

NORTH CENTRAL REGIONAL PLANT INTRODUCTION STATION
NC-7 ANNUAL REPORT, JANUARY 1 - DECEMBER 31, 1997

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 *P.K. Bretting, Iowa
C. State Experiment Stations Representatives
- | | | | |
|--------------|--------------|---------------|---------------------|
| 1. Illinois | *T. Hymowitz | 7. Missouri | *P. Beuselinck |
| 2. Indiana | *J. Janick | 8. Nebraska | *D. Baltensperger |
| 3. Iowa | *C. Brummer | 9. N. Dakota | *J. Franckowiak |
| 4. Kansas | *Vacant | 10. Ohio | *K. Campbell, Secy. |
| 5. Michigan | *A. Iezzoni | 11. S. Dakota | *A. Boe |
| 6. Minnesota | *H. Pellett | 12. Wisconsin | *W. Tracy, Chmn. |

*Voting members

D. U. S. Department of Agriculture

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|---|------------------|
| 1. ARS National Program Staff, Plant Germplasm | *Vacant (Shands) |
| 2. ARS Plant Exchange Office | *E. Garvey |
| 3. ARS Area Director, Midwest Area | R. Dunkle |
| 4. Cooperative State Research, Education and
Extension Service | M. Fitzner |
| 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

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|---------------------------------------|----------------|
| 1. USDA-ARS Staff | |
| a. Research Leader/Coordinator | P. Bretting |
| Supervisory Program Support Assistant | L. Wilson-Voss |
| Office Automation Clerk | B. Powers |
| Office Automation Clerk | R. Schroder |
| Biological Science Technician | Vacant |
| b. Horticulturist | M. Widrlechner |
| Agricultural Research Technician | P. Ovrom |
| Biological Science Technician | J. Edwards |
| Agricultural Research Technician | J. Van Roekel |
| Biological Science Technician | Vacant |
| Agricultural Research Technician | D. Kovach |
| Biological Science Lab Technician | L. Burke |
| Germplasm Program Assistant | R. Stebbins |
| c. Research Entomologist | R. Wilson |
| Agricultural Research Technician | S. McClurg |
| Entomologist | C. Abel |
| d. Geneticist | M. Brothers |
| Biological Science Technician | I. Larsen |

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|---|----------------|
| 2. Iowa State University Staff | |
| a. Research Station Superintendent II | L. Lockhart |
| Field-Lab Technician III | Vacant |
| Field-Lab Technician II | J. Scheuermann |
| Clerk Typist II | L. Minor |
| b. Curator II | M. Millard |
| Field-Lab Technician II | T. Ladjahasan |
| c. Asst. Scientist II (Plant Pathology) | C. Block |
| d. Curator II (Brassica, Grasses) | R. Luhman |
| e. Curator II (Vegetables) | K. Reitsma |
| Field Lab Technician II | L. Hintch |
| f. Curator II (Amaranth) | D. Brenner |

III. PROGRESS OF WORK (P. K. Bretting)

Personnel changes:

Resignations: R. Schweppe, Biological Science Technician, C. Frank, Biological Science Technician, C. Brewer and L. Wells, Office Automation Clerks, and M. Czajkowski vacated their positions during 1997.

Hirings: R. Schroder and B. Powers were hired as Office Automation Clerks, and L. Hintch as a Field Lab Technician.

Promotions and reclassifications: R. Wilson was promoted to GS-14 by RPES panel, P. Ovrom was promoted to GS-8 Agricultural Research Technician, and L. Burke was promoted to a GS-7 Agricultural Research Technician.

Construction:

1. A flat bed dump trailer was constructed.
2. Various maintenance projects were completed: weatherization of a greenhouse, rerouting of a LiCl₂ dehumidification system, repair of headquarters building roof, and grading of field plot land.

Equipment:

1. Laboratory equipment for the seed pathology and genetic marker laboratories was purchased.
2. Six new Pentium computers, a new Pentium server, two flat bed scanners, a tape backup unit, and two palmtop computers were purchased.

IV. PROGRESS IN GERMPLASM AND INFORMATION MANAGEMENT, RESEARCH, AND EDUCATION (P. K. Bretting, L. Wilson-Voss, B. Powers)

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

Acquisition:

1. More than 760 germplasm accessions were acquired by the NCRPIS during 1997 (details listed under the germplasm program assistant's and the curators' reports).
2. Significant acquisitions included more than 200 accessions of ornamentals (especially Echinacea), more than 150 accessions of maize, more than 100 accessions of sunflowers, and more than 80 accessions of umbels.
3. More than 230 accessions were inactivated and their seeds placed in archival storage.

Maintenance:

1. More than 44,000 accessions representing more than 300 genera and 1,600

- species are now maintained at the NCRPIS. More than 1,100 accessions were "backed-up" in long-term storage at the National Seed Storage Laboratory (NSSL).
2. More than 6,800 lots of original seed were placed in long-term (-18 °C) storage.
 3. Inventories of more than 12,000 seed lots were reviewed to verify that the seed amounts were correctly recorded.

Regeneration:

1. More than 1,800 accessions were cultivated for regeneration in Ames, Puerto Rico, St. Croix, and Salinas, CA during field seasons, which at Ames incorporated more than 670 insect cages for controlled germplasm pollination.
 - a. The NCRPIS's germplasm regeneration program received valuable assistance from seed companies. Seminis and SunSeeds regenerated carrot accessions, and Pioneer Hi-Bred International regenerated sunflower and maize accessions.
 - b. A group led by Mr. J. Kojima of Sakata Seeds, and Dr. E. Ryder, USDA/ARS, Salinas, continued to regenerate Spinacia germplasm in positive pressure chambers at the USDA/ARS research site in Salinas, CA.

Distribution:

1. More than 18,000 seed packets were distributed to researchers in the U. S. (ca. 62% of the total) and abroad (the remaining 38%). This total is about 10% higher than our five-year mean for distribution.
2. A large maize seed order (more than 2,000 accessions) was distributed to researchers at the University of Illinois for evaluation of host-plant resistance to a variety of diseases.
3. More than 230 vegetative cuttings were distributed. Thirteen accessions of landscape plants were distributed for long-term evaluation at 24 sites in the North Central Region. The number of ornamental accessions distributed in 1997 greatly exceeded that of previous years.

Testing germplasm's germination, viability, and health:

1. More than 1,200 accessions were assayed for their germination/viability percentages.
2. Maize, sunflower, squash, cucumber, melon, amaranth, Chenopodium, brassicas, and ornamental germplasm regeneration plantings were inspected for pathogens.
3. Accessions of Cucurbita pepo were assayed via ELISA for squash mosaic virus (SqMV) before planting. Living SqMV was detected in 45 year old seeds, the oldest seed from which viable SqMV was recovered.
4. More than 150 accessions of maize were assayed via ELISA for presence of Stewart's bacterial wilt.
5. Research conducted on Stewart's bacterial wilt revealed that the longevity of the causal bacterium in seeds was strongly affected by storage temperature.
6. Research on Cuphea seeds indicated that regimens of alternating light and temperature conditions would increase germination percentages.
7. Research on aged maize kernels revealed that some could be induced to germinate through imbibition and pre-humidifying treatments.

Information management and computers:

1. Personal computers, a new server, flatbed scanners (see "Equipment") and specialized software were purchased to improve the efficiency and reliability of information management at the NCRPIS.
2. The NCRPIS computer staff continued to cooperate with other NPGS sites to refine the new version (GRIN3) of the Germplasm Resources Information Network.
3. More than 300 accessions were assigned Plant Introduction numbers.

4. "One-year", "Five-year" and "Ten-year" Performance Report forms were distributed to trial site cooperators for the NC-7 Regional Ornamental Trials.
5. More than 15,500 characterization/evaluation data points for amaranth were entered into GRIN.

Characterization:

1. Morphological characterization data were recorded for more than 1,800 accessions of maize, brassicas, millets, carrots, amaranths, cucurbits, Cuphea, ornamentals, and other crops.
2. William González completed an extensive characterization of more than 30 accessions of Northern Flint maize with morphological, isozyme, and SSR DNA markers. This represents the first survey of SSR genetic variability for a maize landrace.
3. The first comprehensive taxonomic study of Rubus (blackberries, raspberries) in Iowa was completed.
4. A comprehensive study of the genetic control of variability in isozymes and essential oil composition in Agastache was completed.
5. The first winter-hardiness zone map for China was completed, published, and distributed in printed form and on the Internet.
6. More than 5,700 color images of more than 1,445 maize accessions were captured on digital files for curatorial reference.

Insect management

1. Optimal storage conditions for the pupae of horn-face mason bees, and important germplasm pollinator, were identified.
2. Osmia lignaria, a mason bee native to Iowa, proved to be a superior pollinator of Brassica germplasm.

Evaluation:

1. More than 1,100 accessions were evaluated in total at the NCRPIS in 1996. Accessions of maize, millets, brassicas, Cuphea, mints, and potential ornamentals were evaluated for general agronomic or horticultural merit.
2. More than 60 maize accessions were evaluated for host-plant resistance (in silks) to corn earworm feeding. More than 740 maize accessions were evaluated for host-plant resistance to 1st generation European Corn Borer, and more than 200 accessions were evaluated for host-plant resistance to 2nd generation European Corn Borer.
3. More than fifty sunflower accessions were assayed for host-plant resistance to sunflower moth.
4. A multi-year evaluation of brassicas for host-plant resistance to green peach aphid continued, and incorporated field trials in Hermiston, OR. Some resistance was noted in accessions of B. juncea.
5. Host-plant resistance to powdery mildew was evaluated for hundreds of cucumber germplasm accessions.
6. An evaluation of the adaptation of Japanese landscape plants to the North Central Region was completed and readied for publication.
7. Evaluation data for disease and insect resistance, and percentage seed oil, were entered into GRIN for more than 1,800 sunflower accessions.

