

**NORTH CENTRAL REGIONAL PLANT INTRODUCTION STATION
NC-7 ANNUAL REPORT, JANUARY 1 - DECEMBER 31, 1999**

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I. PROJECT TITLE: NC-7 "Plant Germplasm and Information Management and Utilization."

II. COOPERATING AGENCIES AND PRINCIPAL LEADERS:

- A. Administrative Advisor** D.A. Topel, Iowa
- B. Regional Coordinator** *C.A.C. Gardner, Iowa
- C. State Experiment Stations Representatives**

1. Illinois	*T. Hymowitz	7. Missouri	*P. Arelli
2. Indiana	*J. Janick	8. Nebraska	*D. Baltensperger
3. Iowa	*C. Brummer, Chmn.	9. N. Dakota	*B. Johnson
4. Kansas	*C. Rife	10. Ohio	*R. Miller
5. Michigan	*A. Iezzoni	11. S. Dakota	*A. Boe
6. Minnesota	*H. Pellett	12. Wisconsin	*W. Tracy

*Voting members

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 | A. Hewings |
| 4. Cooperative State Research, Education and Extension Service | Vacant |
| 5. Natural Resources Conservation Service | *P. Koch |
| 6. National Center for Agric. Util. Research | *T. Abbott |
| 7. National Seed Storage Laboratory | *S. Eberhart |

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

- | | |
|---------------------------------------|----------------|
| 1. USDA-ARS Staff | |
| a. Research Leader/Coordinator | C.A.C. Gardner |
| Supervisory Program Support Assistant | L. Wilson-Voss |
| Office Automation Clerk | B. Henry |
| Office Automation Clerk | R. Schroder |
| b. Horticulturist | M. Widrlechner |
| Agricultural Research Technician | P. Ovrrom |
| Agricultural Research Technician | D. Kovach |

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|--------------------------------|---|----------------|
| | Biological Science Lab Technician | L. Burke |
| | Germplasm Program Assistant | R. Stebbins |
| c. | Research Entomologist | R. Wilson |
| | Agricultural Research Technician | S. McClurg |
| | Entomologist | S. Hanlin |
| d. | Plant Pathologist | C. Block |
| | Agricultural Research Technician | J. Van Roekel |
| e. | Geneticist | M. Brothers |
| | Biological Science Technician | I. Larsen |
| 2. Iowa State University Staff | | |
| a. | Research Station Superintendent II | L. Lockhart |
| | Farm Equipment Operator III | L. Crim |
| | Field-Lab Technician II | J. Scheuermann |
| | Clerk III | L. Minor |
| b. | Curator II (Maize) | M. Millard |
| | Field-Lab Technician II | T. Ladjahasan |
| | Field-Lab Technician II | G. Crim |
| d. | Curator II (<u>Brassica</u> , Grasses) | R. Luhman |
| e. | Curator II (Vegetables) | K. Reitsma |
| | Field Lab Technician II | C. Clark |
| f. | Curator II (Amaranth) | D. Brenner |

III. PROGRESS OF WORK (C.A.C. Gardner)

The NCR Plant Introduction Station marked its 51st year of operation in 1999, a year which built upon the celebration of the past 50 years of growth, development, cooperation and accomplishment.

The fruits of our dedicated staff's efforts to improve research methods and operational efficiency are demonstrated not only by statistics representing increasing numbers of available accessions of high quality, but also by an increasing diversity of available species and associated information.

The extent of the applications to which our collections are applied reflects the dynamics of a thriving research community busily learning what our rich natural plant resource heritage offers to enrich our lives and condition.

Personnel changes:

In August 1999, the efforts of the Research Leader Search Committee (members Larry Lockhart, Richard Luhman, Mark Widrlechner, Richard Wilson, and Lori Wilson-Voss from the NCRPIS, Les Lewis, ARS Location Leader, Charles Brummer, ISU Agronomy Department, and chair, Terry Nelsen, Associate Director, ARS, Midwest Area) were successfully completed when Dr. Candice Gardner assumed leadership of the NCRPIS, by becoming the Station's fifth permanent Research Leader.

Resignations and retirements: April Nixon, Office Automation Clerk vacated her position during 1999.

Hirings: Mary Arnold was hired as a Biological Science Aid with seed storage; Steve Hanlin as Entomologist; Lucinda Clark as Field Lab Technician II, vegetable project; Rose Schroder as Office Automation Clerk; and Candice Gardner as Research Leader/Coordinator.

Promotions and reclassifications: Bill Van Roekel, Agricultural Research Technician, was transferred from the Cuphea project to the Plant Pathology Project. In the 1998 Annual Report, it was incorrectly reported that the Curators' job titles were changed to Curator III.

Construction:

1. Design and renovation of station computer/office area.
2. Installation of an automatic watering system in Greenhouse 1 to support the

- sunflower project.
3. Design and initiation of construction for addition to the manager's residence. Estimated completion: March, 2000.
 4. Design and installation of a dust collection system for the entomology lab's rearing facilities.
 5. Installation of new lighting in shop.
 6. Design and construction of a furrow opener used when constructing pollinator cages by station's fabricator.
 7. Overhaul of three engines by station's fabricator.
 8. Continued development of the imaging room used for collection and storage of digital images.

Equipment:

1. Purchased 18 desktop PC's and other hardware and software. A large proportion of the PC's were secured with funds made available by USDA to resolve Y2K issues. (See Section V.)
2. Significant effort to cascade computers among users to enable key users to have quality equipment.
3. Purchased a grinding mill for grinding seeds for Plant Pathology Project.

IV. PROGRESS IN GERmplasm AND INFORMATION MANAGEMENT, RESEARCH, AND EDUCATION (C.A. C. Gardner, L. Wilson-Voss, B. Henry)

(IV. summarizes the accomplishments and progress presented in greater detail in the individual staff reports later in the document.)

Acquisition:

1. More than 1000 new accessions were acquired by NCRPIS in 1999. (See germplasm program assistant's and curators' reports for details.)
2. Significant acquisitions included over 280 accessions of *Daucus*, 160 of ornamentals, 60+ of *Amaranthus*, and over 320 from within the NPGS system, including over 200 maize accessions.
3. New ornamental acquisitions resulted from a plant exploration expedition to the Ukraine by Horticulturist, M. Widrlechner, NC-7 and R. Schutzki of Michigan State University.
4. A plant exploration proposal by Amaranth curator, D. Brenner, was approved and funded to collect native *Spinacia* from Turkmenistan. Actual collection and distribution to NPGS will be made by the Turkmenistanian collaborators, Kurbangeldy Mamedor and Moukhamet Dourikov, in 2000.
5. 1325 accessions were inactivated and their seeds transferred to archival storage.
6. Taxonomic re-identification was accomplished for 233 accessions.

Maintenance:

1. More than 46,000 accessions representing over 300 genera and 1800 species are now maintained at NCRPIS. More than 600 new accessions and replacement seed lots were backed up at NSSL.
2. Original seed samples for the cucumber and pumpkin collections were moved into the freezer for long-term storage, as was approximately half of the melon collection; almost 5200 original samples were placed in the freezer in 1999.
3. 9330 seed lots were re-inventoried in 1999 to verify seed amounts.

Regeneration:

1. About 2100 accessions were cultivated for regeneration in Ames, IA, Fargo, ND, St. Croix, Parlier, CA and Mayaguez, PR during 1999, and over 1300 regenerations were successfully completed. In Ames, pollinating insects were used in 433 cages; this number was a great reduction from 1998, due to

- the loss of over half of the sunflower regeneration from a severe July storm.
2. Nearly 100 flax accessions were regenerated at Fargo, ND in cooperation with Dr. J. Hammond, and also at Ames for comparative purposes.
 3. Sakata Seed Co. of Salinas, CA, continued to assist in regeneration efforts; 80 accessions of *Spinacia* were successfully regenerated.
 4. Two major seed companies agreed to provide resources in tropical nurseries to assist with the regeneration of highland tropical maize populations.

Distribution:

1. Over 20,200 packets were distributed to requestors and evaluators in 1999; 45% were distributed internationally, the remainder domestically. This distribution represents a 25% increase over 1998.
2. Distribution of plant propagative materials reached a new all-time high, with 964 cuttings and 9 plants distributed to meet germplasm requests. NC-7 trial distribution required distribution of over 700 plants.

Testing germplasm's germination, viability, and health:

1. Germination or viability assays were conducted on more than 7300 seed samples, representing 6170 accessions.
2. Our pathologist conducted phytosanitary inspections on the seed increase plots for amaranth, *Brassica*, carrots, cucurbits, sunflower and maize.
3. Research continued to quantify *Erwinia stewartii* populations in maize kernels and to use these data to formulate a statistically based sampling strategy rather than the presently used empirically based system.
4. A pathogen of watermelon, *Acidovorax avenae*, was identified on several *Cucumis melo* accessions in the field; multiple strains of the pathogen are in evidence. Investigation continues on this topic with other pathology collaborators.
5. A protocol was developed to evaluate *Amaranthus* for resistance to *Phomopsis* leaf and stem blight. It is being used to evaluate the various species which comprise the *Amaranthus* collection with definitive results.
6. *Ocimum* seed germination research was initiated in 1999; germination research continues on *Angelica*, maize, sunflower and *Cuphea*.
7. A seed detreater was designed and tested for use in removing chemical coatings from seeds (primarily maize) acquired by NCRPIS from external sources. Research is being initiated to determine whether removing chemical seed treatments is necessary to ensure long-term viability.

Information management and computers:

1. Due to availability of funds to resolve Y2K computer issues, we were able to purchase 18 new PC's. This enabled us to significantly upgrade our staff's capabilities; it also allowed older models to be moved into areas such as the corn processing area or to be retired from use.
2. Other equipment purchased included three hard drives, seven barcode scanners, two LaserJet printers, two digital cameras, a flatbed scanner, a slide scanner, and an LCD projector. Given these hardware purchases and purchases of software to upgrade our present tools and develop new ones, and to enhance computer security, the NCRPIS is in the best position it has ever enjoyed relative to data acquisition and management. The computer committee and staff have done a superb job of identifying needs, establishing priorities and executing them. We have high expectations for significant improvement in our ability to capture and manage information and improve efficiency in these important areas.
3. The Intranet developed on our server continues to be refined to better serve staff members.
4. An Oracle 8 Enterprise Edition database was successfully loaded on one of our local servers, and necessary links were established for local data entry; this has resulted in faster data entry due to better response time.
5. Database links were established to facilitate rapid data transfer between

- the NPGS' GRIN database housed in Beltsville, MD and our own local Oracle database.
6. Three Oracle forms were developed for data entry by the maize group, order processing, and collection and evaluation of germination data.
 7. Our web site has received high praise from both NPGS users and public visitors. It is being used as a model for development of web sites by other NPGS sites.
 8. Efforts continue on the part of NCRPIS computer staff to refine the GRIN 3 version of the information network in conjunction with efforts at other sites.
 9. Over 240 accessions were assigned PI numbers.
 10. Distribution of Initial, Summary and Final Accession Performance Reports increased over prior years, as did the percentage of returned completed reports.

Characterization:

1. Morphological characterization efforts were applied to over 1300 accessions regenerated in 1999.
2. Approximately 5400 accessions of maize, *Amaranthus*, *Cucumis* and *Cucurbita* and sunflower were characterized via color digital imagery. Some of these images are currently available on GRIN; others await transfer.
3. Taxonomic reidentification was accomplished for 233 accessions of *Brassica*, *Ocimum*, *Amaranthus*, and other genera.
4. Latitude and longitude data were added to GRIN for *Helianthus annuus* accessions; these data are being used to conduct an ecogeographical assessment of wild *Helianthus* germplasm diversity.
5. Amalio Santacruz-Varela, Ph.D. candidate, conducted field and isozyme evaluations to characterize the genetic variation of 56 popcorn accessions originating from Latin America and the U.S.
6. Dried plant tissue from the entire *Ocimum* collection was shipped to Scotland for aromatic oil analysis and DNA fingerprinting by Dr. K. Svoboda's research group.

Insect management:

1. Evaluation of *Osmia* preference for domicile type and size resulted in no preference exhibited by *Osmia* for either size or composition (wood vs. PVC).
2. Honeybees were used to pollinate a single accession of *Amaranthus* in the greenhouse.

Evaluation:

1. Molecular characterization of sunflower core subset (112 accessions) and randomly selected accessions (112) by using isozyme markers continues and will be completed in 2000.
2. Entomological investigations to identify sources of host-plant resistance were conducted using over 1300 accessions of maize, *Brassica*, sunflower, *Amaranthus*, *Cucumis* and *Cucurbita*. Five-hundred *Brassica* accessions were tested for host-plant resistance to natural populations of cabbage aphids at Hermiston, OR.
3. During 1999, characterization was conducted on *Amaranthus* for resistance to *Phomopsis* leaf and stem blight (fungal), popcorn for Stewart's wilt (bacterial), *Cucumis melo* for watermelon fruit blotch (bacterial). Observations were also recorded on occurrences of other diseases: *Brassica* for black rot (bacterial) and powdery mildew (fungal), carrot for aster yellows (viral), *Cucumis* for *Cercospora* leaf spot, sunflower for *Alternaria*, *Septoria* and powdery mildew.
4. The NC-7 ornamental trials made significant evaluation progress; results for plants distributed in 1984-1987 are now available on the NCRPIS homepage; results for 1988-1989 will be posted early in 2000.
5. In 1999, 13 accessions were distributed for evaluation at 24 sites and also to arboreta and botanical gardens.

6. A research project has been initiated to statistically evaluate germplasm demand patterns for ten major NCRPIS crops.
7. A three year cage field of *Echinacea* was established to support high demand and interest originating from its unique potential and applicability as a phyto-pharmaceutical.

Enhancement:

1. A long-term recurrent phenotypic selection program to develop a composite population of wild sunflowers for resistance to *Alternaria* and *Septoria* leaf blights and to powdery mildew has resulted in development of two populations ready for release.
2. Work continued to identify the nature of the biological factor (s) responsible for European Corn Borer resistance in some Peruvian maize accessions.
3. Genetic enhancement and characterization of *Amaranthus* continued.

Health, safety, teamwork and EEO progress:

1. Many of the NCRPIS staff attended seminars regarding Hazardous Waste, Pesticide Applicator, and Tractor Safety. Several staff members attended seminars regarding Respirator Training, CPR and First Aid Training, Workplace Violence, Worker's Compensation Supervisor's Training, Electrical Safety, and Dust Mask Training. All field workers received training in the proper use of dust masks. Several NCRPIS staff members served as members of the ARS Campus Safety Committee.
2. The NCRPIS continued extensive efforts to document training received by staff members.
3. NCRPIS staff members attended various seminars regarding supervisory training, civil rights, workplace communications, project management, conflict management, and ethics.

Outreach:

1. A site on the World Wide Web for the NCRPIS established during 1996 at <http://www.ars-grin.gov/ars/MidWest/Ames/index.html> has attracted much interest. During 1999, 5,000 visits to the site were recorded.
2. About 185 visitors toured the NCRPIS during 1999. Informational brochures describing the NCRPIS and its activities were distributed to all visitors, and to relevant offices at the national, regional, and local levels.
3. Several staff members were invited to teach students, civic and other organization about the NCRPIS and its work.
4. Several staff members serve on advisory boards for various germplasm-related projects or organizations. The amaranth curator served President of the Amaranth Institute.
5. The Ornamental Horticulture program distributed various planting and performance reports to trial site cooperators.
6. NCRPIS staff traveled extensively in the U.S. and internationally (Ukraine for plant exploration) to present lectures, attend workshops, serve on advisory committees, and review panels or establish contacts with foreign germplasm researchers.
7. The Supervisory Program Support Assistant traveled to Peoria, IL to train administrative support personnel. Also was appointed to the National Advisory Council for Office Support Professionals where she was elected Co-Chair. She was appointed as Technical Advisor to the Program Administrative Support Task Group. She was also detailed to the National Animal Disease Center as Executive Assistant to the Implementation Team.
8. Nick Golder, ISU intern, focused on meeting Y2K needs and upgrading our computer network, information infrastructure and back-up capabilities.
9. Almost all of the NCRPIS staff were involved in preparations for the Farm Progress Show; seven staff members manned the demonstration plots and booth to meet the public, answer questions and distribute information on NCRPIS.

Scholarship:

1. Mark Widrechner, Horticulturist, was recognized by the Southern Appalachian Botanical Society in 1999 when he was awarded the Richard & Minnie Windler Award for the best systematic botany paper published in Castanea during 1998.
2. Our curators and scientists published five book chapters and articles in peer-reviewed journals, and nine public articles, notes, and reports in organizational newsletters, non-peer reviewed journals or other media.

V. INDIVIDUAL PROGRESS REPORTS

A. Entomology (R. Wilson, S. McClurg)

Progress:

Field

Maize - European corn borer evaluation: 500 maize accessions were evaluated for leaf-feeding resistance to first generation European corn borer. Four rated resistant. One hundred eighty-nine maize accessions were evaluated in the field for second generation European corn borer resistance. Fourteen accessions rated resistant.

Historical data on 1323 accessions evaluated for ECB2 resistance from 1993 through 1999 were summarized and made available to the NCRPIS maize curator. Eighty-eight accessions have shown resistance to second generation European corn borer.

Sunflower - Work continued on sunflower moth evaluation for both cultivated and wild-type sunflowers. Fifty accessions of cultivated sunflowers that had previously rated as resistant were planted in the field to be infested with sunflower moth. A wind storm destroyed the plots on July 30, so no data were collected.

Eight accessions of cultivated-type and 8 accessions of wild-type sunflowers were planted in the field for collection of heads. Plant material has been lyophilized and milled. It will be incorporated into sunflower moth laboratory diets to determine if this technique can be used to detect resistant plants.

Brassica - Five hundred *Brassica* accessions were planted in the field at Hermiston, OR. The plants were tested for host-plant resistance to natural populations of cabbage aphid. Aphid resistance was noted in 24 accessions.

Thirty-six accessions that rated resistant in 1998 were retested in a replicated test in 1999. Fourteen of the accessions maintained their resistant rating.

Amaranth - Twenty-two amaranth accessions were planted in the field to be evaluated for lygus bug resistance. Individual heads of 15 accessions were bagged and infested with 10 lygus bugs each. Heads were harvested and data are being analyzed.

Data from the 1998 field cage pollinator study was analyzed. Honeybees did not significantly affect the amount of seed formed per cage, the quality of the seed, or the amount of pollen transferred between two accessions within each cage.

