0	0	0
	Total:	11406	155	69	69	190	0	0	0	0	155	69	69	190
Millard	NC7-corn.kin	99	0	0	0	0	0	0	0	0	0	0	0	0
	NC7-maize.gems	176	0	0	0	0	0	0	0	0	0	0	0	0
	NC7-maize.inb	2519	5	6	6	6	0	0	0	0	5	6	6	6
	NC7-maize.pop	17086	210	98	95	298	0	0	0	0	210	98	95	298
	NC7-maize.pvp	320	6	3	3	7	0	0	0	0	6	3	3	7
	NC7-maize.wilds	439	4	4	4	7	0	0	0	0	4	4	4	7
	Zea.totals	20540	225	100	97	318	0	0	0	0	225	100	97	318
	Total:	20639	225	100	97	318	0	0	0	0	225	100	97	318
Reitsma	NC7-chicory	277	3	4	4	5	0	0	0	0	3	4	4	5
	NC7-cucumis.cucs	1376	84	66	66	146	0	0	0	0	84	66	66	146
	NC7-cucumis.melo	3200	104	57	57	160	0	0	0	0	104	57	57	160
	NC7-cucumis.wilds	321	3	4	4	6	0	0	0	0	3	4	4	6
	NC7-cucurbita	975	76	66	66	150	0	0	0	0	76	66	66	150
	NC7-cucurbits.misc	1	0	0	0	0	0	0	0	0	0	0	0	0
	NC7-daucus	1294	46	55	55	88	0	0	0	0	46	55	55	88
	NC7-ocimum	98	25	35	35	51	0	0	0	0	25	35	35	51
	NC7-parsnips	71	9	5	5	9	0	0	0	0	9	5	5	9
	Total:	7613	350	180	180	615	0	0	0	0	350	180	180	615
NCRPIS Total:		**51731**	**878**	**261**	**258**	**1335**	**0**	**0**	**0**	**0**	**878**	**261**	**258**	**1335**

Year 2011 Table 3B **Internal NCRPIS Distributions**

01/01/2011 to 12/31/2011

CURATOR	GENUS_CROP	Number Accs	NC7 Related (# Accs)						# Distinct Accs for NC7 Orders	Seed Storage Maintenance	
			Backed Up	Germed	Obs	Regen	Path Test	Total		# Accs Stored	# Accs Ct Rev
Brenner	NC7-amaranth	3352	217	322	247	83	0	869	608	89	291
	NC7-celosia	57	0	2	0	1	0	3	3	2	0
	NC7-echinochloa	306	2	12	3	1	0	18	15	12	2
	NC7-grasses	127	5	16	0	0	0	21	16	18	6
	NC7-legumes	246	0	1	0	11	0	12	12	3	0
	NC7-melilotus	1002	0	0	33	17	9	59	59	0	1
	NC7-panicum	933	8	13	14	10	0	45	27	13	11
	NC7-perilla	25	0	0	0	0	0	0	0	0	1
	NC7-quinoa	350	48	90	2	5	0	145	92	92	69
	NC7-setaria	1015	11	12	3	10	14	50	35	13	12
	NC7-spinach	406	0	0	2	35	0	37	37	0	12
	NC7-umbels	1144	32	46	14	30	0	122	88	49	16
	Total:	8963	323	514	318	203	23	1381	992	291	421
Carstens	NC7-medicinals	498	40	56	7	3	0	106	60	67	28
	NC7-mints	157	1	98	0	5	0	104	104	3	9
	NC7-ornamentals	2455	53	243	1	16	0	313	301	141	151
	Total:	3110	94	397	8	24	0	523	465	211	188
Marek	NC7-asters	364	0	0	0	0	0	0	0	0	0
	NC7-brassica	2010	24	27	0	25	0	76	54	34	20
	NC7-crucifers	1195	11	17	29	37	0	94	81	58	88
	NC7-crucifers.pvp	1	0	0	0	0	0	0	0	0	0
	NC7-cuphea	639	0	4	0	4	0	8	8	0	3
	NC7-euphorbia	208	0	0	0	0	0	0	0	9	0
	NC7-flax	2834	0	251	0	0	0	251	251	0	0
	NC7-flax.wilds	117	1	0	7	4	0	12	11	2	0
	NC7-sun.cults	1829	20	51	104	70	0	245	181	90	140
	NC7-sun.wilds.ann	1374	24	42	30	15	0	111	93	21	13
	NC7-sun.wilds.per	834	21	88	134	21	0	264	236	69	25
	NC7-sun.wilds.sp	1	0	0	0	0	0	0	0	0	0
	Total:	11406	101	480	304	176	0	1061	915	283	289
Millard	NC7-corn.kin	99	0	1	1	0	0	2	2	1	0
	NC7-maize.gems	176	0	2	122	0	0	124	124	0	11
	NC7-maize.inb	2519	5	320	2117	167	65	2674	2235	257	451
	NC7-maize.pop	17086	56	74	129	260	197	716	623	195	226
	NC7-maize.pvp	320	65	91	235	104	20	515	302	115	96
	NC7-maize.wilds	439	0	0	0	0	19	19	19	0	8
	Zea.totals	20540	126	487	2603	531	301	4048	3303	567	792
	Total:	20639	126	488	2604	531	301	4050	3305	568	792
Reitsma	NC7-chicory	277	0	0	0	0	0	0	0	0	0
	NC7-cucumis.cucs	1376	16	27	0	15	0	58	208	12	69
	NC7-cucumis.melo	3200	43	52	0	26	76	197	1030	58	451
	NC7-cucumis.wilds	321	10	13	0	6	0	29	44	18	14
	NC7-cucurbita	975	10	10	0	16	0	36	221	14	151
	NC7-cucurbits.misc	1	0	0	0	0	0	0	299	80	6
	NC7-daucus	1294	69	45	87	33	0	234	0	0	2
	NC7-ocimum	98	0	0	0	1	0	1	33	0	1
	NC7-parsnips	71	0	0	0	0	0	0			
	Total:	7613	148	147	87	97	76	555	1835	182	694
NCRPIS Total:		**51731**	**792**	**2026**	**3321**	**1031**	**400**	**7570**	**7512**	**1535**	**2384**