Enhancement:

1. A long-term recurrent phenotypic selection project continued to develop a composite population of wild sunflowers (H. annuus) with host-plant resistance to both Alternaria and Septoria leaf blights.
2. 'Kerala Red', a new, bright-red ornamental and potherb cultivar of amaranth was formally released.
3. The biological mechanisms for non-DIMBOA-based host plant resistance to European corn borer in Peruvian maize were categorized.
4. Genetic enhancement and characterization of non-seed shattering accessions of Amaranthus continued.

Health, safety, teamwork and EEO progress:

1. Many of the NCRPIS staff attended seminars regarding Worker Right-to-Know Laws, Hazardous Waste, Pesticide Applicator, and Tractor Safety. Several staff members attended seminars regarding supervision, OSHA Laboratory Training, Respirator Training, CPR and First Aid Training, Forklift Training, Bloodborne Diseases, Lockout-Tagout, 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 serve as members of the ARS Campus Safety Committee.
2. The NCRPIS continued extensive efforts to document training received by various staff.
3. NCRPIS staff members attended various seminars regarding supervisory training, civil rights, preventing sexual harassment, gender diversity, and ethics.
4. The Research Entomologist served as a panel member for reviewing USDA/CSREES Capacity Building Grants for 1890 Schools.

Outreach:

1. A site on the World Wide Web for the NCRPIS was established during 1996 at <http://www.ars-grin.gov/ars/MidWest/Ames/index.html> which has attracted much interest. To date (March 1998), more than 1,000 visits to the site have been recorded.
2. More than 195 visitors toured the NCRPIS during 1997. 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. Dr. I. Kucuk, a Turkish maize breeder, spent several months at the NCRPIS learning techniques for evaluating maize for host-plant resistance. He was hosted by the Entomologist, and his visit was sponsored by Winrock International.
4. Several staff members visited local elementary schools to teach students about the NCRPIS and its work.
5. Several staff members serve on advisory boards for various germplasm-related projects or organizations. The amaranth curator was elected to the board of the Amaranth Institute.
6. The Ornamental Horticulture program distributed various planting and performance reports to trial site cooperators.
7. NCRPIS staff travelled extensively in the U.S. and internationally (Mexico, France, Canada) to present lectures, attend workshops, serve on advisory committees, or establish contacts with foreign germplasm researchers.
8. The Research Leader/Coordinator served as Acting National Program Leader, Plant Germplasm and Genomics, at USDA/ARS Headquarters, Beltsville, MD.
9. The Supervisory Program Support Assistant travelled to East Lansing, MI; Urbana, IL; West Lafayette, IN; and Columbia, MO to help train administrative support personnel at those sites.
10. The NCRPIS staff assisted a team from the Government Accounting Office (GAO) with developing an assessment instrument for the National Plant Germplasm System, with interpreting the results of the ensuing survey, and with presenting the results in a report to Congress. The curatorial staff, the Horticulturist, and the Research Leader/Coordinator in particular devoted substantial time to this effort.
11. Several phytosanitary officials from South Africa and Namibia visited the NCRPIS to consult with the Plant Pathologist regarding seedborne transmission of Stewart's bacterial wilt.

V. INDIVIDUAL PROGRESS REPORTS

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

Progress:

Field

Maize - Corn earworm evaluation: Sixty maize accessions were planted in the field in Ames and in Tifton, GA, to obtain silks for evaluation in the laboratory. Silks were collected and frozen, but diets have not been prepared to date. Silk material will be shipped to Peoria, IL, for chemical analysis by Mark Berhow. Five selected maize accessions were sent to Tifton, GA, for field evaluation of corn earworm resistance. All five of the accessions were rated resistant to corn earworm.

European corn borer evaluation: Seven hundred forty-five maize accessions were evaluated for leaf feeding resistance to first generation European corn borer. Seventy-three rated resistant. Two hundred maize accessions were evaluated in the field for second generation European corn borer resistance. Two rated resistant.

European corn borer oviposition preference was tested on 20 backcross populations of maize. This maize is being developed as a Midwest-adapted population with multiple insect host-plant resistance. No significant differences were noted for ovipositional preference.

Sunflower - Work continued on refining the sunflower moth evaluation technique for both cultivated and wild-type sunflowers. Forty-eight accessions of cultivated sunflowers were planted in the field and infested with sunflower moth. Ten accessions of wild-type sunflowers were planted in the field in cages and infested with sunflower moth. All heads have been harvested but processing and data analysis are not finished to date.

Brassica - A replicated field cage test was run to compare two Osmia species of bees for pollination efficiency of selected Brassica accessions. There were no significant differences between the bee species for pollination of B. rapa and Sinapis alba. Osmia lignaria bees were superior to O. cornifrons for pollinating some accessions.

Fifty-seven Brassica accessions were planted in the field at Hermiston, OR. The plants were tested for host-plant resistance to natural populations of cabbage aphid and stem pod weevil. Aphid resistance was noted in B. juncea accessions.

Cuphea - A pollinator study in field cages was conducted to determine the usefulness of Osmia bees as pollinators of Cuphea spp. Data from that study are being analyzed.

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

Laboratory

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

A long-term colony of corn earworms is being maintained to provide sufficient numbers of insects for comparison with insects obtained from the rearing colony in Tifton, GA.

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

Brassica.

A colony of cabbage aphids was started so that Brassica accessions in the could be evaluated in the greenhouse. The colony is not being permanently maintained.

Maize - Ted Wilson (M.S. graduate student, Entomology) is developing a laboratory technique to evaluate maize leaf extracts in diets to aid in finding non-DIMBOA sources of resistance. The three primary extracts being tested are water, methanol, and methylene chloride solutions of leaf extracts. Data are being analyzed.

Greenhouse - A total of 57 Brassica accessions were retested in the greenhouse for resistance to green peach aphid. Nine accessions were rated as having intermediate resistance.

Miscellaneous

Richard Wilson serves as major advisor for one M.S. student and one Ph.D. candidate in Entomology at Iowa State University.

Manuscript review:

During 1997, Richard Wilson peer-reviewed several manuscripts and reviewed manuscripts for the editors of the Journal of Economic Entomology and the Journal of the Kansas Entomological Society.

Cooperative research:

We cooperated with Bill Wiseman (ARS, Tifton, GA) on evaluation of maize for corn earworm resistance.

We are cooperating with Bill Van Roekel and Craig Abel (NCRPIS) on a Cuphea pollination study.

We worked with Rick Luhman and Craig Abel (NCRPIS) on a Brassica pollination study.

We are cooperating with Brad Binder (ARS, Ames, IA) on chemical analysis of maize leaf material with resistance to European corn borer oviposition.

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

We are cooperating with Linda Pollak (ARS, Ames), Craig Abel (NCRPIS), Frank Davis (ARS, Mississippi State, MS), Bill White (ARS, Houma, LA), Wilfredo Salhuana (Pioneer Hi-Bred International, Homestead, FL) to develop a multiple insect host-plant resistant maize population.

EEO activities:

Viewed EEO film "Black History" at NADC, February 25, 1997.

Attended session "Mosaic Workplace: Why Value Diversity?", at NADC, April 23, 1997.

Attended seminar given by Korona Prince at NADC, August 5, 1997.

Richard Wilson served on Peer Review Panel for 1890 Institution Capacity Grants Program, Washington, D.C., April 2-4, 1997.

Entomology and Agronomy Department activities:

Richard Wilson regularly attends faculty meetings held in both departments.

At present, Richard Wilson serves on the Agronomy Department Building Committee, Plant Breeding Panel, Greenhouse Committee, and Awards Committee.

At present, Richard Wilson serves on the following NCRPIS committees: Communication Committee, Computer Committee, Extension Committee, and sporadically on selection committees for screening and evaluating applicants for vacant positions.

Meetings attended:

Iowa Academy of Science annual meeting, Dubuque, IA, April 25-26, 1997.

Amaranth Institute annual meeting, Ames, IA, August 8, 1997. Served on local arrangements committee with D. Brenner and L. Wilson-Voss.

Entomological Society of America annual meeting, Nashville, TN, December 13-18, 1997.

Attended ISU Agronomy Day, Ames, IA, September 11, 1997.

Iowa Academy of Science Student Programs Committee meetings, Ames, IA, February 1 and December 6, 1997.

Attended GEM Field Day and gave a short presentation about current research program, Ames, IA, September 16, 1997.

Attended McCone Popcorn Field Day, Ames, IA, September 11, 1997.

Attended Power Point seminar, Des Moines, IA, December 3, 1997.

Attended 49th Southern Corn Improvement Conference, Atlanta, GA, February 12-13, 1997.

Attended Microsoft Excel seminar, Des Moines, IA, October 14, 1997.

Attended Iowa Honey Producers annual meeting, Ames, IA, October 31, 1997.

Short courses/training:

Viewed Safety Video at NSTL, August 6, 1997.

Attended "Dust Mask" training at PI farm, March 3, 1997.

Attended "Tractor Safety" training at ISU, Ames, IA, March 18, 1997.

Papers presented at meetings:

"Current Research on ECB at the North Central Regional Plant Introduction Station", at Southern Corn Improvement Conference, Atlanta, GA, February 12-13, 1997.

Other:

Richard Wilson serves as the primary resource person for entomological problems on amaranth in the United States. Growers and researchers contact him and request information regarding insect problems they encounter on amaranth.

S. McClurg, R. Wilson, and C. Abel visited Lincoln, NE to observe techniques to evaluate of maize for corn rootworm resistance. February 14, 1997.

Acted as tour host (along with M. Widrlechner) to Dr. Anna Hewings and Dr. Murray Bakst from the Midwest Area Office, June 9, 1997.

Participated in hosting Agronomy 522 class visit to NCRPIS, July 15, 1997.

Traveled to Hermiston, OR, to collect field data for cooperative Brassica test, July 1-2, 1997.