Cucumis - Work was continued on developing a technique for evaluating *Cucumis* accessions for resistance to cucumber beetle. Twelve accessions were planted in both open and caged field plots and evaluated for beetle feeding at several plant stages. Summary of observations is in progress.

Laboratory

Maize - Field material showing resistance to first generation European corn borer, grown by Ted Wilson (M.S. graduate student, Entomology) in 1998, was used in a diet assay conducted by personnel from the Corn Insects/Crop Genetics research unit in Ames. Four of the promising accessions from this study were grown in the field in 1999. Whorl-stage material was collected, lyophilized, milled, and shipped to M. Berhow in Peoria, IL for extractions.

Known resistant and susceptible corn silks collected in the field in 1998 were incorporated into pinto bean diet for a corn earworm oviposition study. Data were collected on percent survival, development time, and number of eggs produced for two generations of insects on ten diets. Data have not been completely analyzed. Corn earworm pupa and moth data from a study begun in 1994 of 29 accessions of corn from races Confite Puntiajudo and Dulcillo de Noreste were completely analyzed for inclusion in a manuscript.

Rearing - A colony of sunflower moths is being maintained in order to provide sufficient numbers of insects for our field evaluation program.

A colony of green peach aphids is being maintained in the greenhouse and growth chamber in order to provide sufficient numbers of insects for greenhouse evaluation of *Brassica*.

A small colony of Madagascan cockroaches is maintained for use in public school presentations.

Greenhouse - Twelve accessions of *Cucumis/Cucurbita* were grown in the greenhouse during the early summer as part of the attempt to develop a cucumber beetle resistance technique. Beetles did not stay on test plants in the greenhouse.

Miscellaneous

Submitted a grant proposal that was funded for \$2,700 for evaluation of *Brassica* spp. for resistance to cabbage aphid. Funding source: National Plant Germplasm System.

Manuscript review:

During 1999, Richard Wilson peer-reviewed two manuscripts and one poster for colleagues and reviewed two manuscripts for the editors of the Journal of Economic Entomology, one for Crop Science, and one for Maydica.

Cooperative research:

We tested fifteen accessions of maize in a replicated test for both first and second generation resistance for Bruce Hibbard (ARS, Columbia, MO).

We are cooperating with Corn Insects/Crop Genetics personnel (ARS, Ames, IA), Mark Berhow (ARS, Peoria, IL), and Craig Abel (ARS, Stoneville, MS) on continuing

research for the chemical mechanism of first generation European corn borer resistance in maize accessions developed from Peruvian lines.

We are cooperating with Gary Reed (OSU, Hermiston, OR) to evaluate *Brassica* for resistance to cabbage aphid.

We sent field-collected sunflower pests to John Barker (ARS, Fargo, ND) for microbe studies of insects from multiple locations.

EEO activities:

RLW - Richard L. Wilson; SGM - Sharon G. McClurg

RLW and SGM attended "Talking with David Frost-Maya Angelou" video at PI Farm, February 9, 1999.

RLW and SGM attended "Midnight Rumble" video at PI Farm, February 16, 1999.

RLW and SGM attended "Chili Cook-off" (ethnic food appreciation) at PI Farm, February 17, 1999.

RLW and SGM attended "Roots of Resistance - A Story of the Underground Railroad" video at PI Farm, February 23, 1999.

RLW and SGM completed the USDA-ARS Sexual Harassment Prevention Training via computer website on August 30, 1999.

RLW and SGM attended "Hispanic Excellence Series: Sports" video at PI Farm, September 16, 1999.

RLW and SGM attended "Hispanic Excellence Series: Arts and Entertainment" video at PI Farm, September 23, 1999.

RLW and SGM attended "Arturo Madrid" video at PI Farm, September 30, 1999.

RLW and SGM attended "Hispanic Excellence in Leaders" video at PI Farm, October 7, 1999.

RLW attended Sexual Harassment Training, Upper Iowa University, Des Moines, October 28, 1999.

Entomology and Agronomy Department activities:

RLW regularly attends faculty meetings held in both departments.

At present, RLW serves on the Agronomy Department Building Committee, Plant Breeding Panel, Greenhouse and Growth Chamber Committee, and the P&S and Merit Staff Awards Committee.

At present, RLW serves on the following NCRPIS committees: Communication Committee, Computer Committee, Extension Committee, and occasionally on selection committees for screening and evaluating applicants for vacant positions. He is ARS Property Officer for the NCRPIS.

RLW serves on a graduate committee for one Ph.D. candidate (Ted Wilson) in Entomology at Iowa State University.

Meetings attended:

RLW attended the following meetings:

1. Plant Science Lecture Series, Iowa State University, Ames, IA, January 7 - 8, 1999.
2. "Web Site Development" training, Des Moines, IA, February 5, 1999.
3. "Global Agriculture and the American Midwest" meeting, Ames, IA, March 18-19, 1999.

4. ESA North Central Branch annual meeting, Des Moines, IA, March 28 - 31, 1999.
5. Iowa Academy of Science annual meeting, Ames, IA, April 23 - 24, 1999.
6. "Food Industry Day", ISU, May 19, 1999.
7. Popcorn Breeders meeting, Gateway Center, Ames, IA, June 9, 1999.
8. Amaranth Institute annual meeting, Omaha, NE, August 9-10, 1999.
9. Tour of Golden Harvest Research Station, Nevada, IA, August 11, 1999.
10. Popcorn Field Day, Ames Seed Farms, Ames, IA, August 26, 1999.
11. Attended (and worked) Farm Progress Show, Amana, IA, September 28, 1999.
12. Iowa Honey Producers annual meeting, Marshalltown, IA, November 19-20, 1999.
13. Entomological Society of America National meeting, Atlanta, GA, December 12-16, 1999.

RLW and SGM both attended:

1. GEM Field Day, Slater, IA, September 22, 1999.

Other activities:

1. RLW serves as the primary resource person for entomological problems on amaranth in the U.S. Growers and professionals contact me and request information regarding insect problems they encounter on amaranth. He revised the entomological section of the Amaranth Production Guide.
2. RLW peer reviewed journal papers for several colleagues.
3. RLW visited 7th Grade class at Sacred Heart School, Boone, IA, March 22, 1999.
4. RLW participated in PI Station farm tour on the following date: Agronomy 522 class, July 8, 1999.
5. RLW hosted personnel delegation from Beltsville headquarters in the absence of M. Widrlechner (Acting RL), July 21, 1999.
6. RLW traveled to Hermiston, OR, to collect field data for cooperative Brassica test, August 2 - 5, 1999.
7. RLW reviewed grant proposal "Origins and host breadth of the creosotebush specialist bee fauna" for National Geographic Society, September 1999.

Short courses/training:

1. RLW and SGM attended Worker Right to Know training at Iowa State University, Ames, IA, January 12, 1999.
2. SGM attended the Association of Laboratory Technicians Symposium, Ames, IA, February 2, 1999.

3. RLW and SGM attended Tractor Safety training at ISU, February 25, 1999.
4. RLW and SGM attended ARS Safety video training at PI Farm, "Managing Safe Workplaces: A Supervisor's Role and Responsibilities" and "Safety, Health, and Environmental Management: Employees Rights and Responsibilities", March 2, 1999.
5. RLW attended Fire Extinguisher training at ISU, April 6, 1999.
6. SGM attended Half Mask Respirator and Fit Test training at ISU, April 13, 1999.
7. RLW and SGM attended Worker Protection Standard training at ISU, May 13, 1999.
8. SGM attended "Commercial Ag Pesticide Applicators Continuing Education", Ames, IA, December 3, 1999.

Presentations:

RLW gave the following presentations:

1. "Insect good guys and insect bad guys: We use them both at the PI Station," invited talk at Annual Meeting of Association of Laboratory Technicians, Ames, IA, February 2, 1999.
2. "Evaluation of sunflower germplasm for resistance to sunflower moth," at ESA North Central Branch Meeting in Des Moines, IA, March 28-31, 1999.
3. "Things are buzzing at the Plant Introduction Station," invited talk to Kiwanis Club, Ames, IA, June 12, 1999.
4. "What's a PI Station All About," invited talk to Kiwanis Club, Ames, IA, October 14, 1999.
5. "Germplasm Research," invited talk at Pacific Northwest Oilseed Conference, Great Falls, MT, November 7-9, 1999.
6. "Overview of the NPGS," invited talk at chapter meeting of American Association of University Women, Denison, IA, November 13, 1999.

Plans for 2000:

Field

Evaluate 500 maize accessions for resistance to leaf feeding by European corn borer.

Evaluate 200 maize accessions for resistance to second generation European corn borer.

Evaluate 20 amaranth accessions for resistance to tarnished plant bug and continue work on refining evaluation techniques.

Evaluate 50 sunflower (cultivated type) and 10 (wild type) accessions for

resistance to sunflower moth.

Cooperate with Mary Brothers, Irvin Larsen, and Steve Hanlin to evaluate pollination efficiency of sunflower leafcutting bees on sunflower.

Cooperate with Steve Hanlin on Osmia bee studies.

Evaluate selected *Brassica* accessions in Oregon for resistance to natural infestations of cabbage aphids.

Laboratory

Develop diet technique to evaluate sunflower accessions for resistance to sunflower moth.

Continue rearing sunflower moths.

Continue cooperative project to determine the mechanism of European corn borer resistance in Peruvian maize.

Develop plan (with Farm Superintendent and Agricultural Research Technician) to remodel Entomology Building laboratory.

Greenhouse and Growth Chamber

Retest *Brassica* accessions that rated resistant to cabbage aphid (in Oregon) for response to green peach aphid.

Continue rearing a colony of green peach aphids in the greenhouse and growth chamber.

Miscellaneous

Continue active participation in the Departments of Agronomy and Entomology.

Continue attending professional meetings and presenting research results.

Continue working with graduate students.

Continue to develop cooperative research projects.

Publications:

Abel, C.A. and R.L. Wilson. 1999. The use of diverse plant species for increasing *Osmia cornifrons* (Hymenoptera: Megachilidae) in field cages. J. Kan. Entomol. Soc. 71: 23-28.

Wilson, R.L. 1999. Entomological Society Meeting - Part I. The Buzz Jan: 2.

Wilson, R.L. 1999. Entomological Society Meeting - Part II. The Buzz Feb: 2.

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of Peruvian maize extracts on growth, development, and fecundity of the European corn borer. *J. Chem. Ecol.* 25: 1281-1294.

Wilson, R.L. 1999. Acquisition and Maintenance of Resistant Germplasm. In Ruberson, J.R., *Handbook of Pest Management*. Marcel Dekker, Inc. New York. pp. 239-262. [Book chapter]

B. Horticulture (M.P. Widrlechner, P. Ostrom)

Germplasm Collections

Acquisition:

During 1999, 160 new accessions of ornamentals and 3 accessions of mint-family plants were received. The largest group of these accessions resulted from an NPGS-sponsored exploration to the forest-steppe transition zone in Ukraine conducted by Mark Widrlechner, Robert Schutzki (Michigan State University), and Vasily Yukhnovsky and Victor Sviatetsky (National Agricultural University of Ukraine).

Maintenance:

Available for distribution:

Ornamentals (NC-7 priority site) 886/2157 (41%) (129 genera)
Ornamentals (For trials or transfers) 91/204 (45%) (78 genera)
Mint-family Plants 60/120 (50%) (13 genera)

The availability of these crops remained relatively constant from 1998.

Distribution:

Nine plants, 964 cuttings and 390 seed packets of ornamentals were distributed to meet germplasm requests, and 725 plants were distributed as part of the NC-7 Trials. Distributions of cuttings and seeds exceeded the record-high levels of 1997. Demand for medicinal plant germplasm (*Calendula*, *Echinacea*, *Hypericum*, and *Tanacetum*) continues to be particularly high. The vast majority of the cuttings were provided to Dr. William Graves at Iowa State University to start a stress-evaluation project on alders and birches. Only eight seed packets of mint-family plants were distributed in 1999.

Duplicated at NSSL and other NPGS sites

Ornamentals (NC-7 Priority Site) 669/2157 (31%)
Ornamentals (For trials or transfers) 41/204 (20%)
Mint-family Plants 57/120 (48%)

The percentage of ornamental accessions backed-up is significantly less than that reported in the 1998 Annual Report. This is despite the fact that 81 accessions of ornamentals and 2 mints were sent to NSSL for back-up in 1999. It is likely that a computational error was made with the method used by the database to calculate these statistics in 1998. GRIN is now designed to document back-ups at NPGS sites other than NSSL, such as the National Arboretum, but manual checks will need to be made to ensure that the GRIN flags are set correctly.

Regenerated

Ornamentals (NC-7 Priority Site) 84/2157 (4%)*
Ornamentals (For trials or transfers) 9/204 (4%)
Mint-family Plants 0/120 (0%)

* This includes 43 successful cage increases, 34 woody ornamental seed increases, and 7 woody plant grow-outs

Regeneration efforts expanded greatly in 1999, with the establishment of a 100-cage, three-year field planted with 185 accessions.

Tested for Germinability/Viability in 1999

Ornamentals (all accessions held as seed) 241/2079 (12%)
Mint-family Plants 2/120 (2%)

This was the largest single-year effort on germination testing of ornamentals to date.

Significant Progress

We established a three-year cage field in 1999 with 185 accessions, our largest single year effort to date. This field includes 95 accessions of *Echinacea*, targeted because of high demand for this germplasm and a backlog of accessions resulting from concerted acquisition efforts during the last few years. The Ukrainian seed collection trip, which had been in the planning process for quite some time, was finally brought to a successful completion in September. We continued a project from 1997 to inactivate all accessions with zero inventory on hand that could not be reobtained. This resulted in the inactivation of 4 ornamental accessions in 1999 and follow-up work that should lead to the inactivation of considerably more accessions early in 2000.

Characterization/taxonomy:

During 1999, there were no large-scale characterization/taxonomy projects on the crops that we curate. However, all herbaceous ornamentals in the cage-increase field and many tree and shrub accessions being regenerated were checked to verify identifications. In all, 6 accessions were re-identified.

Evaluation:

Two grant proposals to evaluate *Alnus* and *Betula* germplasm for stress tolerance were funded in 1999. The Horticulture Research Institute and the USDA-ARS are funding these projects, which are being conducted cooperatively with Drs. William Graves and Jeff Iles at Iowa State University. Initial experiments to optimize seed germination and vegetative propagation were conducted during 1999, with actual evaluation work scheduled to begin in 2000.

Enhancement:

There was no major progress to report with enhancement activities in 1999.

Coordination of the NC-7 Regional Ornamental Trials:

Plant Distribution - In 1999, 563 plants of thirteen accessions were distributed for evaluation to 24 sites, with an additional 162 plants of these accessions provided to arboreta and botanical gardens.

Computer-generated, "One-, Five-, and Ten-year Performance Report" forms were distributed to trial site cooperators this spring. Paul Ovrom has made considerable progress in refining a homepage to post trial results, images of trial plants and other information about the trials on the Internet. Evaluation results for plants distributed in 1984-87 are now available through the homepage, and results for plants distributed in 1988 and 1989 will be posted early in 2000.

Seven updates were emailed or sent to trial site cooperators in 1999 to inform

them about current developments at Ames and throughout the program. A dinner meeting of Trial Site Cooperators took place in Minneapolis, in July, in conjunction with the annual meeting of the American Society for Horticultural Science.

In September, together with Robert Schutzki at Michigan State University and two colleagues in the Forestry Department of the National Agricultural University of Ukraine in Kiev, we conducted a three-week seed collection trip focusing on native trees and shrubs of the forest-steppe transition zone in Ukraine. About 90 populations, representing most of our target species, were collected and accessioned into GRIN. During the next few years, many of these tree and shrub seed collections will be germinated and cultivated for long-term testing in the NC-7 Trials, with two overall goals: finding well-adapted, new landscape plants for the North Central Region and testing scientific hypotheses about the relationships among soils, climates, vegetation patterns and woody-plant adaptation.

Paul Ovrom visited NC-7 trial sites in Wisconsin, Illinois, and Michigan as part of a spring plant delivery trip and also visited the trial site at Iowa State University.

Mark Widrlechner and Paul Ovrom have initiated a multivariate statistical analysis of historical performance data for NC-7 trial plants of known provenance to gain a better understanding of world climatic analogs and aspects of the climate of the North Central region that are most important to woody-plant adaptation.

Germplasm activities in crops other than those curated:

Six requests for accessions with special horticultural or agronomic characteristics were handled by Mark Widrlechner, resulting in the distribution of 165 packets of seed. In 1999, he also responded to eleven general information requests regarding germplasm and its management.

With the help of Germplasm Program Assistant, Robert Stebbins, Mark Widrlechner coordinated the Station's acquisition of new germplasm from Indices Seminum and from the USDA-NRCS Plant Materials Centers.

Recently, Mark Widrlechner initiated a research project to conduct a statistical analysis of germplasm demand patterns for the period 1988-1999 for ten major NCRPIS crops. He has been working with Lisa Burke and the curatorial team to assemble data and is approaching this study as a test of how demand statistics could be used to refine managerial strategies for germplasm regeneration and maintenance. (See Table 1 in Seed Storage section.)

Mark Widrlechner collaborated with David Kovach on a paper documenting dormancy-breaking techniques in *Cuphea*, which was accepted for publication in the journal *Seed Science and Technology*.

In his role as Co-major Professor, Mark Widrlechner has guided Amalio Santacruz-Varela in a research project to elucidate patterns of genetic and morphologic variation among New World popcorn germplasm. Amalio collected a second year of field and popping data in 1999, along with conducting a comprehensive survey of isozyme variation.

Throughout the year, Mark Widrlechner participated in a university-industry-ARS collaboration to establish the Ornamental Plant Germplasm Center (OPGC), a new National Plant Germplasm System site in Ohio, which will focus on the conservation of herbaceous ornamental genera. He was appointed to serve as the agency's representative to negotiate and administer a Specific Cooperative Agreement between ARS and The Ohio State University to fund the OPGC. The

agreement was established in August.

Other research and training activities:

Mark Widrlechner is now working with Welby Smith of the Minnesota Department of Natural Resources to write a treatment of *Rubus* for a new book on the woody plants of Minnesota and has been assisting the staff of the Herbarium of the University of Wisconsin to document the *Rubus* of Wisconsin. He also co-authored a paper on the occurrence of an Old World dewberry, *Rubus caesius*, in Michigan and Iowa with Warren Wagner of the University of Michigan. The paper was submitted to Michigan Botanist and is currently undergoing review.

Recent research on the *Rubus* of Iowa was recognized by the Southern Appalachian Botanical Society in April, 1999, when it awarded Mark Widrlechner the Richard & Minnie Windler Award for the best systematic botany paper published in *Castanea* during 1998.