Year 2011 Table 4 **NCRPIS Accessions (Accs) Observations (Obs) in GRIN, Images in GRIN**

01/01/2011 to 12/31/2011

CURATOR	GENUS_CROP	Number Accs	Number 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 Accs Imaged	Number Acc Images in GRIN for Year	Number Acc Images in GRIN (all years)
Brenner	NC7-amaranth	3352	247	14753	3349	255	3350	296	315	810
	NC7-celosia	57	0	18	5	7	19	3	5	18
	NC7-echinochloa	306	3	25	16	31	303	8	16	52
	NC7-grasses	127	0	0	0	7	21	0	0	23
	NC7-legumes	246	0	7	4	2	101	1	4	28
	NC7-melilotus	1002	33	509	92	43	980	30	32	152
	NC7-panicum	933	14	71	39	58	929	24	39	107
	NC7-perilla	25	0	9	6	0	7	0	1	7
	NC7-quinoa	350	2	23	12	63	301	7	12	106
	NC7-setaria	1015	3	356	121	181	1003	8	24	140
	NC7-spinach	406	2	32	13	11	406	5	13	21
	NC7-umbels	1144	14	392	56	115	367	16	48	172
	Total:	8963	318	16195	3713	773	7787	398	509	1636
Carstens	NC7-medicinals	498	7	20	18	0	307	12	18	285
	NC7-mints	157	0	5	4	0	29	4	4	34
	NC7-ornamentals	2455	7	1335	261	90	856	137	170	871
	Total:	3110	14	1360	283	90	1192	153	192	1190
Marek	NC7-asters	364	0	0	0	0	4	0	0	9
	NC7-brassica	2010	0	0	0	1	1901	5	0	333
	NC7-crucifers	1195	29	0	0	0	821	37	0	334
	NC7-crucifers.pvp	1	0	0	0	0	1	0	0	0
	NC7-cuphea	639	0	3	1	3	368	0	1	14
	NC7-euphorbia	208	0	0	0	0	0	0	0	0
	NC7-flax	2834	0	21	1	1	2825	0	0	1
	NC7-flax.wilds	117	7	0	0	0	82	0	0	6
	NC7-sun.cults	1829	104	1763	55	43	1749	85	49	146
	NC7-sun.wilds.ann	1374	30	197	15	27	1280	6	8	62
	NC7-sun.wilds.per	834	134	929	62	52	561	12	24	111
	NC7-sun.wilds.sp	1	0	0	0	0	0	0	0	0
	Total:	11406	304	2913	134	127	9592	145	82	1016
Millard	NC7-corn.kin	99	1	0	0	0	0	1	0	0
	NC7-maize.gems	176	122	169	8	4	115	8	0	103
	NC7-maize.inb	2519	2117	4581	2100	496	2333	203	1	589
	NC7-maize.pop	17086	129	7407	425	256	14472	382	1	4204
	NC7-maize.pvp	320	235	2450	274	129	318	106	36	219
	NC7-maize.wilds	439	0	0	0	0	264	0	0	107
	Zea.totals	20540	2603	14607	2807	885	17502	699	38	5222
	Total:	20639	2604	14607	2807	885	17502	700	38	5222
Reitsma	NC7-chicory	277	0	93	67	242	276	1	68	256
	NC7-cucumis.cucs	1376	0	24	18	32	1371	13	18	883
	NC7-cucumis.melo	3200	0	24	15	18	3114	14	15	474
	NC7-cucumis.wilds	321	0	0	0	41	287	0	12	59
	NC7-cucurbita	975	0	15	10	13	970	18	11	112
	NC7-cucurbits.misc	1	0	0	0	0	0	0	0	0
	NC7-daucus	1294	87	4970	219	258	1161	76	74	215
	NC7-ocimum	98	0	0	0	73	98	0	0	0
	NC7-parsnips	71	0	0	0	0	70	1	0	0
	Total:	7613	87	5126	329	677	7347	123	198	1999
NCRPIS Total:		**51731**	**3327**	**40201**	**7266**	**2552**	**43420**	**1519**	**1019**	**11063**