Richard Wilson is a member of Iowa Academy of Science Student Programs Committee.

Hosted visiting scientist Dr. I. Kucuk from Turkey, August 3 - October 3, 1997.

Visited Mycogen, Garst, and Pioneer Hi-Bred with Dr. I. Kucuk (Turkey) on August 19, August 27 and September 8, respectively.

Plans for 1998:

Field

Evaluate 200 maize accessions for corn earworm silk feeding resistance.

Evaluate 800 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 developing a better technique for evaluation.

Cooperate with Charlie Block to evaluate selected insect-resistant maize accessions for resistance to common maize pathogens.

Evaluate 50 sunflower (cultivated type) and 10 (wild type) accessions for resistance to sunflower moth.

Cooperate with Kathy Reitsma to evaluate Cucumis for striped cucumber beetle resistance.

Cooperate with Bill Van Roekel and Craig Abel to evaluate pollination efficiency of Osmia bees on Cuphea.

Evaluate selected Brassica accessions in Oregon for resistance to natural infestations of aphids and stem pod borer.

Laboratory

Prepare corn earworm evaluation diets from field-collected silks.

Cooperate with Brad Binder (ARS, Ames) to identify chemicals causing ovipositional resistance to European corn borer.

Continue rearing sunflower moths.

Continue rearing corn earworms.

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

Because sunflower moth larvae feed on pollen, we plan to incorporate chemical extracts of sunflower pollen into sunflower moth diets to see if resistant pollen could be used as a first line of defense against this insect.

Osmia bee diapause studies.

Greenhouse

Cooperate with Rick Luhman to evaluate Brassica for resistance to green peach aphid.

Evaluate chicory for resistance to green peach aphid.

Miscellaneous:

Continue active participation in the Departments of Agronomy and Entomology.

Continue to attend professional meetings and present research results.

Continue working with graduate students.

Continue to develop cooperative research projects.

Publications:

Snook, M.E., B.R. Wiseman, N.W. Widstrom, and R.L. Wilson (1997): Chemicals associated with maize resistance to corn earworm and fall armyworm. Mihm, JA (ed.). Insect Resistant Maize: Recent Advances and Utilization; Proceedings of an International Symposium held at the International Maize and Wheat Improvement Center (CIMMYT). November 27-December 3, 1994. Mexico, D.F.: CIMMYT, p. 37-45.

Wilson, R.L. (1997): Maintenance of, and requests for, maize germplasm having resistance to insect pests. Mihm, JA (ed.). Insect Resistant Maize: Recent Advances and Utilization: Proceedings of an International Symposium held at the International Maize and Wheat Improvement Center (CIMMYT). November 27-December 3, 1994. Mexico, D.F.: CIMMYT, p. 230-233.

B. Horticulture (M.P. Widrlechner, P. Ovrom, J. Edwards)

Germplasm Collections

Acquisition:

Two hundred twenty-three new accessions of ornamentals and two accessions of mint-family plants were received during 1997. Eighty-nine of these accessions resulted from an NPGS-funded project to collect Echinacea from throughout its native range in the United States.

Maintenance:

Available for distribution:

Ornamentals (NC-7 priority site) 765/1911 (40%) (127 genera).
Ornamentals (For trials or transfers) 76/162 (47%) (73 genera).
Mint-family Plants 58/109 (53%) (12 genera).

The availability of these crops decreased slightly in 1997 (from 925 accessions in 1996 to 899 accessions in 1997). This resulted because certain accessions were highly demanded and others were recently made unavailable by low germination rates. Most of these accessions are already in the field for caged regeneration

in 1998.

Distribution:

Two hundred twenty-eight plants, 48 cuttings and 378 seed packets of ornamentals were distributed to meet germplasm requests, and 769 plants were distributed as part of the NC-7 Trials. Requests for ornamental germplasm in 1997 greatly exceeded levels of any previous years. Thirty-three seed packets of mint-family plants were distributed in 1997.

Duplicated at NSSL and other NPGS sites

Ornamentals (NC-7 Priority Site) 614/1911 (32%)
Ornamentals (For trials or transfers) 27/162 (17%)
Mint-family Plants 55/109 (50%)

The percentage of ornamental accessions backed-up improved markedly in 1997. Nearly 700 accessions are now duplicated, as compared to 458 at the close of 1996. GRIN is now designed to document back-ups at NPGS sites other than NSSL, such as the National Arboretum. Many of the 27 "trial/transfer" accessions serve as temporary back-up for the National Arboretum.

Regenerated

Ornamentals (NC-7 Priority Site) 100/1911 (5%)*
Ornamentals (For trials or transfers) 7/162 (4%)
Mint-family Plants 3/109 (3%)

* This includes 32 successful cage increases, 32 woody ornamental seed increases, 30 woody plant grow-outs, and 6 miscellaneous (tent or isolation) increases.

Tested for Germinability/Viability

Ornamentals (all accessions held as seed) 174/1813 (10%)
Mint-family Plants 8/109 (7%)

Significant Progress

The three most notable areas of progress in ornamental germplasm management involved NSSL back-up, accession inactivation, and acquisition. We worked closely with seed storage personnel to expand greatly the number of duplicated accessions. This was made possible primarily by a 1996 project to quantify the number of seeds on hand for all ornamental accessions. Once seed inventories were updated in 1997, a project was initiated to inactivate all accessions with zero inventory on hand that could not be reobtained. This resulted in the inactivation of 156 ornamental accessions and 9 mints, with more accessions to be inactivated in 1998. An NPGS-funded exploration for Echinacea resulted in our largest group of acquisitions: a diverse sampling of about 90 accessions representing most of the known taxa from throughout the United States.

Characterization/taxonomy:

During 1997, 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, 12 accessions were re-identified.

Evaluation:

In 1997, Dr. Roger Fuentes-Granados, a former Ph.D. candidate under Mark Widrlechner's joint direction (along with Lester Wilson of the ISU Food Science Department), defended his dissertation entitled "Genetic Studies of Agastache."

One chapter, describing the genetic control of anthocyanin pigmentation and an allozyme locus in A. rugosa, was published in 1997 in HortScience. Two other chapters were submitted for publication in 1997.

Dr. Lowell Ewart, Michigan State University, received an ARS grant to evaluate Zinnia germplasm for disease resistance. This is the first ARS-funded evaluation project for an herbaceous ornamental collection. The data have been received and are being loaded into GRIN by Mark Bohning at DBMU.

Enhancement:

There was no major progress to report with enhancement activities in 1997.

Coordination of the NC-7 Regional Ornamental Trials:

Plant Distribution - In 1997, 583 plants of thirteen accessions were distributed for evaluation to 24 sites, with an additional 186 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 developing a homepage to post trial results and other information about the trials on the internet. Evaluation results for plants distributed in 1986 are now available through the homepage and other results will be posted in the coming year.

Two newsletter updates and a special letter were sent to trial site cooperators in 1997, to inform them about current developments at Ames and throughout the program.

Research on the floristics, soils, plant communities, and climates of eastern Europe (especially of Ukraine and neighboring states) continues with help of Dr. Robert Schutzki at Michigan State University and collaborators in the Forestry Department of the National Agricultural University of Ukraine in Kiev. A plant exploration proposal to support an expedition to collect landscape tree and shrub

seeds from the forest-steppe transition zone is now in preparation. If funded, the planned trip will occur in September, 1999.

Paul Ovrom visited NC-7 trial sites in Missouri, Kansas, Colorado, and Nebraska as part of a spring plant delivery trip; Mark Widrlechner also visited the trial site at the Minnesota Landscape Arboretum, in conjunction with the 1997 meeting of the NC-7 RTAC.

Performance data for about 20 accessions of trees, shrubs, and vines collected in northern Japan in 1982 and distributed for testing in the NC-7 trials in 1984 and 1985 were statistically analyzed to describe the roles that climatic factors play in landscape plant survival in the North Central Region. This analysis concluded that northern Japanese plants are poorly adapted to drought stress typical of the North Central Region and a set of criteria was established to help focus future landscape plant exploration in northeastern Asia. This study has been accepted for publication in the Journal of Environmental Horticulture.

Germplasm activities in crops other than those curated:

Seventeen requests for accessions with special horticultural or agronomic characteristics were handled by Mark Widrlechner, resulting in the distribution of 284 packets of seed. In 1997, he also responded to thirteen 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, as well as the salvage of seed collections held by the USDA-ARS National Center for Agricultural Utilization Research in Peoria, IL.

Mark Widrlechner continues to oversee Bill Van Roekel's curation of Cuphea and Euphorbia. He has consulted and/or advised Bill on germplasm acquisition and regeneration, verification of taxonomic identity, and the maintenance of accessions in the greenhouse. Further information about this project is contained in Bill's chapter of the annual report.

During the first half of 1997, Mark Widrlechner worked closely with staff at the U.S. General Accounting Office (GAO) to develop appropriate survey instruments to measure the status of system-wide germplasm regeneration as part of a GAO report on the overall condition of the NPGS.

Other research and training activities:

Research on the taxonomy of Rubus in Iowa resulted in the submission of a manuscript entitled, "The Genus Rubus in Iowa," to Castanea in March, 1997. The manuscript contains keys for field identification of those Rubus taxa that occur in Iowa, and also includes distribution maps, synonymy, and morphological descriptions. Biosystematic hypotheses that can be tested via cytogenetic and molecular approaches are also proposed. The manuscript has been accepted for publication and only minor revisions needed to be resolved at the end of 1997.

In early 1997, with the assistance of Rex Heer, an ISU graphic designer, Mark Widrlechner produced a color winter-hardiness zone map for China. Versions of this map have now been published in American Nurseryman and Landscape Plant News and hundreds of copies of this map have been distributed upon request to horticulturists and nursery professionals. An internet version of this map has also been developed.