In 1999, with the assistance of Rex Heer, an ISU graphic designer, Mark Widrlechner produced a color moisture-balance zone map for the north central United States. A B&W version of this map was published as part of an article for *Landscape Plant News* and the color version is posted on our homepage.

Mark Widrlechner continued to collaborate with Roger Fuentes-Granados to complete publications from his doctoral dissertation on genetic studies in the genus *Agastache*. In 1999, the final paper from his dissertation, a report on the genetic control of essential oil production, was accepted for publication in the *Journal of Essential Oil Research*.

Another important aspect of training for the Horticulture project is the course work for keeping pesticide applicator's licenses current. Paul Ovrom and Mark Widrlechner attended training sessions in December.

Paul Ovrom gained valuable experience by participating in the following training activities during 1999: short courses on web site development and Photoshop, and a special supervisory training series offered by Iowa State University.

Communications Activities:

Manuscript and Proposal Review:

Mark Widrlechner served as a peer reviewer for manuscripts submitted to the *Journal American Rhododendron Society*, *Advances in Strawberry Research*, and *Journal of the American Society for Horticultural Science* and as a USDA peer-reviewer for other ARS scientists. Also reviewed plant exploration proposals for the Plant Exchange Office in Beltsville.

Meetings attended:

Throughout 1999: ISU 12+ Supervisory Leadership Series APO
February: The Essentials of Effective Web Site Development and Design (Des Moines, IA) APO
March: Shade Tree Short Course (Ames, IA) MPW, APO; Upper Midwest Organic Farming Conference (Sinsinnawa, WI) MPW
April: Fire Safety (Ames, IA) MPW, APO
June: Woody Landscape Plant CGC (Beltsville, MD) MPW; NC7 RTAC (West Lafayette, IN) MPW
July: Ohio Florists Short Course and Herbaceous Ornamental CGC (Columbus, OH) MPW; American Society for Horticultural Science, including a meeting of NC7 Ornamental Trial Site cooperators and Leafy Vegetable and Crucifer CGCs (Minneapolis, MN) MPW, APO; Plant Germplasm Operations Committee (Pocatello and

Aberdeen, ID) MPW
Aug. - Dec.: Plant Genetic Resource Management, Agronomy 523 (ISU course)
MPW (instructor) and APO (student)
September: Photoshop Software Seminar (Des Moines, IA) APO; Eastern Region
International Plant Propagators' Society (Minneapolis, MN) APO
December: Pesticide applicator's training for greenhouses (Ames, IA) MPW,
APO

MPW - Mark Widrlechner; APO - Paul Ovrom

Presentations:

Widrlechner, Mark P. 1999. The National Plant Germplasm System as a source of genetic materials for organic producers. Invited workshop presentation to Upper Midwest Organic Growers' Conference, Sinsinniwa, WI, March 4.

Widrlechner, Mark P. 1999. Role of the North Central Regional Plant Introduction Station in U.S. agriculture. Invited talk to the Ames Town & Country Kiwanis, Ames, IA, June 19.

Publications which appeared in print in 1999:

Reitsma, Kathleen R. and Mark P. Widrlechner. 1998. *Daucus* and *Apiaceae* in the USDA germplasm collection. *Umbelliferae Improvement Newsletter* 8: 1-4.

Norris, W.R., D.Q. Lewis, M.P. Widrlechner, R.O. Pope, and J.D. Thompson. 1999. The dynamic flora of a midwestern city: An analysis of floristic change and plant collection patterns in Ames, Iowa since 1859. Program Abstracts 111th Session Iowa Academy of Science, Ames, 23-24 April, p. 29.

Widrlechner, Mark P. 1999. A zone map for mean annual moisture balance in the north central United States. *Landscape Plant News* 10(2): 10-14.

Departmental Activities:

Mark Widrlechner continued as an active member of the Crop Seeds Committee and the Plant Breeding and Genetics Advisory Panel of the Agronomy Department at Iowa State University and as an active member of a Horticulture Department Committee on the management of the Reiman Gardens. He collaborated on the development of a multi-disciplinary proposal, involving Iowa State University, the University of Iowa, and the PI Station, to request \$5.5 million (direct costs) from the NIH to create a Center for Research on Botanical Dietary Supplements. Should this project be funded (it did not get funded in the first round but will be revised and resubmitted in 2000), he would serve as the leader of a Core Component on *Echinacea* and *Hypericum* germplasm.

Mark Widrlechner continued to serve as Co-major Professor for one Ph.D. candidate in Plant Breeding and as a committee member for an M.S. student in Botany. In

1999, he became a member of the committee for a Ph.D. student in Horticulture, and completed service on the committee of an M.S. student in Horticulture.

Conclusions and Plans for 2000:

Curation

We began a significant expansion of our ornamental regeneration efforts in 1999, emphasizing highly-demanded genera and generally working to reduce our regeneration backlog. We are also gathering more data to assess seed viability.

Through this expansion in effort, we are now regenerating 95 accessions of

Echinacea. In 2000, we plan to test a draft descriptor list for this genus, which should be valuable for both characterization and evaluation.

With the establishment of the Ornamental Plant Germplasm Center (OPGC) in Ohio, we expect that many of our herbaceous ornamental collections will be transferred to the OPGC during the coming year. We will ensure that the inventory and passport data for transferred collections are in the best possible condition. These transfers should allow us to focus more closely on a smaller set of herbaceous ornamental genera, especially on those genera that also have medicinal, aromatic or industrial uses, and on woody landscape plants.

Curation and research efforts are intertwined in an upcoming project to cultivate seed samples collected in Ukraine, both to add to NPGS collections and to produce new plants for the NC-7 Trials.

Research

Due to administrative assignments, research and publication activities were somewhat reduced in 1999, in comparison to 1997-98. A new map was developed for moisture-balance zones in the North Central region and was described in a publication for Landscape Plant News. At the close of the year, three publications were in press: reports on breaking dormancy in *Cuphea*, on the inheritance of aromatic compounds in *Agastache foeniculum*, and on the occurrence of an Old World species of *Rubus* discovered recently in Iowa and Michigan.

It is now possible to link the summaries of performance data from the NC7 Ornamental Plant Trials with accession records in the GRIN database. During the coming year, we will work with DBMU to establish links on GRIN between all the accessions of woody landscape plants that have been evaluated and our summaries as presented on the Station's homepage. This effort should strengthen the GRIN database and make our performance data more widely accessible.

Research efforts during the coming year will center on studies of the interaction between climate and adaptation of woody landscape plants, evaluation of stress tolerance in alders and birches, and investigations of patterns of germplasm demand. Mark Widrlechner will assist graduate students, curators, and other researchers in ongoing studies of the genetic diversity of our germplasm collections and their potential utility. Studies will also continue on the biosystematics of *Rubus* and the dynamics of the local flora, with special attention paid to the role of exotic species.

Staff Development

Paul Ovrom plans to enroll in Agronomy 541 (ISU course), Applied Agricultural Meteorology, in Spring 2000. He will continue to attend the 12+ Supervisory Leadership Series offered through ISU and plans to complete that training in April 2000. One or two day-long computer training courses may be taken in 2000. Paul plans to attend the International Plant Propagators' Society Meeting in Chicago during the month of October. If time permits, Paul may enroll in a development-related course during the fall semester at ISU.

C. Plant Pathology (C. Block)

RESEARCH NOTES:

1. Research Progress:

a. Field and Greenhouse

Amaranthus disease evaluation:

We developed a protocol to evaluate *Amaranthus* for *Phomopsis* leaf and stem blight resistance. *Amaranthus tricolor*, *A. blitum*, and *A. blitoides* are particularly susceptible, with nearly 100% plant mortality in the field. Two hundred twenty-six accessions, representing 31 species, were evaluated. Little resistance was found among the 142 *A. tricolor* accessions, nor among the *A. blitum* and *A. blitoides* accessions, but several other species were highly resistant, including *A. australis*, *A. caudatus*, *A. cruentus*, *A. dubius*, *A. floridanus*, *A. hybridus*, *A. hypochondriacus*, *A. quitensis*, *A. palmeri*, and *A. spinosus*.

Maize disease evaluation:

Three hundred thirty popcorn accessions were planted to test for gray leaf spot and northern leaf blight resistance. An early season influx of Stewart's bacterial wilt overwhelmed these diseases and ratings were only obtained for Stewart's wilt reaction.

Sunflower genetic enhancement:

We completed a third cycle of evaluation and selection for resistance to *Alternaria helianthi*, *Septoria helianthi*, and powdery mildew in two populations of wild *Helianthus annuus*. These populations will be released as public breeding populations.

b. Lab

Sensitivity of the *Erwinia stewartii* ELISA: Research continued on quantifying *Erwinia stewartii* populations in individual maize kernels. ELISA is routinely used for phytosanitary seed health testing, but the current seed testing protocols are empirically based. We obtained additional data on bacterial populations in kernels, with emphasis on seed lots containing a low percentage of infected kernels. These data will be used to formulate a statistically-based sampling strategy.

c. Cooperative research

The watermelon fruit blotch pathogen, *Acidovorax avenae* ssp. *avenae*, was identified on several *Cucumis melo* accessions in the field. Leaf samples were collected by Dr. Ron Walcott (University of Georgia) to compare melon isolates with typical watermelon isolates by PCR, fatty acid analysis, and pulsed-field gel electrophoresis. Preliminary findings support the idea that there are at least two distinct strains of the pathogen, one group that is virulent on watermelon and a second group where watermelon is not the primary host. We will attempt to obtain more isolates for DNA analysis from some of original S-9 PI Station seed lots.

2. Disease notes and phytosanitary activities:

Plant disease inspections were conducted in the seed increase plots for amaranth, *Brassica*, carrots, cucurbits, sunflower, and maize. All accessions are inspected and the notes used to verify the absence of seed-borne diseases of phytosanitary concern.

Amaranthus seed increase notes:

All of the amaranth seed increases were conducted in the greenhouse. No disease problems were observed.

Brassica and related genera notes:

Field cages containing 131 accessions of Brassicaceae were inspected during early July 1999. A low level of black rot infection (*Xanthomonas campestris* pv. *campestris*) was observed in thirteen accessions. Low to moderate levels of powdery mildew (*Erysiphe cruciferarum*) were observed, primarily on *Brassica rapa* accessions. No diseases were observed on accessions of *Alyssum*, *Biscutella*, and *Brassica carinata*. *Lepidium campestre*, A-15717, had 100% of the plants infected by the white rust fungus (*Albugo candida*).

Carrot seed increase notes:

Aster yellows symptoms were observed in July on five or six plants among the 25 carrot seed-increase cages. The plots were surveyed for leafhopper infestation, but very few were found. The incidence of aster yellows did not increase as the season progressed and the problem was minor.

Cucumis sativus and C. melo seed increase notes:

All plots were surveyed during August 1999. Anthracnose, which is often a significant problem, was scarce. The most prevalent disease was *Cercospora* leaf spot, caused by *Cercospora citrullina*. *Cercospora* leaf spot is normally a tropical or subtropical disease, but can spread long distances via storms. The heavy initial infestation was controlled with one spray of Bravo (chlorothalonil) fungicide. The watermelon fruit blotch pathogen was identified from several *C. melo* (melon) accessions. No cucumbers were affected. Because the pathogen can be seed transmitted, accessions with any leaf disease were tagged, and the seed treated with a 1% hydrochloric acid (HCl) seed wash.

Cucurbita pepo seed increase notes:

Greenhouse seedlings of 33 *Cucurbita pepo* accessions were tested for squash mosaic virus (SqMV) before transplanting to the field. Results are summarized below:

Number of accessions tested: 33

Number of plants tested: 676

Accessions with one or more infected plants: 8

Total number of infected plants: 23

Percent infected plants: 3.4%

Sixteen of the 23 infected plants were from original seed lots. Two were from check varieties and five were from a bulked seed lot of undetermined background.

Sunflower seed increase notes:

All seeds were treated with Allegiance (metalaxyl) fungicide before planting to prevent seedling downy mildew infection. No downy mildew was observed on any sunflowers at the station.

Maize seed increase notes:

Three hundred twelve maize seed-increase plots were rated in late August and early September. Five diseases were found: common rust, common smut, northern corn leaf blight, Stewart's bacterial wilt, and gray leaf spot. No other diseases were observed. Stewart's wilt was widespread and caused significant damage to

some accessions. Seed samples harvested from infected accessions will be tested by ELISA to determine if seeds are contaminated.

Laboratory seed health testing:

Seed lots often require testing before they can be shipped internationally, per phytosanitary requirements of the importing countries. A summary of the test results follows below.

Spinach:

Ditylenchus dipsaci (stem and bulb nematode)- 288 accessions, all healthy.

Verticillium spp. - 2 accessions, all healthy.

Sunflower:

Alternaria zinniae - 3 acc., all healthy.

Septoria spp. - 3 acc., all healthy.

Verticillium spp. - 3 acc., all healthy.

Maize:

Bipolaris zeicola (carbonum) - 12 acc., all healthy.
Bipolaris maydis (southern leaf blight) - 12 acc., all healthy.
Diplodia maydis - 12 acc., one infected seed found.
Diplodia macrospora - 12 acc., all healthy.
Ditylenchus dipsaci (stem and bulb nematode)- 12 acc., all healthy.
Erwinia stewartii (Stewart's wilt) - 141 acc., two infected.
Clavibacter michiganensis ssp. *nebraskensis* (Goss' wilt) - 61 acc., all healthy.
Sclerophthora macrospora (crazy top) - 61 acc., all healthy.

Communication Activities:

Papers, posters, presentations

Block, C.C., Hill, J.H., and McGee, D.C. 1999. Relationship between late-season severity of Stewart's bacterial wilt and seed infection in maize. *Plant Dis.* 83:527-530.

Sooby, J., Myers, R., Baltensperger, D., Brenner, D., Wilson, R., and Block, C. 1999. *Amaranth Production Manual for the Central United States.* Univ. of Neb. Coop. Ext. JC 98-151-S. 23 pp.

Block, C.C. 1999. Prospects For Developing An Inoculum Threshold For Stewart's Wilt In Corn. Invited talk presented at the ISTA-PDC Third International Seed Health Symposium, August 16-19, Ames, IA.

Block, C.C. 1999. Assessing Risk of Seed Transmission of Stewart's Wilt in Corn. Invited talk presented to S. African plant quarantine officials and USDA-APHIS-PPQ officials, ISU Seed Science Center, Aug. 23, 1999.

Meetings attended;

21st Annual Seed Technology Conference, Ames, February 15-16, 1999.

NCR-25 Corn and Sorghum Pathology committee meeting, Kansas City, March 24-25, 1999.

Third ISTA - Plant Disease Committee International Seed Health Symposium, Ames, August 16-19, 1999.

American Seed Trade Association, Chicago, December 7-10, 1999.

Courses/training

Total Quality Management Workshop, conducted by Pioneer Hi-Bred Intl., September 13-14, 1999.

ISO 9000 Auditor Training Workshop, conducted by Pioneer Hi-Bred Intl., September 15-16, 1999.

ISU Grant Writing Workshop, December 3, 1999.

Departmental activities

POS committee member (M.S. student) - Plant Path. Dept.
Greenhouse and Growth Chamber committee - Agronomy Dept.

Extension/Outreach:

1. Consulted regularly with a plant pathology student on developing an immunolocalization technique for *Erwinia stewartii* bacteria from corn flea beetles.
2. Hosted a tour for a French phytosanitary official - emphasis on detection/identification of Stewart's wilt on corn, 8/17/99.
3. Hosted a tour of cucumber and melon plots for two visiting scientists to discuss watermelon fruit blotch, 8/19/99.
4. Hosted a general station tour for a vegetable pathologist from India, 8/20/99.
5. Hosted a tour for a molecular biologist from Pioneer Hi-Bred to discuss sunflower disease resistance testing, 9/2/99.
6. Hosted a high school student for a job-shadowing day, 10/6/99.
7. Hosted a station tour for nine public and private sector seed scientists from the Asian-Pacific Seed Association, 10/8/99.
8. Classroom talk and demonstration of ELISA-based seed health testing for Agronomy 523 class, 10/28/99.

Other:

NCRPIS Committee memberships:
 Accession Performance Report Committee
 Internship Committee
 Computer Committee
 Vegetable technician hiring committee

EEO, Safety, Health:

EEO activities:

1. ARS film on Employee Rights at NADC, 3/2/99.
2. ARS Sexual Harassment Training (on-line), 7/8/99.
3. Hispanic Heritage month videos, 9/16 & 9/23/99.
4. Attended ARS Civil Rights training at NADC, 9/20/99.

Health and Safety activities:

1. Worker Right-to-Know Training, 1/12/99.
2. Respirator Fit Certification, 2/9/99.
3. CPR and First Aid Certification, 2/22-23/99.
4. ISU Tractor Safety Training, 2/25/99.
5. ARS film on Supervision: Managing Safe Workplaces, 3/2/99.
6. ARS film on Safety, Health, and Environmental Management, 3/2/99.
7. Fire Extinguisher Training, 4/6/99.
8. Participated in the ISU Occupational Medicine Health Program.
9. Completed annual laboratory chemical inventory and MSDS update, 3/99.
10. Worker Protection Standard Training, 5/13/99.

2000 Project Plans:

The biggest change in the pathology project came with the addition of Bill Van Roekel as a GS-9 technician on October 22, 1999. Bill transferred from within the Station. His previous responsibilities primarily involved curation of the *Cuphea* and *Euphorbia* germplasm collections. Bill's arrival provides welcome and much-needed assistance to the project.

- a. Research

We plan to continue the amaranth disease evaluation work, at least through summer 2000. The primary objective is characterization of the level of resistance within the *A. tricolor* collection.

We (Block, Gardner, Millard) have obtained USDA-ARS funding to start a maize disease evaluation project. The goal is to characterize maize accessions for reaction to a variety of foliar, stalk, and ear mold pathogens. Evaluations will be conducted by cooperators at public universities and private seed companies. Our role will be to (1) identify and assemble experimental arrays of germplasm; (2) distribute accessions; (3) facilitate establishment of trait standards for evaluation data; (4) receive and process evaluation data for entry into GRIN; (5) distribute data in other forms to cooperators and the maize breeding community; and (6) provide seed of promising accessions for further testing and development.

The two disease-resistant sunflower populations will be prepared for release as public breeding lines.

We are working with Kathy Reitsma, the vegetable curator, on a project to assess the feasibility of a non-destructive seed assay for *Acidovorax avenae* ssp. *citrulli*, i.e. seed washing and agar plating on selective media. Little is known about the longevity of the pathogen in stored seed and possibilities for seed treatment or eradication.