Year 2011 Table 5

Five-Year Summary of NCRPIS Accession Orders by Crop

Includes both DI (research and education) and NR (home gardener) order types

CURATOR	GENUS_CROP	TIME_PERIOD	Number Orders	Number Recipients	Number Items Distributed	Number Accessions Distributed
Brenner	NC7-amaranth	01/01/2007 - 12/31/2007	56	50	532	310
		01/01/2008 - 12/31/2008	52	51	446	291
		01/01/2009 - 12/31/2009	71	67	874	540
		01/01/2010 - 12/31/2010	46	42	632	435
		01/01/2011 - 12/31/2011	52	47	4673	3145
	Total:		277	257	7157	4721
	NC7-celosia	01/01/2007 - 12/31/2007	8	8	35	21
		01/01/2008 - 12/31/2008	4	4	9	8
		01/01/2009 - 12/31/2009	13	12	25	16
		01/01/2010 - 12/31/2010	3	3	4	3
		01/01/2011 - 12/31/2011	6	6	23	19
	Total:		34	33	96	67
	NC7-echinochloa	01/01/2007 - 12/31/2007	5	5	15	14
		01/01/2008 - 12/31/2008	5	4	13	12
		01/01/2009 - 12/31/2009	9	9	60	51
		01/01/2010 - 12/31/2010	9	9	45	31
		01/01/2011 - 12/31/2011	9	7	58	50
	Total:		37	34	191	158
	NC7-grasses	01/01/2007 - 12/31/2007	2	2	6	5
		01/01/2008 - 12/31/2008	2	2	5	5
		01/01/2009 - 12/31/2009	1	1	1	1
		01/01/2010 - 12/31/2010	5	5	7	4
		01/01/2011 - 12/31/2011	6	6	6	4
	Total:		16	16	25	19
	NC7-legumes	01/01/2007 - 12/31/2007	2	2	9	9
		01/01/2008 - 12/31/2008	11	10	86	78
		01/01/2009 - 12/31/2009	15	14	32	22
		01/01/2010 - 12/31/2010	11	11	27	24
		01/01/2011 - 12/31/2011	5	5	17	16
	Total:		44	42	171	149
	NC7-melilotus	01/01/2007 - 12/31/2007	12	11	41	27
		01/01/2008 - 12/31/2008	20	15	411	268
		01/01/2009 - 12/31/2009	23	19	276	218
		01/01/2010 - 12/31/2010	21	17	177	138
		01/01/2011 - 12/31/2011	14	13	78	62
	Total:		90	75	983	713
	NC7-panicum	01/01/2007 - 12/31/2007	11	10	21	20
		01/01/2008 - 12/31/2008	18	18	150	115
		01/01/2009 - 12/31/2009	20	20	228	159
		01/01/2010 - 12/31/2010	18	17	228	211
		01/01/2011 - 12/31/2011	16	14	164	144
	Total:		83	79	791	649
	NC7-perilla	01/01/2007 - 12/31/2007	6	6	21	14
		01/01/2008 - 12/31/2008	5	5	44	19
		01/01/2009 - 12/31/2009	14	14	64	23
		01/01/2010 - 12/31/2010	6	6	67	23
		01/01/2011 - 12/31/2011	6	6	14	9
	Total:		37	37	210	88
	NC7-quinoa	01/01/2007 - 12/31/2007	40	37	307	128
		01/01/2008 - 12/31/2008	50	45	296	132
		01/01/2009 - 12/31/2009	57	54	575	223
		01/01/2010 - 12/31/2010	56	49	527	173
		01/01/2011 - 12/31/2011	49	46	737	212
	Total:		252	231	2442	868