Another important aspect of training for the Horticulture project is the coursework for keeping pesticide applicator's licenses current. All three members of the project attended training sessions in October. In addition, Paul Ovrom and Mark Widrlechner attended the pesticide certification sessions of the Shade Tree Short Course in March.

In February, Paul Ovrom and Jeanne Edwards attended a seminar entitled, "Thinking Outside the Lines," presented by the National Seminars Group in Des Moines.

In an effort to secure high-quality hourly workers for the NCRPIS, an internship program is being initiated. A staff committee was formed to define the program, develop a brochure, and establish standards and evaluation methods. The first interns have been selected and will begin in Spring, 1998. Jeanne Edwards and Paul Ovrom suggested the program and Jeanne Edwards chairs the committee.

Meetings attended:

February: Thinking Outside the Lines Seminar (Des Moines, IA) APO, JCE
March: Shade Tree Short Course (Ames, IA) MPW, APO
June: NC-7 Regional Technical Advisory Committee (Chanhassen, MN) MPW;
Woody Landscape Plant CGC (Beltsville, MD) MPW
July: ASHS Annual Meeting, including Leafy Vegetable CGC, Root & Bulb
Vegetable CGC, Herbaceous Ornamental CGC (Salt Lake City, UT) MPW
October: Eastern Region Annual Meeting of the International Plant Propagators'
Society (Newport, RI) APO; Pesticide applicator's training for
greenhouses (Ames, IA) MPW, APO, JCE
December: North America China Plant Exploration Consortium (Kirtland, OH) MPW

MPW - Mark Widrlechner; APO - Paul Ovrom, JCE - Jeanne Edwards

Presentations and seminars:

Widrlechner, Mark P., David Brenner, John W. Van Roekel, Mary E. Brothers, and Richard Luhman. Germplasm for new crops and new products from the North Central Regional Plant Introduction Station. Presentation to the Association for the Advancement of Industrial Crops, made by David Brenner, Saltillo, Mexico, September 14-18.

Widrlechner, Mark P. Climatic comparisons and the search for new landscape plants. Presentation to the Botany Department, Palacky University, Olomouc, Czech Republic, September 8, and to the Horticulture Department, Iowa State University, October 27.

(Mark Widrlechner was also a co-author on a paper presented by Peter Bretting to Séminaire Agrogene 1997: Exploitation of Biodiversity in Paris, and to an AIBS symposium, in Montreal, and on a poster presented by Roger Fuentes-Granados to the Institute of Food Technologists, in Orlando.)

Publications which appeared in print in 1997:

Bretting, P.K. and M.P. Widrlechner. 1997. Genetic markers and horticultural germplasm management. Proceedings of Séminaire Agrogene 1997: Exploitation of Biodiversity, Paris, 30-31 January, pp. 30-33.

Fuentes-Granados, R.G., L.A. Wilson, and M.P. Widrlechner. 1997. Identifying genetic markers and their role in selecting chemotypes in perennial Lamiaceae. Herbarist 1997: 44-48.

Fuentes-Granados, R.G., and M.P. Widrlechner. 1997. Inheritance of anthocyanin production and malate dehydrogenase isozymes in Aqastache ruqosa (Fisher & Meyer) Kuntze. HortScience 32:733-734.

Widrlechner, M.P. 1997. Hardiness zones in China. (Color map - scale ca. 1:16,360,000.) Iowa State University, Ames, IA.

Widrlechner, M.P. 1997. Chinese forestry - relationships worth cultivating. pp. 38-47. Proc. Symposium on Landscape Plants - Exploration, Breeding, Evaluation, June 27-29, 1996. (N. Rose, ed.) Landscape Plant Development Center, Chanhassen, MN.

Widrlechner, M.P., C.A. Abel, and R.L. Wilson. 1997. Ornamental seed production in field cages with insect pollination. Presented to the Annual Meeting of the Eastern Region of the International Plant Propagators' Society, October, 1996. Combined Proc. of the IPPS. 46: 512-516.

Conclusions:

Curation

1997 was a very productive year in terms of providing samples to meet users' requests, with distributions at record-high levels. Efforts in 1996 to make more ornamental germplasm available and to improve the quality of our inventory data are likely contributing to the record demand. There are still backlogs that decrease the efficiency of curation, such as the number of accessions requiring inactivation and those that have never been tested for viability or backed up (often because of small sample size), but significant progress was made in reducing the inactivation backlog along with increasing the proportion of ornamental accessions duplicated at NSSL.

Regeneration plans for herbaceous ornamentals in 1998 reflect priorities resulting from the results of a demand analysis conducted for 1991-1995 and

reported at the 1996 ASHS meeting. It includes certain annuals, such as Calendula and Zinnia, and perennials, such as Dianthus, Delphinium, Gypsophila, Echinacea, and Tanacetum. Recent germination tests also indicated that there are about 50 accessions of Leucanthemum that require regeneration. These accessions were included in the 1997-98 cage planting. At Paul Ovrom's suggestion, the annual and perennial plants were divided into two separate cage fields for easier management. In 1998, we also plan to verify the locations (and mapping) of permanent plantings of woody ornamentals. In 1999, major emphasis will be placed on the regeneration of Echinacea samples collected in 1997. This may require a three-year field planting to achieve sufficient seed production.

Research

Mark Widrlechner's level of publication activity in 1997 was greater than the three papers that appeared in 1996. For 1998, there are four papers that should be published from manuscripts submitted in previous years and two manuscripts in progress or in press as of February, 1998. The works in progress include a project to evaluate the climates, soils, and vegetation of northeastern Asia to identify candidate regions for future exploration, and an analysis of the control of essential oil production in Agastache foeniculum.

Other research plans for 1998 include an article on umbel germplasm in conjunction with Kathy Reitsma, to be presented at the upcoming International Carrot Congress, and collaborative research with Craig Abel and Dick Wilson on aspects of plant-pollinator interactions.

C. Plant Pathology (C. Block)

RESEARCH NOTES:

Disease and insect resistant maize evaluations:

Thirty-five accessions from the Eldredge popcorn collection and 11 Peruvian accessions (resistant to European corn borer) were evaluated in replicated field trials for resistance to gray leaf spot, northern leaf blight, and eyespot. Two 'Tom Thumb' popcorn accessions, PIs 340871 and 340872, showed good resistance to all three diseases (one year of evaluation) and were also resistant to first generation European corn borer in previous tests.

Sunflower genetic enhancement:

A second cycle of recurrent selection was completed in the effort to develop a composite population of wild H. annuus with resistance to both Alternaria helianthi and Septoria helianthi. Achenes were harvested from 54 plants showing the best resistance.

Longevity of Erwinia stewartii in maize seed:

Survival of Erwinia stewartii bacteria in stored seed was found to be directly related to the storage temperature. An initial seed lot with an average bacterial 'load' of 200,000 colony-forming units (CFU) per kernel was divided into four portions. Each portion was stored at a different temperature, but the same relative humidity (32%). After 18 months, the average bacterial counts dropped to 180,000 CFU/kernel at 5°C, 21,000 CFU/kernel at 15°C, 1,000 CFU/kernel at 25°C, and 0 CFU/kernel at 35°C.

Sensitivity of the Erwinia stewartii ELISA kit:

Experiments were completed to determine the sensitivity of the commercial AGDIA Erwinia stewartii ELISA kit and to determine the average bacterial 'load' of infected maize kernels. The results will enable seed testing laboratories to

calculate statistically optimal sample sizes for phytosanitary tests.

Disease notes on seed increase plots:

Brassica and related genera seed increase notes:

Ninety-five seed increase plots were inspected and were found to be remarkably free of disease except for three Brassica accessions with a slight black rot (Xanthomonas campestris pv. campestris) infection of the lower leaves. One accession of Lepidium was heavily infected by the white rust fungus (Albugo candida) and did not produce seed.

Cucurbita pepo seed increase notes:

Seed transmission of squash mosaic virus was detected from 45 year-old pumpkin seed, the longest survival time ever recorded for this virus. Greenhouse seedlings of 56 accessions were tested for squash mosaic virus before transplanting to the field. Results are summarized below:

Number of accessions tested: 56
Number of plants tested: 550
Accessions with one or more infected plants: 10
Total number of infected plants: 13
% infected plants: 2.4%

Cucumis sativus and C. melo seed increase notes:

Downy mildew, caused by Pseudoperonospora cubensis, was observed on Cucumis melo and C. sativus at the NCRPIS for the first time in 1997. Disease developed in early September and progressed rapidly, causing early death of about 40% of the accessions. Downy mildew is not expected to be an annual problem because cucurbit hosts are not present year-around. The inoculum source was probably wind-blown sporangia from southern states. Two hundred ninety-six seed increase cage plots were inspected for downy mildew, anthracnose, powdery mildew and bacterial leaf blight (Acidovorax avenae ssp. citrulli). Notes were taken on potential disease-resistant accessions including five melon accessions from India which were disease-free (A-20921, A-22332, PI370022, PI512450, PI512459).

Zea mays seed increase notes:

Two hundred twenty-seven maize seed increase plots were rated in late August and early September for six diseases: common rust, common smut, northern corn

leaf blight, Stewart's bacterial disease, gray leaf spot, and northern (carbonum) leaf spot. There were no unusual occurrences of any disease.

Seed samples from 186 accessions were screened for Erwinia stewartii seed infection. The presence of E. stewartii in seed is a major phytosanitary issue in the international shipment of seed corn. Infected seed was detected in 6 of 186 accessions.

Sunflower seed increase notes:

Downy mildew, caused by the fungus Plasmopara halstedii, was the only disease of note in the sunflower increase plots. Several hundred systemically-infected seedlings were removed from the field prior to flowering. The unusually high incidence of infected seedlings may necessitate a metalaxyl (Apron) fungicide seed treatment at planting.

Meetings/presentations:

Presented a poster at the 19th Annual Seed Technology Conference at Ames,

February, 1997.