We plan to conduct preliminary research on two viruses, one found in amaranth and one from sunflower. We would like to confirm the suspected seed transmission and conduct a host range study, with the eventual goal of identifying the pathogens.

We will attempt to develop a better selective agar medium for *E. stewartii*. *Erwinia stewartii* is the major phytosanitary problem in the international movement of corn seed. ELISA works well for detection, but does not indicate whether bacteria are alive. We (and others) have found two existing media to be unreliable because of significant contamination by *Erwinia herbicola*. We plan to evaluate a range of bacterial inhibitors for their ability to selectively inhibit *E. herbicola*.

b. Professional Development

Plans are to become more familiar with data management on GRIN so that disease data and observations can be entered directly by the pathology staff. Disease data are currently handled by the individual crop curators.

c. Staff Development

Bill Van Roekel is making the transition from an Agronomy technical background to Plant Pathology. Much of his training will be hands-on as he becomes familiar with lab techniques, recognizing diseases, and disease ratings. Bill has enrolled in Plant Pathology 407 (Spring semester 2000), which covers plant pathology principles, terminology, and techniques for growing, inoculating and identifying plant pathogens. Additional training opportunities such as the one-week Practical Plant Pathology Workshop at ISU will be explored.

D. Farm (L. Lockhart, L. Crim, J. Scheuermann)

General:

We supervised and coordinated daily operations at the NCRPIS farm. This includes management of all facilities, fields, and greenhouse space. We supervised or conducted 60 pesticide applications in the field and/or greenhouses. This represents approximately a 10% decrease from previous years; we credit this in part to an increase in IPM practices. We responded to 78 maintenance requests from staff members at the farm and the campus location. We coordinated and scheduled the student labor force of 16.0 FTE's. We coordinated facility

construction and upgrades.

Labor:

During 1999, 59 applications for hourly employment were received and reviewed. There were 25 interviews resulting in 20 hourly employees hired. One employee was dismissed for poor work performance and one for habitual tardiness. Currently there are 28 (11.7 FTE) part-time hourly employees working at the NCRPIS.

NCRPIS Farm Crew:

Lloyd Crim has been on staff since March 16, 1998. Lloyd's responsibilities are primarily facility and field maintenance. During 1999, Lloyd removed and remodeled the remaining doors to the storage shed, designed and installed a dust collection system for the entomology lab, installed the shop lighting, and repaired numerous HVAC problems.

Jerry Scheuermann is responsible for general farm equipment and vehicle maintenance. He successfully designed and constructed a furrow opener used when constructing pollination cages, the use of which is estimated to have reduced the time it takes to construct a cage by fifty percent. He also constructed a low volume, high pressure device to be used as a seed detreater; this is used to remove chemical coatings on seeds received by NCRPIS, primarily of maize. Jerry overhauled three engines, saving the NCRPIS several thousand dollars in repair costs, and completed all repairs reported on the annual vehicle inspections.

Maintenance projects:

Shop lighting significantly improved.
Manager's Residence addition designed, approved and construction initiated; anticipated completion date of March, 2000.
Entomology Lab Dust Collection System moved to serve insect rearing facilities.
Automatic watering system in Greenhouse #1 added to support sunflower regeneration efforts.
Planned and completed renovation of computer room and reception area.

Tours:

This past year, Larry Lockhart organized and conducted 12 tours. There were approximately 185 visitors to the NCRPIS during 1999.

Conferences, training, etc. attended:

Electrical Lock-out/Tag-out
Respirator Training Certification, EH&S, ISU
CPR and First Aid Training, ISU

Staff Training:

We conducted three Tractor Safety Training sessions.

Committees:

Larry Lockhart served as Chairman of the NCRPIS Extension Committee. Larry and Lloyd also served on several hiring committees.

Purchasing:

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

E. Controlled insect pollination program (S. Hanlin)

Progress:

Cage pollination: Four hundred thirty-three cages were supplied with pollinators for controlled pollination of 656 plant germplasm accessions. Honey bees were used to control pollinate 350 accessions in the field. In the greenhouse, one nucleus colony was used to pollinate a single accession of *Amaranthus*. *Osmia* spp. were used to control pollinate 82 Brassicaceae accessions.

Beekeeping: Honey bees were successfully over-wintered in the indoor wintering facility with a survival rate of 85% for the parent colonies and 52% for the nucleus colonies. This winter, we placed 148 parent colonies and 192 double story nucleus colonies in the facility. All queens used for queen rearing will be selected next spring from surviving colonies.

All hives were treated with Apistan strips for *Varroa* mite infestations Spring, 1999. To assess the magnitude of infection by *Varroa* mites later in the season, a random sample of 24 hives was treated with Apistan during Fall, 1999, and the number of dead mites captured on sticky cards recorded. Mite population levels were found to be above economically important levels, so all colonies were treated prior to placing them into the overwintering facility.

For the past five years tracheal mite infestations were less than 1%. So fall testing was not implemented this year nor miticide used.

Bombus: Because of unfavorable weather conditions during the spring months, *Bombus* queens were very difficult to obtain in nature and rear for pollination use. So no *Bombus* colonies were established or used.

Megachile rotundata: No alfalfa leaf-cutting bees (ALC) were used this year to regenerate plant germplasm accessions. However, eight domiciles were placed in alfalfa and red clover fields at the PI station and ISU agronomy farm for bee population increase purposes. The four domiciles at the agronomy farm showed an increase, however the four domiciles at the PI station showed little or no buildup.

Osmia cornifrons/Osmia lignaria: *Osmia* spp. were used to pollinate all Brassicaceae seed increase plots.

A comparative study between three different-sized wood structure domiciles and the PVC pipe domiciles was carried out at the Des Moines "Water Works Park". The results indicated that *Osmia* showed no preference between either the size or the make of the domicile. Comparable pupa numbers were found in all of the wood domiciles and most of the PVC domiciles. This study will be continued next year to collect more information.

Last year's "increase stock" was of a higher quality than stock which has been purchased for several years. There was an increase in the number of straws which were filled. However, in order to complete next years pollination, *Osmia* will be purchased from the same supplier for the year 2000.

Musca domestica: Nine pails of house fly larvae were used in *Daucus* cages. Because of the lack of sanitary conditions which occurred during the collection of the larvae, a rearing program was started for the 2000 growing season. In October, 70 pupae were received from the University of Wyoming and house fly rearing began in the entomology growth chamber.

Personnel:

Mike Lund graduated in December after three years of working on the pollination crew. His good work ethic and technical contributions to the program have aided in the continuing success of controlled insect pollination at the NCRPIS.

Matt Lively transferred from the corn crew to the pollination crew in March and assisted throughout the summer with the pollination duties and the repairing of equipment. He has been an asset to the crew and the success of the insect pollinators this summer.

On May 10, Scott Goebel began working on the pollination crew. He has assisted in the building of new equipment and the repairs. He has been a great help in the controlled insect pollination at the NCRPIS and its continuing success.

Meetings:

June 15 - Central Iowa Honey producers
November 19 & 20 - Iowa State Honey producers.

Presentation:

October 1 - Sawyer Grade School - Mrs. Jacobson 1st grade.
October 21 - Agronomy 523.

Training Sessions:

February 25 Tractor Safety
March 2 Video Training - Managing a safe work place: A supervisor's role and responsibility. & SHEM (Safety Health of Environmental Management) employees' rights and responsibilities.
March 25 Forklift Training
April 6 Fire Extinguisher Training
April 7 Pesticide Applicator Training
May 13 Worker Protection Standard
December 3 Commercial Ag. Pesticide Application Training

Future plans:

Investigation of domicile preference of *Osmia* at the Des Moines "Water Works Park".

Continue to develop expertise on storing newly mated, diapausing, *Bombus bimaculatus*.

To investigate and establish a potential pasture which is favored by *Bombus bimaculatus* in order to aid in the collection of bees.

To obtain and use *Megachile pugnata* and *Megachile apiculis* for use in sunflower pollinator studies.

To investigate whether selective pollination occurs in the caged areas with honeybees or if pollination occurs randomly.

To cooperate in a study to observe the preference and pollination by *Megachile rotundata* and honeybees of genetically altered soybeans.

Investigate other possible pollinators for the crops maintained at the PI station.

Assist Carol Fassbinder and Joel Coats with their study on *Varroa* mite control using *Perilla* plant derivatives.

F. Zea Curation (M. Millard, T. Ladjahasan, G. Crim)

Activities

Equipment updates:

Two 600 MHz Pentium III computers were purchased for the imaging room. These computers are used for imaging maize kernels, ears, and ear cross-sections using HP 4C flatbed color scanners. Previously, there was a lone 133 MHz Pentium computer in this location. The equipment for this room is shared by other NCRPIS programs that are also imaging. Currently the imaging equipment is used more than 90% of the time by the maize program.

M. Millard (ISU maize curator II) and G. Crim (ISU field tech II) received new 600 MHz Pentium III computers. Their computers were used to upgrade the computer capabilities in the maize processing room. These new computers are also equipped with CD writers which are used for data archive.

There are ten workstations in the maize processing room. All workstation computers were either upgraded or the workstations received a computer for the first time in 1999. Non-Y2K computers were replaced by 177 MHz Pentium computers or better. These computers were transferred from other NCRPIS personnel, who received new computers after USDA funds became available to replace all Y2K non-compliant computers at the NCRPIS. These computers are being used to capture data on Windows-based Oracle forms during maize processing. Additionally, they are used by all curatorial programs for germinations. All stations were also equipped with bar code readers which are used for data entry. All maize program computers are running MS NT 4.0.

Personnel updates:

T. Ladjahasan (ISU field tech II) went on temporary disability leave in November, 1999 and remained there into 2000. He is taking advantage of an ISU leave donor program to help recover from a serious illness.

Research Progress:

Acquisition:

During 1999, 278 accessions were received. Five new accessions were received through quarantine, one accession with an expired PVP certificate, 19 new or pending Crop Science Registered (CSR) accessions, and 54 old CSR accessions, 24 of which were from South Dakota. The largest group of accessions received was 168 transfer accessions previously held only at NSSL. Thirty-eight of these are Arizona Native American corns, 102 are old North Carolina farmer varieties, and 18 were breeding populations previously donated by Dr. Sprague only to NSSL.

Regeneration:

#/% accessions regenerated--There were 275 accession regenerations attempted in Ames in 1999. This was up from 174 accessions attempted in 1998 and 193 in 1997. One hundred eleven regenerations were populations and 164 inbreds. Fifteen populations were abandoned due to the windstorm and one inbred failed to germinate. The season started with excellent weather for early plant development. A few hot days during midseason reduced seed set in midseason populations and inbreds. Later a windstorm interfered with working the late season accessions. A cool, dry late season slowed development of later maturing varieties, but a late killing frost enabled most late materials to mature anyway. Seed quality was above average. The inbred increase included many of the Michigan public inbred lines recently transferred to Ames and past Crop Science registered (CSR) accessions not previously available in Ames. The population

increase included many old Iowa CSR populations not previously in the collection.

Seed was harvested from eight *Zea perennis* accessions alternately grown in pots in the greenhouse in winter and outside in summer. Two maize collections of the race Cuzco Gigante were increased during the winter. One accession has the largest seed in the collection, but it is below 10% in viability. The newer accession was increased successfully, showing that this race can be grown under greenhouse conditions in Ames. Seed was obtained on the accession with low viability, but further rescue germinations will be needed to obtain higher population sizes.

Four hundred twenty-one accessions were planted on St. Croix in five nurseries in 1999. We have received seed from 221 of the 240 accessions planted in the first three nurseries. One hundred eighty-one accessions were growing when hurricane Lenny brushed the island. The last two nurseries were damaged, but precise damage estimates were unavailable at year's end. Miguel Serrano, a research entomologist at the station, has been acting as coordinator for the quarantine nurseries since Ms. Ester Peregrine left in April 1999 to join the soybean germplasm group at Urbana, Illinois.

As in 1998, no accessions were regenerated in Puerto Rico in 1999. Resources from the previous effort to regenerate 100 tropical accessions per year at the Isabella site of the ARS Tropical Research Station were redirected both there and at the NCRPIS. The maize curator is currently seeking assistance from the private sector in regenerating tropical accessions. A smaller NCRPIS effort will be started in FY 2001 probably with the Illinois Crop Improvement Program at Ponce, Puerto Rico.

Maintenance:

#/% available for distribution--62% (10,535) of the 16,890 accessions held at the end of December 1999 were available for distribution. This represents a slight decrease in the number of accessions available over 1998 (10,580), and a reduction in percent available. This reduction in availability is a result of several factors. A large number of germination tests were conducted in 1999; accessions with low viability were identified. This, combined with a backlog in nursery processing and a recent history of fewer increases, resulted in a lower percentage designated as available. The number of new accessions grew by 1.4%. Generally, the percent availability reflects the balance between deterioration, inventory use, and new accessions with the number of accessions received. Although incremental progress can be made by improving efficiency of operations, no significant progress in increasing the availability rate is foreseen without the influx of additional funding to the NCRPIS.

#/% duplicated at NSSL--NSSL has 71% (12,033) of the *Zea* accessions held at the NCRPIS: **11,656 of the 12,534 (93%) of the accessions with permanent PI numbers are backed up at NSSL.** Only a small shipment of 36 *Zea* accessions was made to NSSL in 1999. We plan to review approximately 1000 accessions of *Zea* for PI-number assignment in 2000. PI assignment, before shipment to NSSL, increases the efficiency of the entire backup process.

#/% tested for viability--We tested the viability on 21% (3557) of the *Zea* collection in 1999. This compares with 9.6% (1595) of the *Zea* collection in 1998; 1.8% (268 of 14,923) in 1997; and 2.2% (326 of 14,804) in 1996. Notably, the long slowdown in maize germinations has come to a close by using the new Oracle germination program, and we have succeeded in efforts to maintain an adequate level of viability monitoring on the maize collection.

Distribution:

#/% distributed--We distributed 4545 packets of 2809 accessions in 1999. This

represents 16.6% of the accessions held in the collection. As you can see from the table below, distributions were up from 1998 in all categories. Also all categories were above the five-year average.

Year	Orders	Cooperators	Packets	Accessions
1995	186	130	4995	2733
1996	251	179	4415	2777
1997	202	160	5034	3282
1998	178	137	3297	2185
1999	231	168	4545	2809
Five year average	209	154	4457	2757

Three hundred seventy-two accessions were sent to CIMMYT as part of the exchange occurring between the NCRPIS and CIMMYT of tropical materials. CIMMYT is acquiring accessions that are not in their collection, and the NCRPIS will obtain accessions thought to be of special utility to U.S. cooperators. The 43 PVP reference lines were also sent to CIMMYT for their research. The CIMMYT staff has streamlined the process for transfer of seed lots previously grown in foreign countries; this was previously problematic due to import requirements of the Mexican government. Seed grown in the U.S. and its possessions must be inspected in the field or lab tested for disease infestation, somewhat slowing the future movement of large samples from the NCRPIS to CIMMYT.

Characterization:

There were 5181 computer images obtained on 4425 lots of 3374 accessions in 1999. This compares to 1888 images on 1037 lots of 777 accessions in 1998 and 3177 images on 1985 lots of 1410 accessions in 1997.

Evaluation:

There were 495 accessions evaluated for first generation European corn borer in 1999. There were indications that one accession from Uruguay and 3 accessions from Brazil may have resistance.

There were 189 accessions evaluated for second generation European corn borer in 1999. There were indications that 14 inbred lines from CIMMYT may have resistance to second generation European corn borer.

Information management update:

#/% of collection with permanent PI accession numbers--74% (12,534) of the total Zea collection has PI numbers. With the help of Dr. S. Eberhart at the NSSL, 22 Iowa synthetics and inbreds, 59 Colorado farmer varieties, and 110 North Carolina farmer varieties were assigned PI numbers in 1999.

Communication:

Papers, posters

The maize crew worked with ISU extension and the GEM project headed by Dr. Linda Pollak in preparing a field demonstration of historical corn types at the 1999 Farm Progress Show in September 1999. The farm staff assisted in the field demonstration and the NCRPIS display.

Meetings attended

1999 North Central Corn Breeders meeting (NCR-167) held in Ames, Iowa, February 1999.

1999 American Seed Trade Association Meetings, Chicago, December 1999.

1999 Maize Crop Germplasm Committee. Held in conjunction with the 1999 ASTA meetings.

Courses/training

Tractor Safety Training
Workers Right to Know Training

2000 Project Plans

Research

The maize staff and Research Leader will review the entire regeneration process to determine the current methodology and the current data being captured. Determinations will be made as to the usefulness of certain procedures and where resources can be saved or reallocated. Advice from the Maize CGC and NCRPIS Technical Committee may be sought.

Regenerations in Ames will be maintained at 200-250 accessions. Resources need to be increased to allow for 300-400 accessions to be increased in the future.

The private sector will be asked to help increase tropical accessions during their off season. Two companies have expressed a strong interest for a nursery during the spring of 2000. The NCRPIS is approaching other companies to increase between 10 and 100 accessions per year. The NCRPIS is expecting to restart its tropical maize increases during FY 2001 when increased resources may become available.

Viability tests will be maintained at 3,000 per year. This allows the collection to be tested on a five-year cycle.

There are some 600 regenerated accessions waiting to be processed from previous increases. An effort will be made to finish up this backlog before any additions to the increase program are attempted above current levels.

The maize staff and the Research Leader plan to review data currently presented to the public in GRIN with the intention of improving the information available on accessions to the user community as well as the way it is presented. Again the Maize CGC will be consulted.

The maize curator, Research Leader, and Plant Pathologist will combine efforts to manage a research project designed to systematically obtain data on sources of maize pathogen resistance in the collection, utilizing public and private cooperator support. This effort is aimed at gaining more knowledge of the collection so that it can be used more effectively in the future.

We will again attempt to back up the last of the Goodman tropical increases from Mexico in FY 2000 and distribute 500 kernel samples to CIMMYT. Additionally, we are going to send several hundred accessions from other LAMP countries which the NCRPIS received, but which CIMMYT has not.

We will try to send several hundred accessions of maize to CIMMYT representing landraces from the U.S. This will assist CIMMYT's development as an international center for maize germplasm. It will also demonstrate the U.S. practice of freely sharing farmer varieties internationally. Regenerations were made requiring a minimum 100-ear population size as a result, seed of these landraces is plentiful.

The NCRPIS will begin procuring the core accessions designated by CIMMYT and published in CD format from the LAMP data. Also, the NCRPIS will try to fill gaps in races not held currently. Additionally, more of the Caribbean accessions will be acquired from CIMMYT.