	NC7-setaria	01/01/2007 - 12/31/2007	16	16	317	225
		01/01/2008 - 12/31/2008	24	24	316	249
		01/01/2009 - 12/31/2009	16	16	145	104
		01/01/2010 - 12/31/2010	26	24	353	265
		01/01/2011 - 12/31/2011	41	37	1490	936
	Total:		123	117	2621	1779
	NC7-spinach	01/01/2007 - 12/31/2007	19	18	1196	374
		01/01/2008 - 12/31/2008	26	23	668	361
		01/01/2009 - 12/31/2009	34	31	527	351
		01/01/2010 - 12/31/2010	23	21	863	361
		01/01/2011 - 12/31/2011	22	19	992	394
	Total:		124	112	4246	1841
	NC7-umbels	01/01/2007 - 12/31/2007	30	29	199	164
		01/01/2008 - 12/31/2008	30	29	463	313
		01/01/2009 - 12/31/2009	64	60	460	276
		01/01/2010 - 12/31/2010	23	18	286	199
		01/01/2011 - 12/31/2011	44	38	640	486
	Total:		191	174	2048	1438
	Brenner Total:		1308	1207	20981	12490
Carstens	NC7-medicinals	01/01/2007 - 12/31/2007	58	48	358	181
		01/01/2008 - 12/31/2008	34	31	232	161
		01/01/2009 - 12/31/2009	64	51	276	153
		01/01/2010 - 12/31/2010	24	20	140	117
		01/01/2011 - 12/31/2011	26	24	91	75
	Total:		206	174	1097	687
	NC7-mints	01/01/2007 - 12/31/2007	10	10	54	47
		01/01/2008 - 12/31/2008	14	14	88	64
		01/01/2009 - 12/31/2009	32	30	178	91
		01/01/2010 - 12/31/2010	8	8	30	24
		01/01/2011 - 12/31/2011	18	16	105	75
	Total:		82	78	455	301
	NC7-ornamentals	01/01/2007 - 12/31/2007	75	71	264	193
		01/01/2008 - 12/31/2008	88	82	336	245
		01/01/2009 - 12/31/2009	109	94	578	364
		01/01/2010 - 12/31/2010	68	59	277	235
		01/01/2011 - 12/31/2011	86	68	546	389
	Total:		426	374	2001	1426
	Carstens Total:		714	626	3553	2414
Marek	NC7-asters	01/01/2007 - 12/31/2007	7	6	16	16
		01/01/2008 - 12/31/2008	14	13	30	20
		01/01/2009 - 12/31/2009	14	11	41	31
		01/01/2010 - 12/31/2010	16	14	32	21
		01/01/2011 - 12/31/2011	12	12	22	20
	Total:		63	56	141	108
	NC7-brassica	01/01/2007 - 12/31/2007	64	49	1754	1047
		01/01/2008 - 12/31/2008	74	64	1866	1233
		01/01/2009 - 12/31/2009	81	75	1694	1037
		01/01/2010 - 12/31/2010	67	60	1845	1236
		01/01/2011 - 12/31/2011	59	59	3330	1657
	Total:		345	307	10489	6210
	NC7-crucifers	01/01/2007 - 12/31/2007	48	43	839	412
		01/01/2008 - 12/31/2008	59	50	658	520
		01/01/2009 - 12/31/2009	56	54	555	389
		01/01/2010 - 12/31/2010	71	61	742	387
		01/01/2011 - 12/31/2011	71	61	742	387
	Total:		305	269	3536	2095