Attended the NCR-25 Corn and Sorghum Diseases committee meeting at St. Paul, February, 1997.

Presented a poster at the APS National Meeting at Rochester, NY, August, 1997.

Attended the Cucurbit CGC meeting at Las Vegas, NV, October, 1997.

Presented two posters at the Iowa Seed Association Conference at Ames, November, 1997.

Committees:

Greenhouse and Growth Chamber Committee (Agronomy Dept.); Accession Performance Report Committee (NCRPIS), Computer Committee (NCRPIS).

Training Sessions:

February: Tractor Safety
March: Dust Mask Training
May: Worker Protection Standard Training
October: Pesticide Applicator Training - seed treatment
October: Pesticide Applicator Training - greenhouse

Publications:

Block, C.C. 1997. Assessing risk of seed transmission of Stewart's wilt. Proceedings of the 51st Annual Corn and Sorghum Research Conference. pp. 181-190.

Block, C.C. 1997. New insights into an old disease: Unraveling the biology of seed transmission of Stewart's disease of corn. Iowa Seed Science Newsletter. 17 (1):4-5.

Block, C.C. 1997. Sources of powdery mildew resistance in the USDA cucumber germplasm collection. Phytopathology (Abstract) 87 (6):S9.

Shepherd, L.M., Block, C.C., and McGee, D.C. 1997. A new seed health assay for Clavibacter michiganensis subsp. nebraskensis. Phytopathology (Abstract) 87 (6):S89.

D. Farm (L. Lockhart, M. Czajkowski, 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 76 pesticide applications in the field and/or greenhouses. We responded to 155 maintenance requests from staff members at the farm and the campus location. We coordinated and scheduled the student labor force of 20.0 FTE's. We coordinated facility construction and upgrades.

Labor:

During the calendar year 1997, 147 applications for hourly employment were received and reviewed. There were 78 interviews resulting in 61 hourly employees hired. Four employees were dismissed for poor work performance and two for habitual tardiness. Currently there are 51 (18.9 FTE) part-time hourly employees working at the NCRPIS.

NCRPIS Farm Crew:

After 13 years of service to the NCRPIS, Mike Czajkowski resigned from his position as a Field Lab Technician III. His talents and positive attitude are greatly missed. The position has been re-classified as an Equipment Operator III. It is anticipated this position will be filled by March 1, 1998.

Jerry Scheuermann is responsible for general farm equipment and vehicle maintenance. He successfully designed and constructed a flat bed trailer for hauling screens, a three point post remover, and overhauled two engines saving the NCRPIS several thousand dollars in repair costs. Jerry also completed all repairs reported on the annual vehicle inspections.

Maintenance projects completed:

Weatherization of Greenhouse 3
Repair of headquarters roof
Re-routed LiCl₂ dehumidification system to eliminate condensation problems
Grading of field plot land to improve drainage
Construction of flat-bed dump trailer
Secured all greenhouses and headhouse to discourage intrusion

Tours:

This past year Larry Lockhart organized and conducted 14 tours. There were approximately 195 visitors to the NCRPIS during 1997.

Conferences, training, etc. attended:

Respirator Training Certification, EH&S, ISU
CPR Training, ISU

Staff Training:

We conducted four Disposable Dust Mask training sessions.
We conducted three Tractor Safety Training sessions.

Committees:

Larry Lockhart served as Chairman of the NCRPIS Extension Committee. The extension committee will be actively involved in planning and preparing materials for the 1998 fifty-year anniversary celebration in July 1998. He is currently serving as a member of the ARS Campus Safety Committee and 98 Planning Committee. Larry also served on the Agronomy Department Compensation Issues committee.

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 (C. Abel)

Progress:

Cage pollinations: Six hundred seventy-one cages were supplied with pollinators for controlled pollination of 721 plant germplasm accessions. Honey bees were used to control pollinate 579 accessions in the field and 1 accession of Euphorbia in the greenhouse. Bombus bimaculatus was used to control pollinate 1 Antirrhinum accession. Osmia spp. were used to control pollinate 137 Brassicaceae accessions, 2 accessions of Staphylea in the greenhouse, and 1 accession of

Celosia in the greenhouse.

Beekeeping: Honey bees were successfully over-wintered in the indoor wintering facility. This winter, we placed 140 parent colonies and 150 nucleus colonies in that facility. We will purchase 21 package bees from Texas this spring. A superior queen will be selected to add to our breeding stock.

Varroa mite infestations within our parent colonies surpassed economically damaging levels again this spring. All hives were treated with Apistan strips. A random sample of 24 hives was treated Fall, 1997, with Apistan to detect Varroa mite levels in the hives. Mite population levels were below economically important levels.

Tracheal mite infestations were <1%. No miticide treatment has been necessary for this pest during the past five years.

Bombus: One Bombus bimaculatus colony was reared this spring. Three new queens were successfully mated from this colony. None of these queens survived winter storage.

Megachile rotundata: No alfalfa leafcutting bees (ALC) were used this year to regenerate plant germplasm accessions.

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

The Iowa-native Osmia lignaria is slowly replacing nesting sites of the Japanese-native Osmia cornifrons.

Pollinator Studies: Osmia cornifrons, Osmia lignaria and honey bees were compared as pollinators of 4 Brassicaceae accessions. Seed yield was not statistically different for the three pollinators of a Sinapis alba accession and a Brassica rapa accession. Osmia lignaria produced significantly more seed than the other two pollinators tested for a Brassica napus accession and another Brassica rapa accession. If similar results are found this spring, we will use the Iowa-native Osmia lignaria for our Brassicaceae increase pollinations.

Honey bees, alfalfa leafcutting bees, Bombus bimaculatus and Osmia cornifrons were used in a Cuphea spp. pollinator study. Results are pending.

A coriander and dill pollinator study was discontinued because of low seed germination of plots grown in fields where drainage tiles had recently been removed.

Personnel:

Nathan Bye recently completed his "term" with the pollinator management program. Nate has worked at the NCRPIS during the past 5 years. Nate's work has advanced the program's efforts considerably during his time here.

Brett Roberts has worked for the pollinator management program for the past 4 years and will be graduating this summer. Brett's skilled labor and foresight on the job have been impressive. Some of Brett's new ideas have been the "driving force" in implementing and advancing the use of alternative pollinators at NCRPIS.

I thank Mike Lund and Gina Phlasterer for their excellent help this past year. All of these student employees have provided a positive work environment that is greatly appreciated by the author.

Future plans:

Continue seeking advice on storing newly mated, diapausing, B. bimaculatus queens.

Investigate the use of Peponapis pruinosa, Xenoglossa strenua, Xylocopa fenestrata, and Ceratina spp. for use in Cucumis pollinator studies.

Investigate the use of Eumegachile pugnata for use in sunflower pollinator studies.

Investigate the use of Anthophora pilipes villosula for Brassicaceae pollination.

Continue research on pasture plantings for rearing Osmia spp.

Conduct a second-year study comparing the pollinating efficacy of Osmia cornifrons and Osmia lignaria on three Brassicaceae spp.

Conduct a second-year study comparing the pollinating efficacy of four pollinators on Cuphea lanceolata.

Publications:

Abel, C.A. and R.L. Wilson. 1998. The use of diverse plant species for increasing Osmia cornifrons (Hymenoptera: Megachilidae) in field cages. J. Kan. Entomol. Soc. In Review.

Cox, R.L., C.A. Abel, and E. Gustafson. 1996. A novel use for bees: Controlled pollination of germplasm collections. Am. Bee J. 136(10):709-712.

Wilson, R.L. and C.A. Abel. 1998. Indoor wintering small honey bee nucleus colonies. Iowa Acad. Sci. In Review.

F. Zea Curation (M. Millard and T. Ladjahasan)**Activities****Curatorial Information****Significant events**

David Kovach, one of our seed technicians, was able to germinate 90% or more of the kernels of three accessions of the Mangelsdorf-Galinat collection. These accessions date to a 1948 collection of Colombian small-seeded flints. One accession of 90 seeds germinated 100% in a 20/23°C regimen. Three other accessions germinated above 60%. Two other accessions chosen from those which did not germinate previously showed mixed results with this treatment. The greenhouse was filled by the plants from this experiment so further experiments must be postponed. This preliminary work demonstrates that there still are viable kernels among the 1600 accessions of the Mangelsdorf-Galinat collection.

Cooperation between CIMMYT and the NCRPIS was strengthened in 1997 by the shipment of 250 accessions from Ames to CIMMYT for regeneration. These accessions were in low quantity or germination and were not held to date by CIMMYT. Seed had to be treated to pass Mexican restrictions.

Regenerations in Ames remained at 1996 levels despite difficulties with funding, difficulty maintaining adequate temporary personnel levels, and other challenges. The quality of the Ames harvest was above average.

All aspects of harvest imaging have been implemented with the acquisition of a

table saw modified for safety by the NCRPIS farm management staff. This saw allows cross sectioning of 25 ears for color flatbed scanning. A second HP4C color flatbed scanner was obtained at the end of FY 1997. Two scanners can now be used simultaneously with one computer. Although materials are prepared on one scanner, the image is obtained on the second. Currently, the maize project captures images of 25 ears of each regeneration in profile and cross section. The images are full size in color JPEG format. Additionally, a seed sample image is obtained at twice normal size after seed processing.

During the last quarter of 1997, a Microsoft Access database was created to track maize program labor usage. This database was created in response to repeated requests for more specific information about the amount of labor necessary for the individual tasks in the maize curation effort. Additionally it will be helpful in tracking the processing of various nurseries' regenerations received. We may be processing maize from up to five different nurseries simultaneously.

In 1997, the maize curator in conjunction with Dr. L. Pollak (USDA-ARS corn breeding) attempted to obtain grant money from the Fund for Rural America program to aid with maintaining and evaluating maize accessions which may have improved quality factors. This proposal was unsuccessful, but it marks the first such attempt by the maize curator.