The NCRPIS will continue to acquire from NSSL accessions held of U.S. populations and inbred lines that are not held in Ames. NSSL has reviewed their holdings of U.S. accessions not held in the active collection at Ames.

The NCRPIS will continue in its program of acquiring public materials and previously Crop Science registered accessions from public institutions. The curator will finish the Indiana program in 2000. Completion of acquisitions from the Illinois, Missouri, Nebraska, and the former Kansas program is also a goal for 2000.

Professional development:

Mark Millard plans to attend the 2000 Joint Corn Breeding Conference held in Baltimore, Maryland in February, 2000.

Mark Millard plans to attend the 2000 Maize CGC and ASTA meetings held in December, 2000.

Staff Development

Staff will be encouraged to learn the use of PC software through external course, ISU courses, or on-line courses.

G. Vegetables (K. Reitsma)

Activities--General Summary

Acquisition and Status:

Statistics concerning acquisition, availability, backup, regeneration, and distribution of the vegetable collections at the NCRPIS have been summarized in the following two tables. Information about maintenance, characterization/taxonomy, evaluation and enhancement follows the tables under the "Specific Crop Summaries."

Table 1: Status of NCRPIS Vegetable collections for 1999.

Genus	New Accessions	PI Numbers	Ames Numbers	NSSL Numbers	Total Accessions	Available #/%	Backed up at NSSL #/%
<i>Cichorium</i>	8	62	186	0	248	162/65	146/59
<i>Cucumis melo</i>	4	2376	632	3	3011	2095/70	1952/65
<i>Cucumis sativus</i>	1	1123	234	1	1358	1194/88	1183/87
<i>Cucumis wilds</i>	0	277	72	0	349	105/30	113/32
<i>Cucurbita</i>	8	834	185	4	1023	761/74	709/69
<i>Daucus</i>	282	569	507	0	1076	567/53	594/55
<i>Ocimum</i>	9	70	24	2	96	72/75	70/73
Umbels	49	340	646	1	987	164/17	201/20
TOTALS	361	5651	2486	11	8148	5120/63	4968/61

Table 2: Distribution of NCRPIS vegetable collections for 1999.

Genus	Orders	Total Packets	Domestic Packets	Foreign Packets	Total Accessions	%Collection Distributed
<i>Cichorium</i>	6	123	58	65	115	46
<i>Cucumis melo</i>	34	946	244	702	800	27
<i>Cucumis sativus</i>	20	1872	1726	146	1176	86
<i>Cucumis wilds</i>	9	249	79	170	109	31
<i>Cucurbita</i>	15	170	111	59	137	13
<i>Daucus</i>	19	489	297	192	339	32
<i>Ocimum</i>	8	206	111	95	88	92
Umbels	22	156	109	47	85	9
TOTALS	133	4211	2735	1476	2849	35

Viability Testing: (General Statement)

Germination tests were performed on 236 *Cucumis*, 109 *Cucurbita*, 157 *Daucus*, and 110 miscellaneous umbels, and data were loaded to GRIN. Germination tests for the 1999 regeneration seed lots are scheduled for spring 2000. Seeds of several genera have been pulled for five-year germination tests to monitor the viability of distribution lots. These tests will be done during the spring of 2000.

David Kovach continues to investigate germination protocols for *Angelica* to determine optimal conditions for germinating seeds of this genus to achieve a more uniform germination rate and larger plant populations for future regenerations.

Evaluation and Enhancement: (General Statement)

All evaluation data received in 1999 for the vegetable crops are listed in the specific crop summaries. At present, there is no enhancement program for the vegetable collections at the NCRPIS.

Activities--Specific Crop Summaries

CICHORIUM

Maintenance and distribution:

No accessions of *Cichorium* were regenerated in 1999.

Characterization/taxonomy:

We received field notes and photos from Lucie Arbuthnot of Sanford, Maine for *Cichorium* accessions grown in her 1997 and 1999 field trials (flooding prevented her from planting her 1998 field trials). I hope to get these data and photos entered into GRIN. Ms. Arbuthnot has also been very helpful in verifying the taxonomy of accessions in the collection.

All available *Cichorium intybus* were distributed to a researcher in Italy for use in a study evaluating genetic distances using RAPD markers. Data from this study should be received with the Accession Performance Report in 2000.

CUCUMIS

Maintenance and distribution:

Fruits were harvested from 43 of 48 accessions of *Cucumis sativus*, 98 of 115 accessions of *Cucumis melo*, and 9 of 10 accessions of wild species of *Cucumis* regenerated in 1999. Germination tests have been performed on the *C. sativus* and *C. melo* seed lots, and the crops will be stored as time permits in March 2000. Regenerations of the 9 wild species of *Cucumis* were accomplished through hand pollination of accessions in the greenhouse. Harvests were made in January 2000. Seeds of these accessions will be cleaned and germinated during the summer of 2000.

Many unavailable accessions of the *Cucumis* collections are "hard-to-handle" because they require photoperiod manipulation, growth-regulator treatment, or a longer growing season to initiate flower and fruit production. This work must be done in the greenhouse as time permits by using hand pollination; it is very labor-intensive work. Charlie Block visually inspects cucurbit seedlings before they are transplanted to the field for regeneration, and he inspects the plants periodically during the growing season. This inspection process enables the pathologist to provide the additional declaration statements sometimes required with phytosanitary certificates for foreign distribution of cucurbit seeds.

Characterization/taxonomy:

Basic notes for taxonomic identification and accession characterization data are recorded from harvested fruits. Work continues on updating passport data for collector and donor records, secondary identifiers, and habitat information, including attempts to determine latitude and longitude for collection sites. The vegetable project has moved forward with the digital imaging of the cucurbit accessions regenerated at the NCRPIS. These images will be loaded to GRIN.

Evaluation and Enhancement:

A majority of the *Cucumis* germplasm requests was distributed for research to identify disease resistance for use in breeding programs. One researcher requested all available accessions of *C. metuliferus* to screen for resistance to root knot nematodes (*Meloidogyne inconita*, *M. japonica*, *M. arenaria*, *M. hapla*) for use in a melon breeding program. A Japanese researcher is evaluating autotoxicity in *C. sativus* germplasm.

CUCURBITA

Maintenance and distribution:

Fruits were harvested from 25 hand-pollinated and 3 cage-pollinated accessions regenerated in 1999. One accession of *Cucurbita pepo* was regenerated by Dr. Linda Wessel-Beaver at the University of Puerto Rico at Mayaguez. Dr. Wessel-Beaver will continue to regenerate additional NCRPIS squash accessions from Mexico and Central America as time permits. Germination tests have been performed on the 1999 regeneration seed lots, and the collection will be stored in March 1999.

Characterization/taxonomy:

Basic notes for taxonomic identification and accession characterization are taken on harvested fruits. Work continues on updating passport data for collector and donor records, secondary identifiers, and habitat information, including attempts to determine latitude and longitude for collection sites.

Charlie Block visually inspects cucurbit seedlings before they are transplanted

to the field for regeneration each year. Because of the increasing concern about seed borne diseases in the cucurbits, we have begun to screen all *Cucurbita* seedlings for virus infection with an ELISA protocol before transplant.

DAUCUS

Maintenance and distribution:

Thirty-eight accessions were planted in the greenhouse for regeneration in summer field cages in 1999. Nine accessions were hand pollinated in the greenhouse due to early bolting, and twenty-two accessions were transplanted to summer field cages. Harvest from the 1999 regeneration season have not been processed or germinated. This work will continue during the summer of 2000. Seed increases were received for 18 accessions from R. Freeman, Sun Seeds, Brooks, OR and L. Baker, Asgrow/Seminis Vegetable Seeds, DeForest, WI.

We received 281 accessions of *Daucus* as a result of a collection trip to Greece, Poland, Syria, and Turkey by Drs. P. Simon (University of Wisconsin, Madison WI) and T. Kotlinska (Plant Genetics Resources Laboratory, Skierniewice, Poland). Many of the accessions were not identified to the species level. Twenty-nine of these accessions were started in the greenhouse in October 1999 for regeneration in the 2000 summer field cages.

Characterization/taxonomy:

Work continues on updating passport data for collector and donor records, secondary identifiers, and habitat information, including attempts to determine latitude and longitude for collection sites. We are awaiting additional passport data for accessions from the collection trip to Greece, Poland, Syria, and Turkey.

Evaluation and Enhancement:

No new evaluation data were received in 1999.

OCIMUM

Maintenance and distribution:

No accessions were regenerated in 1999, but regenerations will be attempted in 2000 on all unavailable accessions.

Characterization/taxonomy:

All available accessions of *Ocimum* were planted in the NCRPIS greenhouse during the summer of 1999 for taxonomic review and for plant material to be evaluated for essential oils. Plants were harvested as they began to flower, dried, packaged and shipped to Scotland for oil analysis and DNA fingerprinting by Dr. Katerina Svoboda and her student Senga Kyle, at The Scottish Agricultural College. Seeds of all available accessions were also recently shipped to Scotland so that this evaluation work could be repeated with fresh plant samples.

Efforts continue to update passport data for collector and donor records, secondary identifiers, and habitat information, including attempts to determine latitude and longitude for collection sites.

UMBELS

Maintenance and distribution:

Six accessions of *Eryngium* and 25 accessions of *Petroselinum* were regenerated in field cages in the summer of 1999. The harvested seeds need further cleaning and germination testing before they can be stored during the summer of 2000.

Characterization/taxonomy:

Responsibility for the miscellaneous umbel collection will be transferred to David Brenner in the coming year. The maintenance of the *Pastinaca* collection will continue as part of the Vegetable Project's responsibilities and a new site crop, NC7-parsnips, will be created on GRIN.

Conclusions:

July 28-31, I attended the following meetings held in conjunction with the American Society for Horticultural Science (ASHS), in Minneapolis, MN:

- Root and Bulb Vegetable Crop Germplasm Committee
- Vegetable Breeders Working Group
- Working Group Chairs and Chairs-elect Meeting
- Genetics and Germplasm Working Group (I served as Chair of this working group for 1998 and 1999.)

I am serving or have served on the following committees:

- Curators' Committee (Ongoing)
- Archive Committee (Ongoing)

Lucinda (Cindy) Clark started with the NCRPIS on June 14, 1999 as the Vegetable Technician. She has taken on the responsibility of day-to-day crew assignments, was instrumental in developing an imaging program for the harvest cucurbit fruits, supervised greenhouse plantings, including the regeneration of 10 accessions of wild species of *Cucumis* by hand pollination and the basil grow out for oil analysis, and has overseen the germination of the 1999 cucurbit seed increases and back-logged germinations of other miscellaneous vegetable crops.

H. Crucifers and Grasses (R. Luhman)

Acquisition:

In 1999 the NCRPIS logged into the GRIN database 19 new Brassicaceae accessions, 12 new millet accessions, and 8 new wild *Linum* accessions (Table 1).

Table 1: Accessions acquired in 1999.

GENUS	TOTAL ACCESSIONS (Dec 1999)	ACCESSIONS ACQUIRED	PERCENT ACQUIRED(1999)
<i>Berteroa</i>	13	1	7.7
<i>Brassica</i>	1971	7	0.4
<i>Cardaria</i>	1	1	100.0
<i>Crambe</i>	228	1	0.4
<i>Echinochloa</i>	227	3	1.3
<i>Eruca</i>	189	1	0.5
<i>Erysimum</i>	80	1	1.3
<i>Lepidium</i>	134	4	3.0
<i>Linum</i> (wild)	155	8	5.2
<i>Matthiola</i>	29	1	3.4
<i>Panicum</i>	983	1	0.1
<i>Setaria</i>	1001	8	0.8
<i>Sinapis</i>	192	1	0.5
<i>Thlaspi</i>	20	1	5.0
All Others	316	0	0.0
Total	5544	39	0.7

Maintenance and distribution:

Available for distribution:

About 77% of the accessions that I maintain have Plant Introduction numbers and about 73% are available for distribution (Table 2). The number of accessions that I maintain decreased about 18% during 1999, as a result of many inactivations (1215 accessions from a 1988 National Center of Agricultural Utilization Research (NCAUR) donation and 100 accessions from a 1998 NCAUR donation).

Table 2: NCRPIS Crucifer and Millet Germplasm.

GENUS	TOTAL ACCESSIONS (DEC 1999)	ACCESSIONS WITH PI NUMBERS (DEC 1999)	PERCENT ACCESSIONS WITH PI NUMBERS	AVAILABLE ACCESSIONS	PERCENT AVAILABLE ACCESSIONS
<i>Brassica</i>	1971	1576	80	1562	79
<i>Echinochloa</i>	227	160	71	141	63
<i>Linum</i>	155	75	48	16	10
<i>Panicum</i>	983	911	93	857	87
<i>Setaria</i>	1001	951	95	858	86
Other Crucifers	1091	525	48	609	56
Other Grasses	116	43	37	13	11
TOTAL	5544	4241	77	4056	73

Distribution:

In 1999, we distributed seed from 24 of the 34 genera that I curate. Seventy-four orders representing 2098 domestic and 296 foreign packets of seed were distributed (Table 3). At least 15 of the orders represent orders shipped for phytoremediation work. Other orders were sent for molecular characterization, resistance to insects and diseases, chemical analysis, tissue culture, oil research, winter hardiness and archeological work. One order to Sierra Leone (representing six of the reported *Panicum* accessions and six of the reported *Setaria* accessions) was not accepted and was sent back to the NCRPIS.

Table 3: 1999 Distributions.

GENUS	TOTAL ACCESSIONS (Dec 1999)	DOMESTIC PACKETS DISTRIBUTED	FOREIGN PACKETS DISTRIBUTED	DOMESTIC ACCESSIONS DISTRIBUTED	FOREIGN ACCESSIONS DISTRIBUTED
<i>Brassica</i>	1971	1823	242	1013	222
<i>Echinochloa</i>	227	3	6	3	6
<i>Linum</i>	155	26	0	16	0
<i>Panicum</i>	983	0	7	0	7
<i>Setaria</i>	1001	19	8	18	8
Other Crucifers	1091	226	33	223	15
Other Grasses	116	1	0	1	0
TOTAL	5544	2098	296	1274	258

GENUS	TOTAL ACCESSIONS (Dec 1999)	TOTAL PACKETS DISTRIBUTED	TOTAL ACCESSIONS DISTRIBUTED	PERCENT ACCESSIONS DISTRIBUTED
<i>Brassica</i>	1971	2067	1096	55.6
<i>Echinochloa</i>	227	9	8	3.5
<i>Linum</i>	155	26	16	10.3
<i>Panicum</i>	983	7	7	0.7
<i>Setaria</i>	1001	27	26	2.6
Other Crucifers	1091	299	227	20.8
Other Grasses	116	1	1	0.9
TOTAL	5544	2436	1380	24.9

Backed Up:

Currently, about 82% of these accessions are backed up at the National Seed Storage Laboratory (Table 4). This is a decrease of ca. 2% over 1998.

Table 4: Numbers of Accessions backed up at the National Seed Storage Laboratory.

GENUS	TOTAL ACCESSIONS (Dec 1999)	ACCESSIONS BACKED UP	PERCENT BACKED UP	# BACKED UP IN 1999
<i>Brassica</i>	1971	1851	93	5
<i>Echinochloa</i>	227	166	73	0
<i>Linum</i>	155	3	2	0
<i>Panicum</i>	983	874	89	0
<i>Setaria</i>	1001	911	91	0
Other Crucifers	1091	683	63	0
Other Grasses	116	37	32	0
TOTAL	5544	4525	82	5

Regeneration:

During 1999, we attempted to regenerate 198 accessions (Table 5) and harvested seed from 130 of those accessions. Eleven of the regeneration attempts were from plots that were overwintered in 1998. Accessions not regenerating seed were due to: no parental germination (27 accessions), dead plants in the field (6 accessions), overwintered (25 accessions), accessions not overwintering in 1998 (5 accessions), no seed produced (5 accessions). In addition, 17 more accessions were left to overwinter in an attempt to get a better harvest in 2000.

Table 5: 1999 Regeneration.

GENUS	ATTEMPTED REGENERATIONS (ACCESSIONS)	HARVESTED REGENERATIONS (ACCESSIONS)	INACTIVATED	OVERWINTERED
<i>Alyssum</i>	25	9	0	10
<i>Biscutella</i>	13	4	1	6
<i>Brassica</i>	53	49	3	0
<i>Camelina</i>	4	1	3	0
<i>Chorispora</i>	2	0	0	0
<i>Crambe</i>	1	0	0	0
<i>Enarthrocarpus</i>	2	1	0	0
<i>Eruca</i>	11	9	0	0
<i>Erucastrum</i>	6	4	0	0
<i>Erysimum</i>	42	19	0	25
<i>Lepidium</i>	4	2	0	1
<i>Setaria</i>	28	27	0	0
<i>Sinapis</i>	7	5	1	0
Total	198	130	8	42

Germination:

Table 6 indicates that 204 germinations (196 accessions) were completed during 1999.

TABLE 6: Germinations performed in 1999.

GENUS	TOTAL ACCESSIONS (Dec 1999)	GERMINATION TESTS	ACCESSIONS GERMINATED	PERCENT ACCESSIONS GERMINATED
<i>Brassica</i>	1971	30	26	1.3
<i>Echinochloa</i>	227	1	1	0.4
<i>Linum</i>	155	9	9	5.8
<i>Panicum</i>	983	0	0	0.0
<i>Setaria</i>	1001	70	70	7.0
Other Crucifers	1091	91	87	8.0
Other Grasses	116	3	3	2.6
Total	5544	204	196	3.5

Characterization/taxonomy:

Table 7 shows a breakdown of the observations recorded for the 1998 Brassicaceae regeneration.

Table 7: 1998 Brassicaceae observations:

Observation	Number of Observations
First flower	119
Mid flower	120
Last flower	100
Corolla color	102
Silique arrangement	113
Plant height	115
Harvest dates	115
Number of plants harvested	115
Total	899

Two-hundred sixty-three accessions of *Brassica* from NCAUR were selected for further field observations in 1999. One-hundred thirty-four of the 263 accessions will be bulked into 21 new accessions, 29 of the 263 accessions will remain as separate accessions (based on seed and/or field characteristics), and 100 accessions will be re-tested. One-thousand one-hundred ninety-seven NCAUR accessions will remain inactive.

Two-hundred ninety-three *Brassica* observations (data for 20 accessions) and 684 crucifer observations (data for 68 accessions) were entered into GRIN (Table 8).

Table 8: Observations entered into GRIN during 1999.