	NC7-crucifers.pvp	01/01/2007 - 12/31/2007	0	0	0	0
		01/01/2008 - 12/31/2008	0	0	0	0
		01/01/2009 - 12/31/2009	0	0	0	0
		01/01/2010 - 12/31/2010	0	0	0	0
		01/01/2011 - 12/31/2011	0	0	0	0
	Total:		0	0	0	0
	NC7-cuphea	01/01/2007 - 12/31/2007	19	10	720	507
		01/01/2008 - 12/31/2008	18	15	98	81
		01/01/2009 - 12/31/2009	27	22	138	107
		01/01/2010 - 12/31/2010	9	7	98	90
		01/01/2011 - 12/31/2011	7	4	62	51
	Total:		80	58	1116	836
	NC7-euphorbia	01/01/2007 - 12/31/2007	4	3	10	8
		01/01/2008 - 12/31/2008	7	6	85	83
		01/01/2009 - 12/31/2009	8	6	35	29
		01/01/2010 - 12/31/2010	6	6	18	14
		01/01/2011 - 12/31/2011	9	6	41	30
	Total:		34	27	189	164
	NC7-flax	01/01/2007 - 12/31/2007	8	8	60	56
		01/01/2008 - 12/31/2008	16	16	243	230
		01/01/2009 - 12/31/2009	22	19	120	111
		01/01/2010 - 12/31/2010	13	13	119	111
		01/01/2011 - 12/31/2011	15	15	123	105
	Total:		74	71	665	613
	NC7-flax.wilds	01/01/2007 - 12/31/2007	4	3	19	19
		01/01/2008 - 12/31/2008	6	6	24	22
		01/01/2009 - 12/31/2009	9	8	36	30
		01/01/2010 - 12/31/2010	2	2	37	36
		01/01/2011 - 12/31/2011	4	4	17	16
	Total:		25	23	133	123
	NC7-sun.cults	01/01/2007 - 12/31/2007	64	47	755	542
		01/01/2008 - 12/31/2008	83	68	1673	985
		01/01/2009 - 12/31/2009	96	82	757	550
		01/01/2010 - 12/31/2010	81	57	2465	1380
		01/01/2011 - 12/31/2011	61	54	1466	958
	Total:		385	308	7116	4415
	NC7-sun.wilds	01/01/2007 - 12/31/2007	42	38	1302	1106
		01/01/2008 - 12/31/2008	58	52	1059	754
		01/01/2009 - 12/31/2009	67	60	820	571
		01/01/2010 - 12/31/2010	63	54	888	675
		01/01/2011 - 12/31/2011	65	55	1479	999
	Total:		295	259	5548	4105
	Marek Total:		1606	1378	28933	18669
Millard	NC7-corn.kin	01/01/2007 - 12/31/2007	14	14	28	6
		01/01/2008 - 12/31/2008	15	15	25	6
		01/01/2009 - 12/31/2009	10	10	21	7
		01/01/2010 - 12/31/2010	7	7	16	7
		01/01/2011 - 12/31/2011	14	14	17	6
	Total:		60	60	107	32
	NC7-maize.gems	01/01/2007 - 12/31/2007	23	22	381	67
		01/01/2008 - 12/31/2008	27	23	329	81
		01/01/2009 - 12/31/2009	25	18	324	87
		01/01/2010 - 12/31/2010	22	20	272	102
		01/01/2011 - 12/31/2011	18	16	318	119
	Total:		115	99	1624	456

	NC7-maize.inb	01/01/2007 - 12/31/2007	259	203	3314	919
		01/01/2008 - 12/31/2008	271	210	5216	1634
		01/01/2009 - 12/31/2009	311	238	3721	1040
		01/01/2010 - 12/31/2010	273	207	4685	1608
		01/01/2011 - 12/31/2011	288	229	5322	2027
	Total:		1402	1087	22258	7228
	NC7-maize.pop	01/01/2007 - 12/31/2007	207	174	1722	1016
		01/01/2008 - 12/31/2008	234	191	2338	1547
		01/01/2009 - 12/31/2009	319	276	3928	2810
		01/01/2010 - 12/31/2010	206	164	2501	1743
		01/01/2011 - 12/31/2011	217	184	2214	1588
	Total:		1183	989	12703	8704
	NC7-maize.pvp	01/01/2007 - 12/31/2007	188	106	3181	130
		01/01/2008 - 12/31/2008	190	107	2340	153
		01/01/2009 - 12/31/2009	236	125	3754	194
		01/01/2010 - 12/31/2010	222	136	4338	229
		01/01/2011 - 12/31/2011	252	149	4631	277
	Total:		1088	623	18244	983
	NC7-maize.wilds	01/01/2007 - 12/31/2007	67	62	272	43
		01/01/2008 - 12/31/2008	60	58	201	42
		01/01/2009 - 12/31/2009	64	55	313	149
		01/01/2010 - 12/31/2010	50	41	212	93
		01/01/2011 - 12/31/2011	66	63	301	157
	Total:		307	279	1299	484
	Zea.totals	01/01/2007 - 12/31/2007	744	567	8870	2175
		01/01/2008 - 12/31/2008	782	589	10424	3457
		01/01/2009 - 12/31/2009	955	712	12040	4280
		01/01/2010 - 12/31/2010	773	568	12008	3775
		01/01/2011 - 12/31/2011	841	641	12786	4168
	Total:		4095	3077	56128	17855
	Millard Total:		4155	3137	56235	17887
Reitsma	NC7-chicory	01/01/2007 - 12/31/2007	5	5	203	162
		01/01/2008 - 12/31/2008	13	11	230	146
		01/01/2009 - 12/31/2009	19	18	35	26
		01/01/2010 - 12/31/2010	9	7	67	60
		01/01/2011 - 12/31/2011	6	6	324	216
	Total:		52	47	859	610
	NC7-cucumis	01/01/2007 - 12/31/2007	115	94	3368	1866
		01/01/2008 - 12/31/2008	121	106	3583	2033
		01/01/2009 - 12/31/2009	215	195	3881	2452
		01/01/2010 - 12/31/2010	87	72	3677	2121
		01/01/2011 - 12/31/2011	100	91	3809	1913
	Total:		638	558	18318	10385
	NC7-cucurbita	01/01/2007 - 12/31/2007	41	36	525	323
		01/01/2008 - 12/31/2008	71	65	436	248
		01/01/2009 - 12/31/2009	113	107	1564	817
		01/01/2010 - 12/31/2010	46	43	836	478
		01/01/2011 - 12/31/2011	48	42	895	596
	Total:		319	293	4256	2462
	NC7-cucurbita.misc	01/01/2007 - 12/31/2007	0	0	0	0
		01/01/2008 - 12/31/2008	0	0	0	0
		01/01/2009 - 12/31/2009	0	0	0	0
		01/01/2010 - 12/31/2010	0	0	0	0
		01/01/2011 - 12/31/2011	0	0	0	0
	Total:		0	0	0	0