Acquisition:

New accessions received

During 1997, 154 Zea accessions were acquired. Among those acquired, 52 accessions originated from quarantine regenerations on St. Croix, at Beltsville, and by Pioneer Hi-Bred in Chile. Fifty-three of the new accessions are U.S. accessions formerly held only at NSSL. Forty one of these U.S. accessions were old Corn Belt Dent farmer varieties from Colorado, a state whose maize was previously not well represented in the NCRPIS collection.

Maintenance and distribution:

#/% available for distribution--70% (10474) of the 15015 accessions held in December 1997 were available for distribution. This percentage has been stable for some years indicating that we are regenerating at a status quo level. Regenerations are balancing the receipt of new accessions and new unavailable accessions generated by distribution and seed deterioration. The largest single

portion of unavailable accessions continues to be the 1600 accessions in the Galinat-Mangelsdorf collection.

#/% distributed--We distributed 5036 packets of Zea seed in 1997. This represents 22% (3284) of all Zea accessions held at the NCRPIS. Last year's figures were 4415 packets representing 19% (2780) of the collection. One large distribution was of 2000 accessions to L. du Toit and J.K. Pataky at the University of Illinois for a broad initial screening for corn smut (Ustilago maydis), Stewart's wilt (Erwinia stewartii), and southern rust (Puccinia polysora) host-plant resistance. The Stewart's wilt data will be the first data for this disease placed on GRIN.

#/% duplicated at NSSL--NSSL has 68% (10278) of the Zea accessions held at the NCRPIS: **9852 of the 10733 (92%) of the PI'ed accessions are backed up at NSSL.** Only a small shipment of 45 Zea accessions was made to NSSL in 1997. In 1997, as in 1996 and 1995, the NCRPIS emphasized backing up other crops with a much lower percentage of accessions duplicated at NSSL. We plan to review 1000 accessions of Zea for PI-number assignment in 1998. PI assignment before shipment to NSSL increases the efficiency of the entire backup process.

#/% accessions regenerated--In 1997, 519 accessions were planted for regeneration

as compared to 659 accessions in 1996 and 425 in 1995. This represents just under 3.5% of the total Zea collection. The decrease in the number of accessions is not a reflection of a decrease in effort. Smaller plantings of more accessions were made on St. Croix in 1996, because there were fewer original seeds to plant per accession.

One-hundred ninety-three accession regenerations were attempted in Ames in 1997 in the field. This was a slight increase from the 176 attempted in 1996. Early spring development was slowed by cooler than average temperatures. There was a group of accessions silking during mid-season when growing degree days rapidly accumulated after the initial slow development. This made it difficult to keep up with pollinations with the crew available. The season was extended beyond average by warmer than average fall temperatures. Little precipitation during the final period of maturation reduced ear diseases, but accelerated plant maturity which again caused a large number of accessions to require harvest during a short time. Late-generation corn borer damage was above normal. Early to mid-season accessions should produce average yields of grain. Better than average yields were achieved on late-maturity accessions.

Ninety-nine accession regenerations were attempted in 1997 in Puerto Rico. This is the same effort undertaken in 1996. Weather was good there and seed quality should be excellent.

Two-hundred twenty-seven quarantine accessions were regenerated on St. Croix in 1997. All but 60 of these accessions are repeated regenerations of accessions which previously had low population sizes during earlier St. Croix increases. After processing accessions received from St. Croix in 1997, there will be 100 accessions remaining in quarantine at NSSL. Most of them cannot be grown on St. Croix because the permit does not allow growing of accessions from certain

countries, or the seed supply is so small that cultivating them under St. Croix conditions would be unsuccessful.

Significant progress--The nurseries on Puerto Rico and in Ames produced excellent quality seed. Despite budget difficulties, enough accessions were regenerated to maintain the status of the Zea collection on a 30-year cycle.

Challenges--The number of unavailable accessions due to acquisition and distribution remained the same. The regeneration program at Isabela, Puerto Rico was terminated. Arrangements must be made for tropical regenerations with other facilities on Puerto Rico or elsewhere.

#/% tested for viability-- We tested the viability on 1.8% (272) of the Zea collection in 1997. This compares with 3.3% (498) and 8.0% (1165) of the collection in 1996 and 1995 respectively. The reduction over time continues to be a concern. A new germination data capturing program is undergoing final beta testing and should help return germinations to the 20% per year figure needed to optimally monitor the collection viability status. Certainly, the NCRPIS should try to test 10% of the maize collection every year.

#/% of collection with permanent PI accession numbers--72% (10,594) of the total Zea collection has PI numbers. Few temporary-numbered accessions were assigned PI numbers in 1997. The Germplasm Program Assistant who will perform this work was busy with other NCRPIS tasks this year. Zea will become a priority crop for assigning permanent numbers in 1998.

Characterization/taxonomy:

#/% characterized/classified---The accessions grown in 1997 were characterized in a cursory fashion. Little progress was made in computerizing old characterization data. Efforts continued on obtaining high quality images for future data acquisition. Five-thousand seven-hundred fifty-four computer images of 1445

accessions were obtained in 1997. Two-thousand four-hundred twenty-eight images of 374 accessions were obtained in 1996. To date, 12% (1819) of the collection has been digitally imaged.

Significant progress--As mentioned earlier, many accessions have been imaged with a color flatbed scanner. A second flatbed scanner was acquired for this purpose. These digital images can be used in the future for precise characterization of ear and kernel traits.

Evaluation:

#/% evaluated--73% (10928) of the accessions in the Zea collection has been evaluated for resistance to first-generation European Corn Borer. There should be a correction to last year's report, because 69% (10190) of the collection had then been evaluated instead of 74% (10,969) as stated.

To date, 18% (2685) of the accessions in the collection have been evaluated for resistance to second-generation European Corn Borer. All data on European Corn Borer evaluations obtained in Ames have been loaded into GRIN.

As mentioned earlier, L. du Toit and J.K. Pataky at the University of Illinois did an initial screening of 2000 maize accessions for corn smut (Ustilago maydis), Stewart's wilt (Erwinia stewartii), and southern rust (Puccinia polysora). The Stewart's wilt data will be loaded in 1998 and will be the first data for this disease placed on GRIN.

During the last six years, the Assistant Scientist II (Plant Pathology) has screened our increase plots for diseases which are important for seed export into some countries. To date, no sorghum downy mildew has been observed. Common corn smut, common rust, and leaf blights always occur and we cannot certify that our maize grown in Ames is free of these diseases.

Significant progress--The first-generation European Corn Borer observation represents the highest percentage of the corn collection evaluated for characteristic. Stewart's wilt data on a large number of accessions were obtained for the first time.

Enhancement and/or utilization:

#/% enhanced--No enhancement program has been undertaken with Zea at the NCRPIS. The NCRPIS is providing seed storage space for the intermediate stages of the GEM project, headed by Linda Pollak, which is enhancing landraces from the collection with elite germplasm from the seed industry. The products of this enhancement program will be deposited in the collection within three years.

Significant progress--The GEM project has sparked continued interest in those landraces used in the enhancement program. It has also sparked some interest in evaluating other accessions in the collection for future enhancement.

Support/administrative personnel:

Significant accomplishments--The Zea technician continues to become more proficient with computers. This year he performed much of the ear and kernel imaging work.

Challenges--Doug Fuller, a Research Associate working with Iowa State University's corn yield test program, again assisted the Zea curatorial effort for three months in the winter of 1996-97. He was of great value in the imaging area. Funding was reduced by Iowa State for the maize yield tests and the popcorn program and Doug's position was terminated; therefore, we did not have his services in the fall of 1997. This third-time equivalent is greatly missed.

Travel and Meetings attended:

I attended the 1997 Maize CGC meeting at the American Seed Trade Association meetings in December in Chicago. I presented a written report on Zea curatorial activities.

I attended the NCR-167 meetings held in Des Moines in February. I reported that the NCRPIS obtained a large group of accessions from the University of Minnesota program which had been closed down. Other university maize breeding programs appeared to be having financial difficulties and more accessions may be transmitted to the NCRPIS in the future for long-term preservation.

Conclusions:

State of the program

In summary, we are keeping up with accession maintenance tasks, but again in 1997 as in several previous years we must say: "barely." The number of maize accession regenerated must be increased, and we must improve the data for those accessions in the GRIN database. Selection of accessions for seed orders is still hindered by a lack of rapidly accessible data and the lack of certain accessions representing key components of genetic variability in maize.

Strengths and weaknesses: what facilitated or hindered progress

The maize program is becoming one of the most automated curatorial efforts at the NCRPIS. Only further automation will help to overcome the limited number of people assigned to the project.

The maize collection requires all of my working hours, and additional full-time permanent positions assigned to the maize program would be desirable. At present, many jobs are not done efficiently due to rapid personnel turnover. Travel to other nurseries must be rotated among personnel. Spring planting and fall harvests are delayed because of personnel shortages. Tasks of a more technical nature are not accomplished.

Future plans:

Regenerations in Ames are expected to continue at about the 200 accession level in 1998. Resources must be increased to enable 300-400 accessions to be increased annually.

Germinations will be resumed in 1998 at higher levels. New data acquisition software will be fully tested, with the goal of germinating 3000 lots of seed.

Quarantine regeneration procedures must be reviewed. Reorganization in Beltsville has meant that staff there must be trained and facilities expanded for quarantine increase of corn. Additionally, the current St. Croix permit must be reviewed with APHIS to determine if it might be expanded to enable seed to be grown from countries currently prohibited.

Back up of the last of the Goodman tropical increases should be completed in 1998.

Further exchanges of accessions contained in the NCRPIS collection, but not in CIMMYT's collection, will occur in 1998.