GENUS	TOTAL ACCESSIONS (Dec 1999)	NUMBER OF OBSERVATIONS ENTERED	NUMBER OF ACCESSIONS WITH OBSERVATIONS ENTERED	PERCENT OF ACCESSIONS WITH OBSERVATIONS ENTERED
<i>Brassica</i>	1971	293	20	1.0
<i>Echinochloa</i>	227	0	0	0.0
<i>Linum</i>	155	0	0	0.0
<i>Panicum</i>	983	0	0	0.0
<i>Setaria</i>	1001	0	0	0.0
Other Crucifers	1091	684	68	6.2
Other Grasses	116	0	0	0
Total	5544	977	88	1.6

Meetings attended:

Crucifer Crop Germplasm Committee Meeting (American Society for Horticultural Science, Minneapolis, MN, July).

A written report to the Forage & Turf Grass CGC prepared by Richard Luhman was presented by David Brenner (Agronomy Society of America, Salt Lake City, UT, November).

Other Activities:

1. I estimate that 40% of my time has been spent supporting the computer project at the NCRPIS. Various duties included:
 - A. Supervised a Computer Intern
 - B. Assisted with the planning and implementation of a renovated computer/farm office area
 - C. Switched our e-mail system to Microsoft Exchange and Microsoft Outlook 2000
 - D. Switched our virus protection software so it is managed from the server
 - E. Backup of server and workstations
 - F. Installed software for NCRPIS workstations
 - G. Server day-to-day maintenance
2. I served on the following committees:
 - A. Computer Committee
 - B. Communications Committee

- C. Curator Committee
- D. Extension Committee
- E. Research Leader search committee

Future Activities:

The 1999 crucifer regenerations will be stored.

Further work will be done on the *Brassica* accessions received from the NCAUR in 1988.

The 2000 field regeneration will include ca. 150 Brassicaceae accessions.

The remainder of the *Brassica* observations for the 1999 regeneration will be recorded and entered into GRIN.

I will review *Brassica* and millet Plant Introduction records to ensure that the appropriate and proper information is entered into GRIN. Additionally, I will be working closely with the Crop Germplasm Committees to determine what additional material should be included in the collections.

Computer-related tasks as needed.

- I. Amaranthus, Celosia, Chenopodium, Coronilla, Dalea, Galega, Marina, Melilotus, Perilla and Spinacia (D. Brenner)

Germplasm Status

Crop	New accessions	Total accessions	1998 Available #/%	1999 Available #/%	Backed up at NSSL #/%
<i>Amaranthus</i>	67	3323	2436/72	2718/81	2681/81
<i>Celosia</i>	0	50	12/34	17/34	14/28
<i>Chenopodium</i>	2	232	165/72	167/72	168/72
legumes misc.	2	223	93/42	97/44	109/49
<i>Melilotus</i>	16	924	659/73	683/74	738/80
<i>Perilla</i>	0	21	21/95	21/100	21/95
<i>Spinacia</i>	4	380	291/77	319/84	333/88

Germplasm Distribution and Activity

Amaranth	Orders/ Recipients	Total Packets	Total Accessions #/%	Cultivated to Regenerate #/%	Germination Tested #/%
<i>Amaranthus</i>	63/50	3682	2494/75	328/10	695/21
<i>Celosia</i>	3/3	24	17/34	2/4	16/32
<i>Chenopodium</i>	10/10	294	163/40	7/3	62/27
legumes misc.	4/4	32	32/14	5/2	122/56
<i>Melilotus</i>	9/9	287	254/48	0	27/3
<i>Perilla</i>	4/4	61	20/95	0	18/86
<i>Spinacia</i>	11/10	1061	332/87	80/21	179/47

AMARANTHUS: 3323 accessions.

Acquisition and inactivation:

Sixty-seven accessions were acquired, including advanced lines from China and landrace accessions from Nepal.

One-hundred twenty-two accessions were merged due to duplication within the collection. The duplication was caused in 1990 and prior years by accessioning populations that had been acquired previously from other sources.

Maintenance and distribution:

Two-hundred forty-six accessions were sent for back-up at the NSSL.

Forty-four accessions received new PI numbers.

Characterization/taxonomy/evaluation:

Ninety-seven observations were loaded into the GRIN database and are publicly available.

One-hundred seventy-five accessions were re-identified. Most of the identifications were based on grow-outs during seed regenerations. Three-hundred thirty-seven (10%) of the *Amaranthus* accessions remain identified only to genus.

Three-hundred seventy-two amaranth images were loaded into GRIN by Mike Cagley of the Beltsville NPGS office. PI 511715 is one example. These images are scanned from photographic slides taken in 1988-89. Ten additional years of images await scanning and loading.

Enhancement and/or utilization:

Varietal development of non-shattering grain types continued, utilizing male-sterility assisted backcrossing of the non-shattering trait into the cultivar Plainsman; field observations of various characteristics of the lines were made. David Baltensperger of the Univ. of Nebraska will cooperate in the development of non-shattering cultivars. Two non-shattering germplasm populations were made available by Iowa State Univ. <http://www.ag.iastate.edu/centers/cad>. One of the largest orders ever sent from the NCRPIS, 2,429 accessions, was sent to Dr. Sado Sakamoto, at Ryukoku University, Japan. The seeds will be characterized for starch type (translucent/opaque) and the data will be returned for inclusion in GRIN. Starch-type data would be useful in developing grain cultivars for special applications, such as clear noodles.

CELOSIA and **GOMPHRENA**: 50 accessions.

Acquisition: none

Maintenance and distribution:

No accessions were sent for back-up at the NSSL.

No accessions received new PI numbers.

Two accessions were planted in late 1999 to test and refine regeneration methods before larger regenerations are attempted.

CHENOPODIUM: 232 accessions.

Acquisition and inactivation:

Two accessions were acquired.

Maintenance and distribution:

Two accessions were sent for backup at the NSSL.

One accession received a new PI number.

Seven accessions planted in late 1999 represent European wild species; their regenerations will improve the taxonomic breadth of germplasm available from the collection.

CORONILLA, DALEA, GALEGA, MARINA, and SECURIGERA: 223 accessions.

Acquisition:

Two accessions were acquired.

Maintenance and distribution:

Two accessions were sent for back-up at the NSSL.

During 1999, five perennial accessions planted in 1997 were cage pollinated in a greenhouse with honeybees. The cage screen was a commercially available mosquito-net cot-cover.

Characterization/taxonomy/evaluation:

Two accessions were re-identified taxonomically.

Herbarium specimens of PI 612573 (formerly Ames 22617) were distributed to taxonomists, including Dr. E. Small; they were not identifiable even to genus, although they have affinity to *Trigonella*. Five accessions (PI 612571-612575) may represent the same taxon, because they have the same original seed type as PI 612573. All of these accessions are from Mongolia, and are presumably adapted for growing in the drier regions of the northern U.S. The taxonomic inquiries will be continued.

MELILOTUS: 924 accessions.

Acquisition:

Sixteen accessions were acquired.

Maintenance and distribution:

Twenty-seven accessions were provided to NSSL for back-up. One accession received a new PI number.

Characterization/taxonomy/evaluation:

Two accessions were re-identified.

Plans:

A regeneration cycle starting in the fall of 2000 will be postponed in favor of plantings from the miscellaneous Umbelliferae collection, which has more urgent regeneration needs.

PERILLA: 21 accessions.

Acquisition:

None was acquired.

Maintenance and distribution:

No accession were sent for back up at NSSL.

No new PI numbers were assigned.

Plans:

We need to acquire rare chemotypes for production of aromatic oils. I will continue to contact potential seed sources.

SPINACIA: 380 accessions.

Acquisition:

Four accessions were acquired.

Maintenance and distribution:

Eighty accessions were sent to Mr. Matt Linder of the Sakata Seed Company in Salinas, CA for regeneration using facilities and labor donated without charge by the Sakata Seed Company and by Dr. Ed Ryder of the USDA-ARS. The harvests from early 1999 were unusually large.

Sixty-one accessions were sent for back-up at NSSL.

Three accessions received new PI numbers.

Plans:

Cooperation with the seed regeneration group in Salinas, CA, should be continued.

Professional meetings attended:

International Botanical Congress XVI, St Louis, MO, August 1-7, 1999.

Amaranth Institute, Omaha, NE, August 9-10, 1999.

The Association for the Advancement of Industrial Crops and New Crops CGC, Eugene, OR, October 17-21, 1999

Agronomy Society of America, Clover and Special Purpose Forage Legume CGC, and Forage and Turf Grass CGC, Salt Lake City, UT, October 31-November 4, 1999.

Publications, presentations, and grants:

I am the first author on a review of amaranth breeding co-authored with six others and accepted for publication in Plant Breeding Reviews in 2000. Drafts of this manuscript have been widely distributed as an email attachment and have been well received.

Amaranth research was discussed in a Des Moines Register popular article about grain amaranths and the NCRPIS collection, "New crop may take root," September 26, 1999, (section J) by Jerry Perkins.

Brenner, David M. 1999. Sea beach amaranth germplasm. Chinguapin 7:14

August 3, 1999 Amaranthaceae and Chenopodiaceae crop germplasm maintenance, oral presentation and abstract (8.1.7) for the XVI International Botanical Congress,

symposium on the Biology of the Amaranthaceae and Chenopodiaceae alliance. St. Louis, Missouri.

Plant exploration in Turkmenistan to collect spinach germplasm:

A Plant Exploration Proposal, written by David Brenner, was funded by the U.S. National Plant Germplasm System. The plant collecting will be done by Turkmenistani scientists in May 2000. The collectors are experienced field biologists and germplasm experts, with excellent local knowledge. Wild spinach is a traditional main dish in Nokhur, where it is cooked in many different ways. Within their combined experience, the collectors have already located collecting sites.

The new spinach (*Spinacia turkestanica* Iljin) germplasm from Turkmenistan is a potential source of resistance to new races of blue mold, also called downy mildew (*Peronospora farinosa*). These new disease races are a threat to the world spinach industry, and are the subject of much industry attention and germplasm evaluation. Germplasm sources of resistance are an acquisition priority for the Leafy Vegetable CGC.

Collection is needed in other countries from the Caucasus Mountains to eastern Pakistan, and beyond. Turkmenistan is a priority collection site objective because of availability of collaborators and the abundance of wild species located in an area in danger from overgrazing, which should be collected before further environmental deterioration makes it impossible.

The collectors will drive from Ashkhabad to the Kopetdag Mountains, where they will collect germplasm from five or more diverse sites. All germplasm will be documented with the number of plants sampled, latitude, longitude, elevation, plant description and site description. If possible, herbarium specimens will be made at each site.

Plans:

In early 2000 (when this report was pending) there were two significant changes in my responsibilities. I was assigned approximately 1000 accessions of miscellaneous Umbelliferae germplasm for curation, and my new full-time, half-year assistant Stephanie Bruner began work. With the new responsibilities and help, I plan to have a large field planting of coriander and dill and to enter old passport data, observation data and images into GRIN.

I plan to test a protocol for greenhouse regeneration of miscellaneous Umbelliferae germplasm. Use of a greenhouse may reduce risk and labor needs as compared to field regenerations if it does not compromise genetic integrity.

Miscellaneous:

The greenhouse space available to regenerate *Amaranthus* germplasm was reduced due to new construction and lighting from greenhouse users adjacent to my area, resulting in reduction of regeneration capacity by 36 accessions per year. Curtains were installed to exclude long-day lighting from adjacent projects that make parts of my area too dark to regenerate amaranths.

I completed a one-year term as President of the Amaranth Institute at the August 1999 meeting in Omaha, Nebraska, organizing and moderating the program. Twenty people from four countries attended the meeting. The Amaranth Institute nourishes a culture of crop improvement and collaboration that includes farmers, product developers, and researchers. Use of email to distribute information has

facilitated international interaction within the organization. Exciting presentations included one about the re-introduction of amaranth in Mexican villages. The October, 2000 meeting will be in Puebla, Mexico, in conjunction with Mexican amaranth groups.

I assisted three Iowa State University graduate students with their amaranth research projects by providing amaranth literature, seeds, information and plants. The projects involve forages studied by Byron Sleugh, systematics studied by Donald Pratt, and herbicide tolerance by Ian Zelaya. I am honored to help support their innovative and rigorous work.

I prepared written progress reports for three Crop Germplasm Committees: Clover and Special Purpose Legumes, Leafy Vegetables, and New Crops, attended two of these CGC meetings, and a Forage and Turf Grass CGC meeting.

March 13, 1999 was my tenth anniversary with the NCRPIS. This milestone is for me an opportunity to look at the long-term results of steady progress, such as going from 721 to 2712 available amaranth accessions. In recent years, I have also completed advanced projects and collaborations such as the Plant Breeding Reviews paper. As the amaranth regeneration cycle nears completion, I want to resolve any remaining documentation or curation issues in the amaranth collection. Now that I am a mid-career curator, I need to refresh my work and flexibility by seeking new projects such as the miscellaneous Umbelliferae collection.

Acknowledgments:

Antonia Agua worked on my crew for most of 1999. She cleaned seeds and performed many germination tests. Debra Stansberry and Matt Lively were on the crew for shorter terms. Richard Luhman and Nick Golder have provided excellent computer support.

J. Sunflower and Miscellaneous Asters (M. Brothers, I. Larsen)

Acquisition:

In 1999, 55 *Helianthus* accessions (27 of cultivated *H. annuus* and 28 of wild *Helianthus* species) were received and logged into GRIN. Of these new acquisitions, 27 accessions of wild *Helianthus* were collected by M. Brothers and I. Larsen in the Missouri River Valley area of western Iowa and northwestern Missouri. Previously, this area was not adequately represented in the wild *Helianthus* collection.

Nine new miscellaneous asters were received and logged into GRIN: three *Arctium*, one *Conoclinium*, two *Eupatorium*, two *Stemmacantha* and one *Vernonia*.

Maintenance and distribution:

The status of the *Helianthus*, flax, and miscellaneous asters collections is summarized in Table 1.

The flax collection was inventoried and repackaged into our uniform storage containers.

#/% distributed-- Seventy-two separate *Helianthus* germplasm requests (22 foreign and 50 domestic) were received and 2815 packets, representing 1540 accessions (41% of the collection), were distributed. Compared to 1998, *Helianthus* germplasm requests increased 13% and packet distribution increased 15%.

In 1999, we received 13 separate flax requests (six domestic and seven foreign) and 193 packets were distributed.

Six separate requests for genera in the miscellaneous asters collection were also received (*Madia* - 1 request, 1 packet distributed; *Tithonia* - 2 requests, 3 packets distributed; *Vernonia* - 3 requests, 4 packets distributed).

#/% duplicated at NSSL--135 *Helianthus* accessions were sent to NSSL; 67% (2532 accessions) of the total collection is now duplicated.

Almost the entire cultivated flax collection (2801 of 2803 accessions) is duplicated at NSSL.

One *Vernonia* accession was sent to NSSL; 58 miscellaneous asters (20% of the collection) are duplicated at NSSL.

#/% regenerated--1999 greenhouse regenerations were conducted on 20 cultivated *H. annuus* accessions with limited original seed quantity or poor seed quality. Hand-pollinated, field increases were attempted on 58 cultivated accessions. One hundred eighty-five wild, annual accessions were germinated for regeneration and 114 of these accessions were transplanted into cages for controlled pollinations. Fifteen perennial *Helianthus* accessions were germinated and nine were transplanted to the field; five perennial accessions were caged for controlled pollinations. Tubers were dug from 12 *H. tuberosus* accessions and 15 plots of perennial *Helianthus* species were relocated.

On July 31, 1999, a storm with straight-line winds exceeding 70 mph severely damaged our sunflower regenerations. All of the 117 large pollination cages had to be disassembled. We had enough materials to reconstruct 35 pollination cages which were used for high-priority increases. Conduit and key clamps have been purchased to construct additional frames. The cabling system will be modified in 2000 to provide more reinforcement. The cultivated sunflowers were also damaged in the storm. Most accessions were severely lodged and the plant stems were broken off at or just above soil level. Thirty-six high priority accessions were

identified and plants were propped up with a wire line anchored with fence posts. Because of the damage, 1999 regenerations were not very successful.

Ninety-eight (98) cultivated flax accessions were regenerated at Fargo, North Dakota in cooperation with Dr. James Hammond. These same accessions were also grown at Ames, Iowa for comparative purposes. The Fargo area received a substantial amount of rain just prior to flax harvest which adversely affected yield. Germination tests will be conducted on this material and compared to the Ames-grown increases.

Ten flax accessions representing five different flax plant types were planted at various seeding rates. The standard seeding rate is 1000 seed planted per plot (a plot consists of 2 rows each 5 m in length). We wanted to compare this seeding rate with lower rates of 250 seed and 500 seed per plot.

1999 field regenerations were attempted on 26 miscellaneous asters (in general, one accession for each genus in this collection). Twelve accessions germinated and were transplanted to the field. Seed was harvested from *Madia sativa* and *Cnicus benedictus* accessions and 2 *Vernonia* accessions were relocated into a greenhouse. Accessions of *Helenium autumnale*, *Heliopsis helianthoides*, *Stemmacantha carthamoides*, *Vernonia fasciculata* and *Vernonia gigantea* were left to overwinter in the field and will be harvested in 2000.

#/% tested for germinability/viability-- In 1999, 857 *Helianthus* and 2 flax

viability tests were conducted and recorded on GRIN.

A study comparing the effectiveness of four germination protocols in promoting germination across a range of wild sunflower species was conducted in 1999. A germination treatment developed by David Kovach, Biological Science Technician-Plants, increased seed germination and reduced labor requirements. The protocol for this germination treatment is as follows:

Two germination blotter papers in standard germ boxes are moistened with 25 ml of 1 mM gibberellic acid (GA₃). Seed are placed on the moistened blotter paper and held at 23° C for approximately 16 hours then stored in the dark at 5° C for 14 days. After the cold stratification, the bottom layer of blotter paper is replaced. Distilled water (20 ml) is slowly added on top of the blotter paper and the excess water poured off. The germination boxes are then placed in a growth chamber set at 25° C for 14 hours (fluorescent light)/15° C for 10 hours (dark).

The results from this study were presented at the Sunflower Research Forum in January 2000.

Characterization/taxonomy:

Plant and achene characterization data were recorded for *Helianthus* increases. Descriptor definitions and GRIN data were reviewed and corrected when necessary.

Latitude and longitude data were added to GRIN for wild *H. annuus* accessions. Dr. Robert Webster, National Germplasm Resources Laboratory, is using these data to conduct an ecogeographic assessment of wild *Helianthus* germplasm diversity.

In 1999, 7678 observations were added to GRIN for 1392 accessions.