NC7-daucus	01/01/2007 - 12/31/2007	24	21	330	284
	01/01/2008 - 12/31/2008	29	26	684	475
	01/01/2009 - 12/31/2009	83	79	802	491
	01/01/2010 - 12/31/2010	19	18	353	303
	01/01/2011 - 12/31/2011	25	23	1995	1006
Total:		180	167	4164	2559
NC7-ocimum	01/01/2007 - 12/31/2007	11	10	68	51
	01/01/2008 - 12/31/2008	20	19	137	91
	01/01/2009 - 12/31/2009	39	37	442	91
	01/01/2010 - 12/31/2010	10	9	157	91
	01/01/2011 - 12/31/2011	9	9	51	38
Total:		89	84	855	362
NC7-parsnips	01/01/2007 - 12/31/2007	3	3	8	8
	01/01/2008 - 12/31/2008	2	2	6	6
	01/01/2009 - 12/31/2009	11	11	80	46
	01/01/2010 - 12/31/2010	2	2	20	19
	01/01/2011 - 12/31/2011	2	2	8	8
Total:		20	20	122	87
Reitsma Total:		1298	1169	28574	16465
NCRPIS Total:		**8118**	**6571**	**138276**	**67925**

Table 6a **NC7 NIFA Regional Order History**

TIME_PERIOD	Total Number of Orders	Number of Orders (DI)	Foreign Orders (DI)	Domestic Orders (DI)	Domestic Orders (DI) NIFA Regions NC7	NE9	S9	W6
01/01/2010 to 12/31/2010	1571	1153	275	878	420	111	182	165
01/01/2009 to 12/31/2009	1835	1488	231	1257	600	133	290	234
01/01/2008 to 12/31/2008	1577	1239	233	1006	486	113	201	206
01/01/2007 to 12/31/2007	1491	1138	240	898	455	113	181	149
01/01/2006 to 12/31/2006	1507	1182	249	933	506	110	184	133
01/01/2005 to 12/31/2005	1225	930	175	755	348	77	198	132
01/01/2004 to 12/31/2004	1045	787	164	623	287	71	159	106

Note: Total Number of Orders includes all orders handled, including NC7 orders.