Long-postponed projects

The Minnesota public inbred lines have been deposited in the NCRPIS. A review of NSSL and NCRPIS holdings of other U.S. public germplasm must be performed and existing projects then must be queried to fill in gaps.

The NCRPIS must procure more Caribbean accessions and representatives of races of maize not currently in the NCRPIS.

Dr. Bill Tracy spent considerable time prior to 1996 selecting the most important materials to be conserved from the Crookham sweet corn collection now in NSSL. Again in 1998 we will try to begin regenerating those accession he selected.

Travel

I plan to attend the NCR-167 meetings in Ames in February. Again my interest this year is in procuring old publicly-released inbred lines.

Tropical regenerations in Isabela, Puerto Rico have been terminated. Trips to Puerto Rico, St. Croix, or other locations may be necessary to arrange and provide oversight of new tropical nurseries. Travel by one or two of the Zea staff may be required to accomplish hand pollinations.

I will attend the American Seed Trade Association, the Maize Crop Germplasm Committee, and the Sweetcorn Breeders' meetings in December.

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." During 1997, 11 umbels, 321 Cucumis melo, 70 Cucumis sativus, 91 wild Cucumis species, 125 Cucurbita and 1 Daucus were backed up at NSSL. A substantial number of Cucumis accessions will be sent to NSSL for back up after PI numbers are assigned in 1998.

Table 1: Status of NCPRIIS Vegetable collections for 1997.

Genus	New Accessions	PI Numbers	Ames Numbers	NSSL Numbers	Total Accessions	Available #/%	Backed up at NSSL #/%
Asparagus	1	146	15	0	161	31/19	15/9
Cichorium	0	62	157	0	219	82/37	67/31
Cucumis melo	7	2407	652	3	3062	1802/59	1581/52
Cucumis sativus	1	962	388	1	1351	1078/80	813/60
Cucumis wilds	56	277	70	0	347	117/34	113/33
Cucurbita	1	828	174	4	1006	679/67	601/60
Daucus	7	570	146	0	716	711/51	594/83
Ocimum	2	70	8	2	80	43/54	48/60
Umbels	84	337	432	1	770	194/25	199/26
TOTALS	159	5659	2042	11	7712	4537/59	4031/52

Table 2: Distribution of NCPRIIS vegetable collections for 1997.

Genus	Orders	Total Packets	Domestic Packets	Foreign Packets	Total Accessions	%Collection Distributed
Asparagus	0	0	0	0	0	0
Cichorium	4	22	21	1	20	9
Cucumis melo	30	1535	1059	476	1012	33
Cucumis sativus	21	1354	508	846	839	62
Cucumis wilds	8	21	14	7	15	4
Cucurbita	16	276	243	33	250	25
Daucus	13	271	110	161	204	28
Ocimum	3	91	2	89	46	51
Umbels	8	341	99	242	196	25
TOTALS	103	3911	2056	1855	2582	33

Viability Testing: (General Statement)

Data for 1992, 1994, and 1995 germinations (816 records) were loaded into GRIN in April 1997. Germination tests for the 1996 regeneration seed lots were scheduled for the summer of 1997, but had to be deferred to 1998 due to insufficient temporary summer help. Seeds of several genera have been removed from storage by seed storage personnel for five-year germination tests to monitor the viability of distribution lots. These tests will be done during the summer of 1998.

Evaluation and Enhancement: (General Statement)

All evaluation data received in 1997 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

ASPARAGUS

Maintenance and distribution:

Seed of Asparagus has not been regenerated at Ames since 1956. The Horticulturist maintains some ornamental accessions as plants in the campus greenhouse. There has been no progress in maintaining this collection, as the germplasm is difficult to maintain as seed. It would be best if we could find a clonal repository because many accessions are dioecious or male sterile. No seed or plant orders were received in 1997.

Characterization/taxonomy:

No formalized characterization of the Asparagus collection has occurred, although a few notes are recorded in old field books. These data cannot be entered on GRIN until descriptors are specified. There is no Asparagus Crop Germplasm Committee.

CICHORIUM

Maintenance and distribution:

No accessions were regenerated in 1997, but regeneration of 100 accessions in field cages will be attempted in the summer of 1998.

Characterization/taxonomy:

A descriptor list has been developed for Cichorium and will be used to characterize accessions regenerated in 1998.

CUCUMIS

Maintenance and distribution:

The attempted regeneration of 289 melon and 64 cucumber accessions in 1997 again focused on the germplasm collected in India in 1992 and China in 1994. Actual results of the 1997 increases will not be known until the crop is stored in September 1998. Germination tests will be performed on accessions regenerated in 1996 and 1997 during the spring of 1998.

Many of the unavailable accessions of Cucumis sativus and wild species are "hard-to-handle" because they require day-length manipulation, growth regulator treatment, or a longer growing season, to initiate flower and

fruit production. This work must occur in the greenhouse (hand pollination is required) as time permits.

The Plant Pathologist 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. One accession was inactivated due to duplication.

Evaluation and Enhancement:

Updated evaluation data were received in 1997 for powdery mildew resistance in Cucumis melo from Dr. C. Thomas, U.S. Vegetable Laboratory, Charleston, South Carolina.

CUCURBITA

Maintenance and distribution:

Regenerations were attempted on 46 accessions, with 40 accessions transplanted to the field (29 for hand pollination, 11 for bee pollination in cages). Actual results of the 1997 regenerations will not be known until the seed is stored in September 1998. Germination tests will be performed on the 1996 and 1997 regeneration seed lots during 1998.

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.

The Plant Pathologist 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:

Regenerations were attempted on 74 accessions of carrots. Of the 34 accessions attempted at the NCRPIS, 23 were transplanted to field cages for pollination by bees and flies, 7 annual accessions were hand-pollinated in the greenhouse, and 4 accessions failed to germinate. We received increase seed of 9 accessions regenerated by Roger Freeman, Sun Seeds, Brooks, Oregon, and seed of 34 accessions regenerated by Larry Baker, Seminis Vegetable Seeds, DeForest, Wisconsin. Fifteen accessions were sent to Roger Freeman, and another 25 to Larry Baker for increase in the 1997-1998 growing season.

Germination tests will be performed on the 1997 all regeneration seed lots.

Characterization/taxonomy:

We received evaluation and characterization data from Dr. P. Simon, USDA-ARS, Madison, Wisconsin for root color. 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. Also, two accessions were inactivated due to duplication.

Evaluation and Enhancement:

We received data for carotene and anthocyanin content for carrots from Dr. P. Simon, Univ. of Wisconsin, Madison, WI.

OCIMUM

Maintenance and distribution:

Regenerations were attempted on 30 accessions of Ocimum, two of which failed to germinate. One accession, which failed to set seed, was inactivated because all 27 original seeds were used in the regeneration attempt. Seed was harvested from 28 accessions grown in cages with honey bees as pollinators. Germinations will be performed on the 1997 increase seed in 1998.

Characterization/taxonomy:

Taxonomic identification was reviewed for all Ocimum accessions regenerated in 1997. Thirteen accessions underwent species reidentification, and taxonomy was confirmed for 14 accessions.

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.

UMBELS

Maintenance and distribution:

Regenerations were attempted on six Angelica, ten Pastinaca, and ten Torilis accessions in 1997. Four Torilis and three Pastinaca were transplanted to field cages. Only a few seeds of three Angelica germinated, and these accessions are being maintained in the greenhouse.

Characterization/taxonomy:

There are a number of misidentifications in this sitecrop. Herbarium specimens will be prepared when accessions are regenerated and sent to Beltsville, MD for reidentification, if the Horticulturist and I are unable to identify the accessions ourselves.

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.

One accession of Petroselinum was inactivated due to duplication.

Conclusions:

Meetings attended:

April 11, I attended the National Seminars Group one-day training program "Shortcuts to Creating and Maintaining Organized Files and Records" in Des Moines, Iowa.

July 22-26, I attended the following meetings held in conjunction with the American Society for Horticultural Science (ASHS), in Salt Lake City, Utah:

-Root and Bulb Vegetable Crop Germplasm Committee

- Leafy Vegetable Crop Germplasm Committee
- Cucurbit Genetics Cooperative
- Squash Breeders Working Group
- Vegetable Breeders Working Group
- Genetics and Germplasm Working Group (I served as secretary of this working group for 1997, and will serve as Vice Chair for 1998, and Chair for 1999.)

October 30, I attended the Cucurbit Crop Germplasm Committee meeting in Las Vegas, Nevada.

I am serving or have served on the following committees:

- Curators' Committee (Ongoing)
- Archive Committee (Ongoing)
- 1998 Planning Committee (Ongoing)
- Forms Committee (March)
- Office Automation Clerk (Farm) Search Committee (April)

H. Crucifers and Grasses (R. Luhman)

Acquisition:

Twelve accessions of Brassica, 22 accessions of miscellaneous crucifers, two accessions of Echinochloa, five accessions of Setaria, three accessions of miscellaneous grasses, and six accessions of Linum were received and logged into the GRIN database in 1997.

Maintenance and distribution:

Available for distribution:

About 64% of the accessions that I maintain have Plant Introduction numbers and about 58% are available for distribution (Table 1). Availability is slightly up (0.3% to 2.5%) for most groups when compared to the 1996 data (the exception being the miscellaneous grasses which is down 0.4%). One-thousand three-hundred thirty-one Brassica accessions received from the National Center for Agricultural Utilization Research (NCAUR) in Peoria, Illinois in 1988 lack Plant Introduction numbers. Oil analyses have now been received from NCAUR. We will use this information to make decisions about formal entry of these accessions into the NPGS.

Table 1: NCRPIS Crucifer and Millet Germplasm.