Evaluation/Utilization:

Eight accessions of *Helianthus debilis* ssp. *debilis* were planted and evaluated by M. Brothers and M. Widrlechner (Horticulturist) for their potential as a bedding plant. The promising accessions will be evaluated again in 2000.

In 1999, *Helianthus* seed was distributed for evaluation of host-plant resistance to rust, *Sclerotinia*, a sunflower virus, sunflower moth, and sunflower stem weevil. Data sets were received and entered into GRIN for percentage seed oil and fatty acid composition. Two flax accessions were evaluated for wilt resistance.

Dr. Tom Gulya, Fargo, ND, screened 128 wild *H. annuus* accessions for rust resistance. The 128 accessions were collected from seven areas of the United States, and accessions from Texas had the highest frequency of resistance to both Australian and North American races of rust. Dr. Gerald Seiler, Fargo, ND, identified a new cytoplasmic male sterility source from a wild *H. annuus* accession collected in Texas. Also, Dr. Larry Charlet, Fargo, ND, evaluated ten sunflower accessions for resistance to the sunflower stem weevil. Two accessions showed lower densities of weevil larvae in the stalks at harvest.

Professional development (I. Larsen):

Training activities:

Added Categories 4 (seed treatment) and 10 (demonstration and research pest control) to Pesticide Applicator's Certification and maintained certification in the following categories:

1A - weed control
1B - insect control
1D - fruit and vegetable pest control
3G - greenhouse pest management

USDA Sexual Harassment Prevention Training, 8/99 (web-based training).

Attended the 'Hispanic Excellence Series' videos, 9/99.

Completed the appropriate safety training including:

Worker Right-to-Know Standard 1/12/99

Tractor safety 2/25/99

Forklift safety 3/25/99

Fire Extinguisher safety 4/6/99

Worker Protection Standard 5/13/99

Meetings/Seminars attended:

The 21st Sunflower Research Workshop, 1/14-15/99 (Fargo, ND).

Association of Laboratory Technicians Symposium, 2/2/99 (Ames, IA).

Participated in educating the general public about the NCRPIS at the Farm Progress Show, 9/28-29/99 (Amana Colonies, IA).

Served on the Field Lab Technician II (Vegetable Crops) selection committee.

Professional development (M. Brothers):

Training:

USDA Sexual Harassment Prevention Training, 7/99 (web-based training).

Completed the appropriate safety training including:

Worker Right-to-Know Standard 1/12/99
Lab Safety - Chemical Storage/PPE/Fume Hoods 2/4/99
Commercial Agricultural Pesticide Applicators 2/24/99
Tractor safety 2/25/99
Fire Extinguisher safety 4/6/99
Respiratory Certification 4/13/99
Worker Protection Standard 5/13/99
Chemical Hygiene Plan 6/23/99
Hazardous Waste Generators 6/30/99

Meetings/Seminars attended:

The 21st Sunflower Research Workshop, 1/14-15/99 (Fargo, ND).

Sunflower CGC Meeting, 7/13/99 (Detroit Lakes, MN).

Ex Situ Plant Conservation Symposium: strategies for survival, 9/29-30/99 (Chicago, IL).

Served on the Extension committee, the Curators committee, and the PGOC In Situ sub-committee.

Presentations and publications:

Brothers, M.E. and J.F. Miller. 1999. Core subset for the cultivated sunflower collection. Proc. of the 21st Sunflower Research Workshop, pp. 124-127.

Seiler, G.J. and M.E. Brothers. 1999. Oil concentration and fatty acid composition of achenes of *Helianthus* species (Asteraceae) from Canada. Econ. Bot. 53:273-280.

Discussed sunflower curation with numerous groups/individuals who toured the NCRPIS facilities.

Future plans:

Regenerate 10 cultivated *Helianthus* accessions in the greenhouse and conduct hand-pollinations of 75 cultivated *Helianthus* accessions and caged increases of 115 wild *Helianthus* accessions.

Initiate a pollinator study conducted jointly with the entomology project to investigate the effectiveness of honeybees and two species of sunflower leafcutter bees as pollinators of wild *H. annuus* and *H. petiolaris* accessions.

In cooperation with Dr. Jim Hammond, North Dakota State University, regenerate 100 flax accessions in North Dakota. The accessions will also be grown at Ames, IA to determine the feasibility of regenerating flax at our station.

Continue the isozyme evaluation of the 112 cultivated sunflower accessions identified as the cultivated core subset. In addition, 112 randomly selected accessions will also be evaluated to determine the validity of the core and to

elucidate further inter- and intra- cluster relationships.

Review Ames-numbered *Helianthus* accessions for possible assignment of permanent PI numbers.

Table 1. Status of the *Helianthus*, flax and miscellaneous aster collections (December 31, 1999).

Collection	Accessions	Available accessions		Accessions with PI numbers	
		#	%	#	%
<i>Helianthus</i>	3775	2272	60	2623	70
Cultivated accessions	1627	1313	81	1024	63
Wild accessions	2148	959	45	1599	74
Flax	2806	2786	99	2803	99
Miscellaneous Asters	303	82	27	65	22

K. Germplasm management of Cuphea and other new crop species (J.W. Van Roekel)

Cuphea

Acquisition:

No new *Cuphea* accessions were added to the collection.

Maintenance and distribution:

1999	# of accessions	% of accessions in collection
Total accessions	815	n/a
Available	481	59
Distributed	109	13
Duplicated at NSSL	557	68
Regenerated	13*	2
Germinated	348**	n/a

* Thirteen accessions were grown for seed increase in 1999; seed is being processed at the time of this report.

** Three hundred and forty eight lots were selected for germination testing. Testing will continue into 2000.

As many as 175 accessions of *Cuphea* may soon be inactivated, primarily because original seed samples did not germinate in past multiplication attempts. Inactivation will be initiated if no additional seeds of these accessions can be obtained.

Characterization/taxonomy:

Significant progress: Characterization data for 1999-increased accessions have been collected.

Evaluation/Enhancement:

Field evaluation of accessions for possible ornamental use continues to be performed by Dr. M. Widrlechner.

Euphorbia

Acquisition:

Five new accessions of *Euphorbia* were added to the collection.

Maintenance and distribution:

1999	# of accessions	% of accessions in collection
Total accessions	207	n/a
Available	40	19
Distributed	2	1
Duplicated at NSSL	50	24
Regenerated	6*	3
Germinated	0	0

* Accessions maintained in greenhouse for increase and distribution.

Characterization/taxonomy:

None.

Evaluation/Enhancement:

None.

Meetings attended:

New Crops CGC, AAIC Annual Conference, and Future of *Cuphea* meeting, Eugene, Oregon, October 16 -20, 1999.

EEO activities:

Black History Month presentation, February 17, 1999.

Co-authored (with Irv Larsen) Patriotism, the July focus article for the AAACRAC WEB page.

USDA online Sexual Harassment Workplace Awareness online training course, July 7, 1999.

Hispanic American Month presentations, September 16 and 23, 1999.

Training:

Worker Protection Standard training, January 12, 1999.

Pesticide Applicator Continuing Education, Cat. 1A, 1B, and 10, February 24, 1999.

Tractor Safety Training, February 25, 1999.

ARS Safety training videos, Employee Rights and Responsibilities, and Managing Safe Workplaces, March 2, 1999.

Forklift safety training, March 25, 1999.

Completed Agronomy 317, Weed Science, Iowa State University, May, 1999.

Completed Agronomy 220, Crop Quality, Utilization, and Evaluation, May, 1999.

Received Bachelor of Science degree in Agronomy from Iowa State University, May, 1999.

Extension/Outreach:

Gave presentations to fourth grade classes on beekeeping, honeybees, their value in pollination, and their use and importance at NCRPIS.

Representative for NCRPIS at the Farm Progress Show, September, 1999.

Gave tours of NCRPIS to several groups.

Plans:

Due to changes in staffing needs, I am now working under the supervision of Dr. Charles Block, the station Plant Pathologist. Low demand for the *Cuphea* and *Euphorbia* collections and the need for a plant pathology technician necessitated this change.

There are issues that still need attention in the maintenance and curation of the *Cuphea* and *Euphorbia* germplasm collections. Viability of *Cuphea* seed in cold storage appears to be very good for several years, and some work has been done to confirm that. However, additional germinations of seeds that have been stored for more than five years need to be taken to confirm this observation. In the *Euphorbia* collection, more than 100 accessions have been received since 1998 that have not been regenerated. Successful regeneration of these accessions would make them available for distribution.

I am currently enrolled in a plant pathology course, Plant Pathology 407, at Iowa State University. This class will increase my knowledge and ability to identify plant pathogens. It also provides training in lab techniques for culturing pathogens and inoculating plants, as well as other skills required for my new duties.

L. Seed Research, Seed De-treatment, and Computer Application Development (D. Kovach)

Seed Research:

Summary: Research continued this year on *Angelica* and *Ocimum*. Seeds from the Galinat maize collection, as well as from PI 217407 'Ladyfinger', were germinated for the corn crew for seed increase. Also, cooperative work was done with the sunflower crew for a poster presentation and with NSSL demonstrating poor viability on *Cuphea* seed.

Angelica plants were re-started in the greenhouse in order to produce new seed to study its seed biology. Attempts at growing *Angelica* in 1998 did not produce healthy plants due to improper fertilization.

In cooperation with Kathy Reitsma, curator, *Ocimum* seed germination experiments were initiated in 1999. Three accessions of *Ocimum* were investigated due to their low germination percentages from standard paper towel germination tests. As shown in Table 1, a germination regimen of 30/20 + light using germination paper and germination boxes seemed to alleviate low germination problems in two accessions (PI 500946 and PI 500948). Tests with and without light revealed that these *Ocimum* accessions responded well to the light treatment; greater than 90% germination was attained. This might indicate that standard paper towel germination tests could be limiting the amount of light that reaches the seed. The third accession (PI 500952) only germinated to approximately 60-65% and was the subject of further investigation.

Further tests on PI 500952 showed no response to KNO_3 and GA_3 treatments. A slight increase may be seen using the accelerated after-ripening technique, but not enough to warrant the time and energy required to use it. The use of greater amplitudes in the germination regimen, as shown in Table 1 using the 30/10 C + light regimen, resulted in only slightly higher germination percentages for 12 hour or shorter photoperiods, but no increase was observed using the 30/5 C + light or 35/25 C + light regimen.

Use of cold stratification treatments actually hindered the germination in *Ocimum* seed (Figure 1). This is not surprising since *Ocimum* is a chilling-sensitive genus. Germination percentages were at approximately 64% with no cold treatment and declined almost linearly with increasing duration of cold treatment.

Further tests on PI 500952 are planned for 2000, investigating whether more after-ripening is needed to get higher germination percentages or whether the seed viability is just lower for this particular seed lot.

Table 1. Germination results of three <i>Ocimum</i> accessions. Results reported in percent germination.			
Treatment ^a	PI 500946 (90ncai01)	PI 500948 (90ncai01)	PI 500952 ^b (97ncai01)
BP; 30/20 C + light. (Data from GRIN.)	16	12	-
TP; 30/20 C + light. ^c	97	97	60
TP; 30/20 C + dark.	23	3	13
TP; 30/20 C + light + KNO ₃ .	-	-	63
TP; 30/20 C + light + GA ₃ .	-	-	61
aa; 30/20 C + light.	96	99	67
TP; 30/10 C + light for 12 hrs.	-	-	65
TP; 30/10 C + light for 16 hrs.	-	-	55
TP; 30/10 C + light for 8 hrs.	-	-	65
TP; 30 C + light.	-	-	54
TP; 30 C + dark.	-	-	6
TP; 30/5 C + light.	-	-	56
TP; 30/5 C + dark.	-	-	34
TP; 35/25 C + light.	-	-	57
TP; 35/25 C + dark.	-	-	17

^a Unless otherwise noted, light duration was for 12 hrs per 24 hr cycle. BP = Between Papers (i.e. the paper towel method), TP = Top of Paper (i.e. seed on top of germ paper in germination boxes), aa = accelerated after-ripening.

^b To be tested again in 2000.

^c Means shown are averages of two tests for PI 500946 and PI 500948 and five tests for PI 500952, as 30/20 C + light was the control.

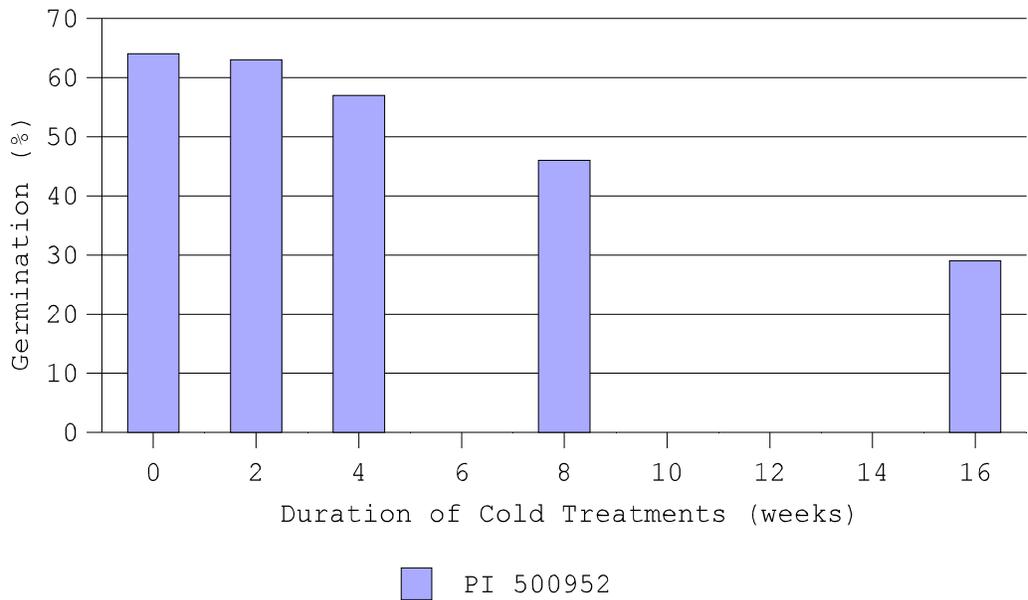


Figure 1. Germination response of PI 500952 to cold treatments. Cold treatments were followed by 30/20 C + light germination test.

In a cooperative effort with Mark Millard, curator, and Gaylan Crim, technician, 102 plants of accession PI 217407, 'Ladyfinger' popcorn, using original lot 54ncpo01, were started from seed using a pre-humidifying treatment and a mid-temperature germination regimen (23/20 C + light). This technique resulted in 57% germination of seeds that were received at NCRPIS 46 years ago. Information is not available as to when the seed was actually produced.

This technique was also used on 8 accessions (comprised of 10 lots total) from the Galinat maize collection with mixed results. The first five accessions comprised of Ames 16319 (semi-dent), Ames 16320 (flint), Ames 16510 (dent), Ames 16511 (dent), and Ames 16512 (dent) did very poorly; only 1% germination overall. The last accessions comprised of Ames 16950 (popcorn), Ames 17496 (popcorn), tested lots 90ncao01, 02, and 03, and Ames 17753 (popcorn) resulted in very good germinations; 76% overall. These results are in line with previous work conducted at NCRPIS with the Galinat collection. Generally, the popcorn lines have survived very well. The dents, flints, and floury types have not. The seedlings were then given over to the corn crew for growing out.

In cooperation with Mary Brothers, curator, and Irv Larsen, technician, a study was conducted to try to develop a simpler method of breaking seed dormancy in wild sunflower. The method developed is described in Sunflowers, Flax, and Miscellaneous Asters. Test results showed our method to be slightly better in germination percentages and required significantly less time to conduct than another method reported in the literature. Research will continue here at the station to determine if this method can be applied to other genera.

At the request of NSSL, I looked into the viability of several *Cuphea* accessions stored at NCRPIS as a check against what NSSL had stored. Several accessions stored here had much better viability than samples at NSSL, even though the two lots tested were from the same lot originally sub-sampled. This led to speculation and a possible test to see why *Cuphea* seed sent from here is not storing well at NSSL. Unfortunately, due to job position transitions at NSSL, the study has not yet been conducted.

After refereed reviews, a final manuscript on work testing dormancy-breaking techniques for *Cuphea* seed was submitted and recently accepted by Seed Science and Technology. This work was in cooperation with Dr. Mark Widrlechner, the station's Horticulturist.

This year also included the review of two papers. One paper review was officially requested by an associate editor of Crop Science and another was an unofficial review of a paper to be submitted by NSSL personnel.

Seed De-treatment:

With the arrival of the station's new research leader, Dr. Candice Gardner, the issue of seed de-treatment was reexamined. It was decided that for immediate needs, a small, mechanized, low-volume, high-pressure water spray system would be built. Larry Lockhart, the Station Superintendent, and Jerry Scheuermann, Machinist, came up with a plan that would meet these specifications. Jerry built the seed de-treater that is now used.

Work continues to determine whether treated seeds actually need cleaning and whether better, more efficient means to clean the seed can be devised. We are also investigating the best ways to dispose of the rinsate.

In a preliminary test to measure how well-washed seeds were surviving the de-treatment process, seven accessions of *Cucumis* seed and 20 accessions of *Zea mays*, washed in the summer of 1999, were tested for germination 6 months later. Results for *Cucumis* were good. All seven accessions tested at 89% germination or better. Results for *Zea mays* were mixed. Eight of the 20 accessions tested at less than 85% germination, which is the critical value for regenerating corn seed. Of the remaining 12 accessions above the 85% critical level, eleven were above 90% germination. Since there were so few seed to test, we could not test the seed prior to washing. In another test, 10 accessions of *Zea mays* seed, washed in 1996 and stored in 4 C, 30% RH conditions for the past three years, were also tested for germination. Five accessions tested below the 85% critical level. The other five accessions were at 94% germination or better. It is hard to draw conclusions from these tests except to say that for at least some *Zea mays*, de-treating the seed has little deleterious effect. For other accessions, de-treating may have a detrimental effect or seed lots are being sent to the station that have low viability. Obviously, a larger-scale test with controls is needed to determine the effects of short-time exposure of maize seed to water. Discussions with leading seed physiologists from across the United States would indicate that washing *Zea mays* seed is unlikely to harm the seed's viability.

Computer Application Development:

Three Oracle forms were developed this past year. In addition, numerous enhancements were made to forms and reports already in use at the users' requests.

The first new Oracle form developed was for data entry of maize observations, tailored to the specific needs of the maize crew. The form allows the user to scan a bar code for the accession number and then enter observation data directly into GRIN. The form calculates frequency totals and tracks which observations have been entered.