Table 6b **NC7 NIFA Regional Packet History**

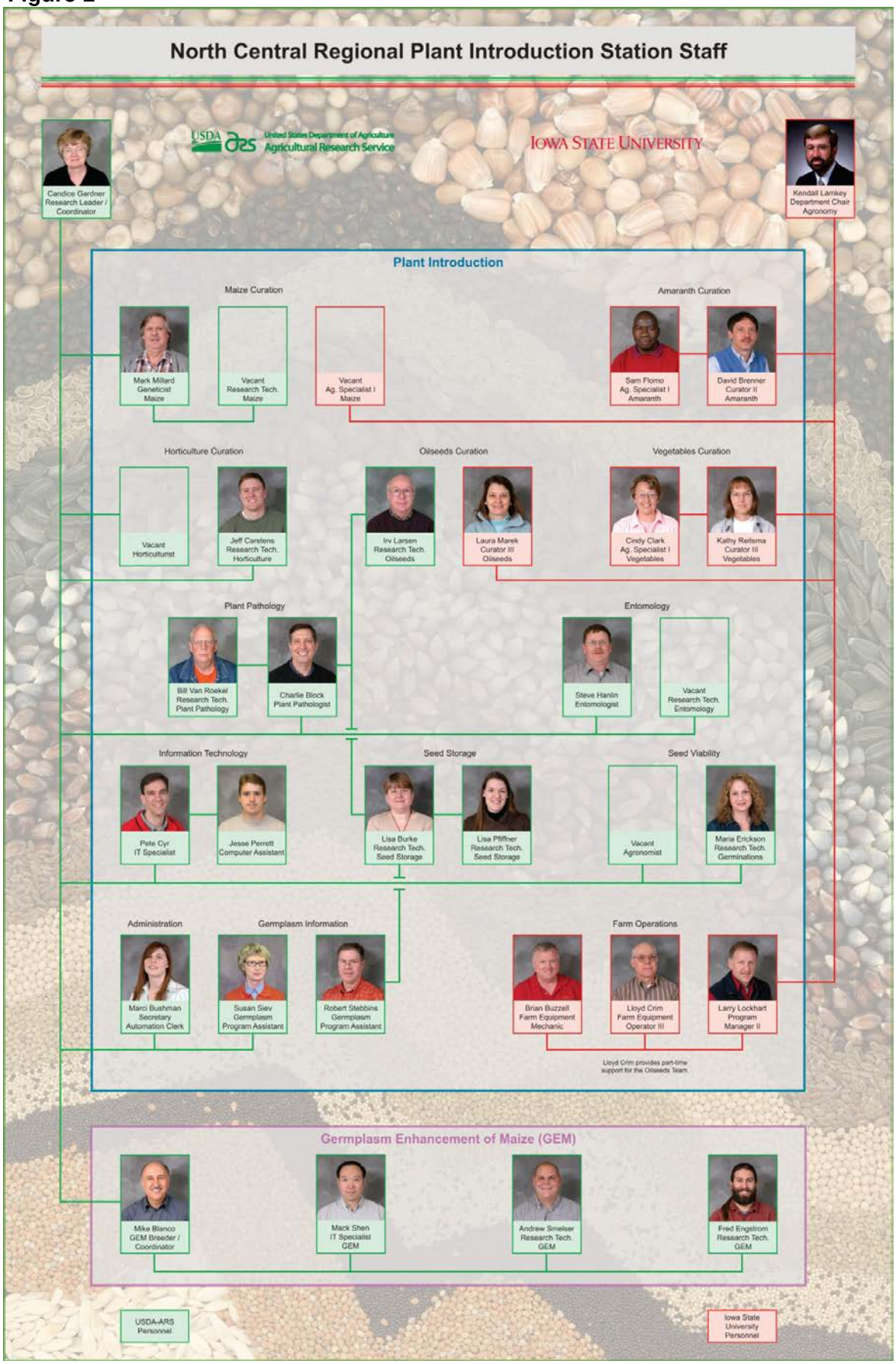
TIME_PERIOD	Total Number of Packets	Number of Packets (DI)	Foreign Packets (DI)	Domestic Packets (DI)	Domestic Packets (in DI orders) NIFA Regions NC7	NE9	S9	W6
01/01/2010 to 12/31/2010	45738	27035	7789	19246	9252	2690	3515	3789
01/01/2009 to 12/31/2009	37564	27359	5931	21428	10917	2587	4096	3828
01/01/2008 to 12/31/2008	40662	24824	6719	18105	9264	1735	3560	3546
01/01/2007 to 12/31/2007	39065	22257	7765	14492	7218	1230	3433	2611
01/01/2006 to 12/31/2006	36382	26079	11950	14129	7483	1550	2354	2742
01/01/2005 to 12/31/2005	34108	22474	7510	14964	4434	2416	4723	3391
01/01/2004 to 12/31/2004	27225	17404	5539	11865	4237	3449	1823	2356

Note: Total Number of Packets includes all packets handled, including NC7 distributed.

Table 7 **Germination by Crop**

Site Crop	Distribution lots with >2000 seed	All germ tests prior to 2001	% of total	Germ tests between 2002 & 2007	% of total	Germ tests between 2008 & 2012	% of total	No germ test - mostly bulk seed lots.
NC7-amaranth	3287	1228	37.3	1472	44.8	582	17.7	5
NC7-celosia	44	24	54.5	8	18.2	10	22.7	2
NC7-echinochla	276	8	2.8	244	88.4	23	8.2	1
NC7-grasses	99	1	1.0	81	81.8	9	9.0	8
NC7-legumes	148	102	68.9	27	18.0	5	3.3	14
NC7-melilotus	844	56	6.6	710	84.0	42	4.9	36
NC7-panicum	922	503	54.5	406	44.0	11	1.1	2
NC7-perilla	23	0		0		23	100.0	0
NC7-quinoa	264	125	47.3	28	10.0	87	32.9	24
NC7-setaria	984	222	22.6	713	72.4	43	4.3	6
NC7-spinach	380	221	58.0	41	10.7	96	25.2	22
NC7-umbels	816	294	36.0	309	37.9	167	20.4	46
Brenner Subtotal	8087	2784		4039	49.9	1098	13.6	166
NC7-medicinals	349	32	9.2	158	0.5	127	36.4	32
NC7-mints	120	0	0.0	0	0.0	115	95.8	5
NC7-ornamentals	961	4	0.4	11	1.1	536	55.7	410
Horticulture Subtotal	1430	36		169	11.8	778	54.4	447
NC7-asters	111	9	8.1	60	54.0	6	5.4	36
NC7-brassica	1968	684	34.7	1167	59.2	114	5.7	3
NC7-crucifers	1052	595	56.5	306	29.0	96	9.1	55
NC7-cuphea	506	363	71.7	43	8.4	25	4.9	75
NC7-euphorbia	59	0	0.0	46	78.0	13	22.0	0
NC7-flax	2825	563	20.0	1534	54.3	720	25.0	8
NC7-flax.wilds	102	3	2.9	62	60.7	22	21.5	15
NC7-sun.cults	1487	223	14.9	1071	72.0	182	12.2	11
NC7-sun.wilds.ann	1203	421	34.9	640	53.2	132	10.9	10
NC7-sun.wilds.per	463	6	1.2	259	55.9	151	32.6	47
NC7-sun.wilds.sp	0	0	0.0	0	0.0	0	0.0	0
Marek Subtotal	9776	2867		5188	53.1	1461	14.9	260
NC7-corn.kin	10	2	20.0	0		3	30.0	5
NC7-maize.gems%	189	12	6.0	75	39.6	48	25.4	54
NC7-maize.inb%	1876	75	3.9	884	47.1	917	48.8	0
NC7-maize.pops%	9476	956	10.0	5974	60.0	2531	26.7	15
NC7-maize.pvp%	296	1	0.3	56	18.9	228	77.0	11
NC7-maize.wilds	168	3	0.2	48	25.5	30	17.8	87
Millard Subtotal	12015	1049	8.7	7037	58.6	3757	31.3	172
NC7-chicory	228	33	9.6	184	80.7	1	0.4	10
NC7-cucumis.cucs	1178	433	36.8	537	45.5	102	8.6	106
NC7-cucumis.melo	1574	25	1.5	391	24.8	1121	71.2	37
NC7-cucumis.wilds	160	71	44.3	36	22.5	37	23.1	16
NC7-cucurbita	474	160	33.7	270	56.9	42	8.8	2
NC7-daucus	1175	0	0.0	884	75.2	282	24.0	9
NC7-ocimum	93	0	0.0	4	4.3	89	95.6	0
NC7-parsnips	52	6	11.5	46	88.5	0	0.0	0
Reitsma Subtotal	4934	728	14.8	2352	47.7	1674	33.9	180
Grand Total	**36242**	**7464**	**20.6**	**18785**	**51.8**	**8768**	**24.2**	**1225**

Figure 1


North Central Regional Plant Introduction Station Staff
USDA ARS 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
Vacant Research Tech. Maize
Vacant Ag. Specialist I Maize
Amaranth Curation
Sam Flomo Ag. Specialist I Amaranth
David Brenner Curator II Amaranth
Horticulture Curation
Vacant Horticulturist
Jeff Carstens Research Tech. Horticulture
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
Entomology
Steve Hanlin Entomologist
Vacant Research Tech. Entomology
Information Technology
Pete Cyr IT Specialist
Jesse Perrott Computer Assistant
Seed Storage
Lisa Burke Research Tech. Seed Storage
Lisa Pfiffner Research Tech. Seed Storage
Seed Viability
Vacant Agronomist
Maria Erickson Research Tech. Germinations
Administration
Marci Bushman Secretary Automation Clerk
Germplasm Information
Susan Siev Germplasm Program Assistant
Robert Stebbins 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
Andrew Smelser Research Tech. GEM
Fred Engstrom Research Tech. GEM
USDA-ARS Personnel
Iowa State University Personnel