A second form was developed for order processing. This was made to work in conjunction with a previously developed form for regeneration and germination planning. The two work together to allow quicker entry of order items based on data stored in the inventory tables.

A third form was developed to evaluate raw germination data for data corrections and possible recalculation of totals.

Other work focused on linking DBMU's database with NCRPIS's new Oracle database. This involved the creation of database links 'on-the-fly' for the purpose of data transfer between the two databases for use by the corn crew for germination data entry.

Database Development:

This year an Oracle database, Oracle8i Enterprise Edition, was successfully put on one of the station's local servers. Database tables needed for germination entry were created, and database links were developed to allow for the local entry of germination data. The database links allow for data back-up to DBMU upon demand. Currently, a local database is being used by the corn crew for their germinations as a test of the system. So far, the system has worked well. As expected, response time from our local database is faster than from the remote database in Beltsville.

EEO/HRM/CR:

I am an ARS Ames Area Civil Rights Committee (AAACRAC) member responsible for the AAACRAC website. Responsibilities includes attending monthly meetings, developing web pages for the nine monthly observances, providing pamphlets for civil rights related events and showing videos related to the monthly observances.

USDA Civil Rights Training: On-line training for Sexual Harassment Prevention Training. July 7, 1999.

Seminars, Trips, and Other Training:

Attended ISU Seed Science Center's Seed Technology Conference, Feb. 16, 1999.

Attended Iowa Oracle Users Group meeting in Des Moines, Feb. 25, 1999.

Traveled to Beltsville, MD for 4½ days training on the installation, use and maintenance of Oracle8i databases. Aug. 8 - 13, 1999.

Plans for 2000:

Research plans for the year 2000 include continued work on *Angelica*, testing dormancy-breaking techniques for a wide range of species, attempting to 'recover' a line of Cuzco corn seed previously fumigated with methyl bromide, and investigating the long-term affects of chemical treatments on corn seed. The direction of future work on Oracle forms, reports, and database development will be dependent on a joint decision at a special meeting of personnel at NCRPIS to be held early in 2000.

M. Information Management: Germplasm Program Assistant (R. Stebbins)

Germplasm Collections

Acquisition:

The North Central Regional Plant Introduction Station (NCRPIS) acquired a total of 1025 new accessions in 1999. Of these new accessions, 324 were received from within the National Plant Germplasm System (NPGS). The majority of these came from the National Seed Storage Laboratory (NSSL) in Fort Collins, Colorado. Included in this group were 227 accessions of *Zea* and 54 accessions of *Helianthus*.

The remaining 701 accessions were received from outside the NPGS. Included in this group were 282 accessions of *Daucus*, 160 accessions of ornamentals, and 67 accessions of *Amaranthus*. As new accessions are recorded on the Germplasm Resources Information Network (GRIN), an effort is made to include as much passport information as possible. Typical passport information would include a source history, cooperator records, collection site description, pedigree, secondary identifiers, and any other pertinent information provided by the donor.

Maintenance:

Assistance with curatorial management was provided by processing requests for taxonomic re-identifications and nominations of accessions to the inactive file. In total, 233 accessions received taxonomic re-identifications. Among these were 176 accessions of *Brassica* and 24 accessions of *Ocimum*. Also, 1352 accessions were nominated for inactivation. The inactivations included 1220 accessions of *Brassica* and 92 accessions of other crucifers.

Additionally, 244 accessions were assigned PI numbers. Included in this group were 117 accessions of *Zea*, 43 accessions of *Amaranthus*, 35 accessions of *Cuphea*, and 34 accessions of ornamentals.

Finally, 125 accessions were inactivated due to duplication. The inventory lots of these accessions were combined with the lots of their respective duplicates. This group included 122 accessions of *Amaranthus*.

Projects:

One of the first steps to obtaining a PI number for an accession is to proof the passport information for accuracy and completeness. Proofing passport information is an ongoing project that is secondary to logging in new material. This project involves locating paper files of accession information, corresponding with collectors and donors, searches the Internet and researching maps and GIS databases.

One of my projects involved working with Mark Widrlechner to prepare 35 accessions of ornamentals and mints for PI number assignment. This required printing accession reports for the curator to proof. Any errors in GRIN were corrected and new reports were printed for a final check before requesting PI numbers. I coordinated communications with 16 foreign and domestic seed banks to request seed. The requests covered many different crops at NCRPIS.

I served as secretary of the Computer Committee for the entire year. The committee is responsible for maintaining a modern and efficient computer system; its duties include budgeting, network and resource planning, repairing, and purchasing.

On a few occasions, I processed outgoing seed orders. I have received training to accomplish this task when the staff member responsible for this is absent.

I volunteered to function as the NCRPIS representative in the Ames Area's annual food drive during the fall holiday season. The duties included the collection and delivery of non-perishable food and cleaning items to local food pantries.

I spent two days at the Farm Progress Show in the Amanos. I assisted other staff members as we explained our displays and field plots to show attendees. I believe we successfully communicated our mission to visitors.

I helped assemble information regarding Jack Harlan's substantial contributions

to the NPGS during his time as a Plant Explorer. This information was used by Peter Bretting in a tribute to Jack Harlan as part of a special memorial symposium at the ASA/CSSA annual meeting.

I worked with Mark Millard and NSSL Director Steve Eberhart to update several maize GRIN records. The pedigree and narrative information for several Crop Science Registered (CSR) accessions of maize was updated per Dr. Eberhart's instructions.

Conclusions:

Compared to 1998, new accessions received at NCRPIS were down by 4594 in 1999, a decrease of 82%. In maintenance areas, re-identifications were down by 32%, nominations to the inactive file were up by 705%, and PI number assignments were down by 36% compared to their 1998 levels.

Although acquisitions were down compared to 1998, they were 33% higher than 1997 levels. 1998 was simply an exceptional year. The significant increase in inactivations was due to a large group of *Brassica*. These *Brassica* were determined to be similar and will be bulked together into new accessions during 2000.

N. Order processing (L. Minor)

During 1999, there were 869 orders entered into GRIN. A total of 20,248 packets was distributed to requestors and evaluators throughout the world. Of the total packets distributed, 45% of these were sent to foreign requestors.

The number of orders entered into GRIN this year was 97% greater than that of 1998. Packet distribution was up by 4,116 or ca. 25.5%. The number of requests received electronically this year was 299 (compared to 229 in 1998).

We distributed 351 Initial Accession Performance Report forms in 1999. By the year's end, 241 (69%) had been returned. The Summary Accession Performance Reports and Final Reports that were mailed out in 1999 totaled 192. Of these, 112 (58%) have been returned. The return rate on the Initial Performance Report forms remained nearly the same as in 1998. There was a 26% increase in the number of Summary Accession Performance Report forms returned compared to 1998.

The Accession Performance Report Committee is making plans for 2000 to revisit the Accession Performance Report process to allow for electronic transfer of information and to modify the forms in order to capture more information.

I plan to work on developing a more efficient system for tracking the various Accession Performance Reports as they are distributed and returned.

Committees:

Accession Performance Report
Archives
Courtesy

Training:

Worker Right to Know, March 23, 1999.

O. Seed Storage (L. Burke)

1. Research: Working with Mark Widrlechner to document changes in demand for our major crops during the period of 1990 through the present (in Table 1 below).

Table 1. Summary of distributions for ten major crops from the NCRPIS, 1988-1999.

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
NC7-amaranth acc.												
Avail	721	773	819	972	1355	1351	1376	1797	2049	2182	2436	2712
Items distributed	159	264	391	779	872	1578	838	869	544	444	2746	3682
Accessions distributed	120	177	282	405	397	651	438	287	239	186	1798	2494
Number of orders	12	26	23	37	46	53	51	63	43	53	63	62
Cooperators responsible	12	17	21	34	43	36	43	48	34	40	57	50
NC7-brassica acc.												
Avail	1139	1230	1260	1404	1404	1396	1333	1365	1393	1477	1558	1559
Items distributed	4859	2727	1755	4140	1841	3558	2326	2134	944	2267	1560	2168
Accessions distributed	955	1220	926	1427	1028	1408	1345	1225	801	973	1201	1110
Number of orders	26	36	26	28	40	24	21	25	31	40	36	53
Cooperators responsible	18	30	23	28	37	22	19	24	29	37	32	46
NC7-cucumis.cucs acc.												
Avail	707	739	792	829	836	828	816	983	1076	1078	1203	1194
Items distributed	1203	2944	2139	2024	691	2148	111	1542	2272	1351	268	1872
Accession distributed	798	764	816	838	566	844	93	993	921	840	224	1176
Number of orders	29	25	30	28	23	19	13	24	19	22	20	23
Cooperators responsible	23	18	23	23	17	18	12	19	15	20	19	23
NC7-cucumis.melo acc. Avail.	1300	1316	1444	1501	1569	1564	1498	1698	1808	1802	2130	2095
Items distributed	5332	656	184	1258	937	2669	647	825	1075	1538	1206	945
Accessions distributed	1612	432	153	802	701	1551	539	602	762	1011	716	800

Number of orders	28	32	22	44	30	47	30	34	34	33	33	35
Cooperators responsible	22	22	14	31	24	26	20	26	29	28	24	27
NC7-cucurbita acc. Avail.	511	527	560	584	578	566	569	687	665	679	704	761
Items distributed	157	98	21	2208	247	315	165	63	15	275	114	170
Accessions distributed	130	79	21	675	196	303	130	57	11	249	98	137
Number of orders	11	10	6	21	12	8	11	12	4	16	15	16
Cooperators responsible	10	10	6	20	11	7	11	11	4	16	15	15
NC7-daucus acc. Avail.	387	413	414	420	453	434	457	512	510	711	538	567
Items distributed	616	323	124	1261	636	241	516	865	377	271	922	489
Accessions distributed	390	201	120	430	427	153	326	475	254	204	525	339
Number of orders	13	9	5	12	15	13	13	16	15	13	19	20
Cooperators responsible	9	8	5	11	12	12	10	15	12	11	16	16
	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
NC7-maize% acc. Avail.	5003	5037	5333	5811	5958	5950	9726	10050	10185	10474	10580	10582
Items distributed	3500	4355	4925	2695	4357	2906	3238	4800	4226	4843	3170	4545
Accessions distributed	2266	2577	3781	2063	2671	1879	1991	2639	2689	3185	2133	2809
Number of orders	105	128	101	110	174	173	192	257	318	252	323	353
Cooperators responsible	83	93	80	86	124	139	149	195	243	211	192	278
NC7-spinach acc. Avail.	254	258	257	257	257	257	206	205	217	241	291	317
Items distributed	6	0	1021	159	0	0	0	293	1009	1196	1395	1061
Accessions distributed	6	0	256	130	0	0	0	217	218	253	308	332

Number of orders	3	0	5	5	0	0	0	6	6	10	14	11
Cooperators responsible	3	0	5	3	0	0	0	6	6	8	12	10
NC7-sun.cults acc. Avail.	720	735	830	893	909	887	972	1042	1068	1192	1285	1313
Items distributed	3469	3951	2104	2217	2233	1826	1109	2229	2690	2882	1854	2111
Accession distributed	673	787	886	877	918	929	661	1062	1054	1025	915	1092
Number of orders	54	47	31	39	45	48	36	57	42	59	44	57
Cooperators responsible	40	34	28	31	32	33	24	31	31	42	32	41
NC7-sun.wilds acc. Avail	199	217	228	237	241	240	598	674	636	778	877	959
Items distributed	765	1401	546	1059	345	448	320	792	833	492	547	704
Accessions distributed	222	225	245	245	202	297	214	434	483	355	426	448
Number of orders	33	47	20	25	33	28	24	44	36	28	28	37
Cooperator responsible	26	31	18	23	27	23	23	30	30	25	22	31

2. Communication Activities
 - a. Courses and training

Lisa Burke participated in Agronomy 523: Plant Genetic Resources Management at Iowa State University
 - b. Outreach

Lisa Burke assisted with tours of the station for visitors from Iowa State University (Botany 202), the NPGS station at Sturgeon Bay and Native Seed/SEARCH
 - c. Other

Lisa Burke developed the display of World and United States maps detailing the destinations of seed orders leaving the station for 1999.
3. EEO, Safety. Health
 - a. EEO

Lisa Burke attended EEO activities, including videos shown during African American history month and Hispanic Heritage Month. She also assisted in planning activities designed to encourage informal communication among the staff (i.e. potlucks).
 - b. Safety

Lisa Burke attended a re-certification class for CPR and First Aid in February 1999 to keep her first responder status current.
4. Seed Storage Activities
 - a. Freezer

The original seed samples for the cucumber and pumpkin collections were moved into the freezer for long-term storage. Approximately half of the melon collection has been moved into the freezer with the remaining half to be moved in 2000. Moving the first half of the melon collection resulted in the creation of 367 split lots for the purpose of making original samples available and having a portion of the sample in the freezer. A total of 5196 lots were placed into the freezer in 1999.
 - b. Storage

5148 lots were stored, meaning that they have been inventoried and deposited in their proper location in medium- or long-term storage. The largest project under the Storage heading was the completion of cultivated flax collection. All accessions of the flax collection received from Fargo have been stored and are now a part of the active collection.
 - c. Inactivations

1444 lots were inactivated. 1208 of those inactivated were from the Brassica collection. We requested the return of backup samples for those accessions from NSSL.
 - d. NSSL Backup

1322 lots were backed up at NSSL. These include both new accessions for NSSL and lots that replace backup lots of lesser quality.
 - e. Distributions

20503 packets were distributed as germplasm distribution or observation orders. 11283 packets were sent to domestic requestors and 9220 were sent to foreign requestors.
 - f. Re-inventory

9330 lots were re-inventoried in 1999. Jars were pulled and seed amounts verified. These data were entered in GRIN.
 - g. Continuing projects

Work continues on repackaging and re-inventorying the maize reference collection. Re-inventorying of the maize collection also continued in 1999.
 - h. Miscellaneous activities

There were numerous activities that resulted shifting the locations of packets and jars and re-labeling. There were 155 lots that were renumbered due to duplication. 243 accessions were given permanent PI numbers.
5. Personnel

- a. Federal employees
Mary Arnold was hired as a temporary, full-time federal employee from Jan - Sept of 1999. She was supervised by Lisa Burke. Mary attended the appropriate federal training and EEO activities. She also assisted in the planning and implementation of informal communication activities.
 - b. State employees
Mary Block continued to work in seed storage part time in 1999. Mary Arnold worked as a state employee when her temporary position ended (Oct - Dec).
6. 2000 Project Plans
- a. Continuation of plans from 1999
Continued work on the maize reference collection, re-inventory of the maize distribution lots, re-inventory of other crops, work on a storage system for balanced samples, and moving the rest of the melon collection to the freezer. New maps are being made to document World and United States germplasm distribution for 2000.
 - b. Storage
Store 1999 increases to make them available and back them up at NSSL
 - c. Personnel
Mary Arnold was rehired in a temporary one year (with possible one year extension) federal position. Training and development of her position will take place during the coming year.

P. Computers and Telecommunications: (R. Luhman, M. Millard, R. Stebbins, R. Wilson)

Year 2000 Reports: Monthly reports were submitted to Iowa State University to monitor our Y2K preparedness. We also worked with NADC to submit an Information System's Security Plan and a Y2K Business Contingency Continuation Plan. A Y2K contingency plan was developed that weighed heavily on data backup. No Y2K problems have been reported.

Equipment Purchased: Desktop PC's (18), Ultra Fast SCSI Hard Drives (2), Handheld symbol Barcode Scanner (7), HP Color LaserJet printer (2), Digital cameras (2), Intellimouse trackball (1), Ergonomic keyboard (1), Flatbed Scanner (1), LCD projector (1), Switch box (1), Slide scanner (1), SCSI Cards (3), Hard Drive (1), CDROM Drive (1), HP Jetdirect Card (1), SCSI Cable (1)
Software: Adobe Acrobat 3.0 (1), Adobe Acrobat 4.0 (2), Corel Office 2000 (1), Dreamweaver 2.0 (2), MS Exchange Server 5.0 (5 user license), MS Exchange Server 5.0 Client Access (45 licenses), MS Frontpage 2000 (2), MS Office 97 Professional (1), MS Office 2000 Developer (1), MSOffice 2000 Professional (2), MSOffice 2000 Professional licenses (20), Norton AntiVirus Corporate Edition (58 licenses), Partition Magic (1), PCAnywhere (2), Procomm Plus 4.7 (2), Visual C++ Professional 6.0 (1), Visual J++ Pro 6.0 (1), Windows NT 4.0 Server (5 user license), Windows NT 4.0 Server Client Access (45 licenses), Windows NT 4.0 Workstation (9), WordPerfect 8.0 (4)

Progress:

1. All staff members are using MS Outlook 2000 and the MS Exchange Server for email. This change was necessitated by security concerns and to reduce diversion of effort caused by supporting multiple e-mail systems.
2. Installation of virus software on our server has given us the ability to ensure that all of our users are using the most current virus protection. This virus software also scans all incoming and outgoing email.
3. The renovation of the farm computer room/main office has helped in organization.
4. Our Internet site has had about 5000 hits during 1999. Plans: We will upgrade our server to a faster machine, investigate upgrading our workstations and servers to Windows 2000 and check into means of further improving our backup system.

Q. Molecular Marker: (M. Brothers)

Mary Brothers continued the isozyme evaluation of the 112 accession sunflower core subset and an additional 112 randomly selected sunflower accessions as discussed in the sunflower curation section.

Amalio Santacruz-Varela, PhD candidate, conducted an isozyme evaluation to characterize the genetic variation of 56 popcorn accessions originating from Latin America and the United States. His research project is titled "Genetic diversity of North American popcorn and its relationship with Mexican and South American popcorns."

During 1999 the NCRPIS's molecular marker lab space and equipment have been used by USDA-ARS and Iowa State University scientists.

A team lead by Dr. Kendall Lamkey (USDA-ARS, Iowa State University, Department of Agronomy) continued its research to measure genetic diversity in open-pollinated populations of maize germplasm, primarily 'Corn Belt Dent' related material. Their goal is to determine if the modern U.S. maize crop is as genetically diverse as it was before the predominance of hybrid cultivars. They wish to increase efforts towards conserving currently unexploited, temperately-adapted, maize germplasm.

Dr. M. Paul Scott (USDA-ARS, Iowa State University, Department of Agronomy) has used our facilities as a 'clean room' for setting up PCR reactions. His lab is using PCR to detect transgenes in maize tissue, and because they work with the same genes repeatedly, it is necessary to set up the reactions in a clean room to avoid contamination that would result in false positives.