GENUS	TOTAL ACCESSIONS	ACCESSIONS WITH PI NUMBERS	PERCENT ACCESSIONS WITH PI NUMBERS	AVAILABLE ACCESSIONS	PERCENT AVAILABLE ACCESSIONS
<u>Brassica</u>	3148	1547	49	1477	47
<u>Echinochloa</u>	221	160	72	141	64
<u>Linum</u>	134	75	56	11	8
<u>Panicum</u>	982	911	93	857	87
<u>Setaria</u>	989	950	96	798	81
Other Crucifers	986	522	53	521	53
Other Grasses	113	43	38	12	11
TOTAL	6572	4207	64	3817	58

Distribution:

In 1997 we distributed seed from 19 of the 33 genera that I curate. Thirty-nine U.S. and 24 foreign orders were shipped representing 876 and 2009 packets of seed, respectively (Table 2).

Table 2: 1997 Distributions.

GENUS	TOTAL ACCESSIONS	DOMESTIC PACKETS DISTRIBUTED	FOREIGN PACKETS DISTRIBUTED	DOMESTIC ACCESSIONS DISTRIBUTED	FOREIGN ACCESSIONS DISTRIBUTED
<u>Brassica</u>	3148	820	1423	648	876
<u>Echinochloa</u>	221	0	0	0	0
<u>Linum</u>	134	0	0	0	0
<u>Panicum</u>	982	2	50	2	45
<u>Setaria</u>	989	16	235	15	227
Other Crucifers	986	37	298	37	278
Other Grasses	112	1	3	1	3
TOTAL	6572	876	2009	703	1429

GENUS	TOTAL ACCESSIONS	TOTAL PACKETS DISTRIBUTED	TOTAL ACCESSIONS DISTRIBUTED	PERCENT ACCESSIONS DISTRIBUTED
<u>Brassica</u>	3148	2243	960	30
<u>Echinochloa</u>	221	0	0	0
<u>Linum</u>	134	0	0	0
<u>Panicum</u>	982	52	47	5
<u>Setaria</u>	989	251	235	24
Other Crucifers	986	335	298	30
Other Grasses	112	4	4	4
TOTAL	6572	2885	1544	23

Backed Up:

Currently, about 86% of the accessions that I maintain are backed up at the National Seed Storage Laboratory (Table 3).

Table 3: Numbers of Accessions backed up at the National Seed Storage Laboratory.

GENUS	TOTAL ACCESSIONS	ACCESSIONS BACKED UP	PERCENT BACKED UP	# BACKED UP IN 1997
<u>Brassica</u>	3148	3048	97	79
<u>Echinochloa</u>	221	166	75	3
<u>Linum</u>	134	3	2	2
<u>Panicum</u>	982	874	89	25
<u>Setaria</u>	989	912	92	7
Other Crucifers	986	630	64	28
Other Grasses	112	36	32	0
TOTAL	6572	5669	86	144

Regeneration:

During 1997 we attempted to regenerate 180 accessions (Table 4) and harvested 131 of those accessions. During the spring of 1997 we had an unexpected wind storm along with cool temperatures that caused a loss of 19 Brassica regenerations and 11 miscellaneous crucifer regenerations. Ten Linum accessions did not germinate and will be candidates for inactivation. One Lepidium and eight Linum regenerations did not set seed. We also harvested two miscellaneous crucifer accessions that overwintered during the winter of 1996-1997.

Table 4: 1997 Regeneration.

GENUS	ATTEMPTED REGENERATIONS (ACCESSIONS)	HARVESTED REGENERATIONS (ACCESSIONS)	1997 HARVESTED ACCESSIONS FROM 1996
<u>Brassica</u>	93	74	0
<u>Echinochloa</u>	0	0	0
<u>Linum</u>	28	10	0
<u>Panicum</u>	0	0	0
<u>Setaria</u>	0	0	0
Other Crucifers	59	47	2
Other Grasses	0	0	0
Total	180	131	2

Germination:

Table 5 indicates that 174 germinations (158 accessions) were completed during calendar year 1997.

TABLE 5: Germinations performed in calendar year 1997.

GENUS	TOTAL ACCESSIONS	GERMINATION TESTS	ACCESSIONS GERMINATED	PERCENT ACCESSIONS GERMINATED
<u>Brassica</u>	3148	63	60	2
<u>Echinochloa</u>	221	6	6	3
<u>Linum</u>	134	0	0	0
<u>Panicum</u>	982	36	32	4
<u>Setaria</u>	989	13	12	1
Other Crucifers	986	56	48	5
Other Grasses	112	0	0	0
Total	6572	174	158	2

Characterization/taxonomy:

During the 1997 Brassicaceae increase, flowering date, corolla color, silique arrangement, plant height, harvest date(s), and number of plants harvested were recorded.

Seven-hundred Brassica observations (data for 159 accessions) and 375 crucifer observations (data for 88 accessions) were entered into GRIN (Table 6).

Table 6: Observations entered into GRIN during 1997.

GENUS	TOTAL ACCESSIONS	NUMBER OF OBSERVATIONS ENTERED	NUMBER OF ACCESSIONS WITH OBSERVATIONS ENTERED	PERCENT OF ACCESSIONS WITH OBSERVATIONS ENTERED
<u>Brassica</u>	3148	705	159	5
<u>Echinochloa</u>	221	0	0	0
<u>Linum</u>	134	0	0	0
<u>Panicum</u>	982	0	0	0
<u>Setaria</u>	989	0	0	0
Other Crucifers	986	375	88	9
Other Grasses	112	0	0	0
Total	6572	1080	247	4

Meetings attended:

1. NetWare Training Session (November 1997)

Publications:

Widrechner, M.P., D. Brenner, J.W. Van Roekel, M.E. Brothers, and R. Luhman. Germplasm for new crops and new products from the North Central Regional Plant Introduction Station. Presentation to the Association for the Advancement of Industrial Crops, made by David Brenner, Saltillo, Mexico on September 14-18.

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 temporary Computer Technician
 - B. Switched our server from a 486DX2 to a new Pentium computer
 - C. Assisted with installation of backup system software and hardware
 - D. Installed software for NCRPIS workstations
2. Server maintenance
3. I served on the following committees:
 - A. Computer Committee
 - B. Communications Committee
 - C. Curator Committee
 - D. Extension Committee

Future Activities:

The 1997 crucifer regenerations will be stored.

I will attempt to determine what should be kept from the NCAUR Brassica collection as well as the crucifer and millet material that was received from the NCAUR.

The 1997 field regeneration will include ca. 150 Brassicaceae accessions and ca. 50 grass accessions.

I will check the 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)

AMARANTHUS: 3305 accessions.

Acquisition and inactivation:

Nineteen accessions were acquired, and 10 accessions were inactivated or merged due to duplication within the collection.

Maintenance and distribution:

1997	#	% of collection
Accessions available for distribution	2182	66
Seed orders	53	NA
Packets distributed	444	NA
Accessions distributed	186	6
Accessions backed-up at NSSL	2504	76
Accessions planted to regenerate	287	9
Accessions germination tested in 1997	235	7

One-hundred eighty accessions were sent for back-up at the NSSL.

Thirteen accessions received new PI numbers.

A new "Chapin Watermatics" irrigation system was installed in one of the greenhouse rooms. It improves on the old system because the water is distributed more evenly. I plan to expand the new system in 1998.

We are developing methods for embryo rescue via tissue culture. Carren Frank was very helpful in preparing media and initiating two experiments. The best medium that we tried was made from 11.6 g Gamborg's B-5 Medium, with 8 g agar (1.6%), 75 ml coconut water (15%), 6 mg kinetin (12mg/L), and 300 ml ddH₂O. This medium was firm enough that the seedlings did not submerge. We discovered that abnormal seedlings similar to those from old poor seed lots can be generated by sandpapering fresh seeds. We had growth from even small fragments of embryo, but those fragments from above the radical did not root. When the study is expanded we will prepare a second medium including rooting hormones to test their effects on the non-rooted seedlings.

Characterization/taxonomy/evaluation:

Fifteen-thousand five-hundred sixty-four observations were loaded into GRIN where the data are publicly available. These data include characterization data on seed shapes and colors.

Two-hundred seventy-one accessions were re-identified. Most of the identifications were based on grow-outs during seed regenerations. Six-hundred sixty-five (20%) of the Amaranths accessions remain identified only to genus.

Enhancement and/or utilization:

The development of a non-shattering grain line has continued with male-sterility assisted backcrossing of the trait into the variety 'Plainsman'.

CELOSIA and **GOMPHRENA**: 35 accessions.

Acquisition: Two Gomphrena accessions were transferred from the NSSL. They are used for virus indexing.

Maintenance and distribution:

1997	#	% of total number of accessions
Accessions available for distribution	12	34
Seed orders	3	NA
Packets distributed	3	NA
Accessions distributed	2	6
Accessions backed-up at NSSL	14	40
Accessions planted for regeneration	3	9
Accessions germination tested in 1997	18	51

The two Gomphrena accessions were regenerated in field cages with honeybee pollination. They set seed well, but mice consumed many of the seeds until we used a chemical treatment to protect them.

The Celosia accession PI 274280 was cage pollinated with both Osmia and honey bee pollination, but failed to set seed. This seed failure could be explained by self-incompatibility.

Many of the original seed lots were germination tested which will help with deciding which accessions to inactivate, or regenerate.

Characterization/taxonomy/evaluation:

Two accessions of Celosia were re-identified from the Amaranthus collection.

CHENOPODIUM:225 accessions.

Acquisition and inactivation:

Three accessions of wild species from European botanical gardens were acquired. One accession was inactivated due to duplication in the collection.

Maintenance and distribution:

1997	#	% of total number of accessions
Accessions available for distribution	156	69
Seed orders	8	NA
Packets distributed	18	NA
Accessions distributed	16	7
Accessions backed-up at NSSL	166	74
Accessions planted for regeneration in 1997	3	1
Accessions germination tested in 1997	25	11

Fourteen accessions were sent for backup at the NSSL. Six accessions received new PI numbers.

Characterization/taxonomy/evaluation:

Three accessions were re-identified taxonomically.

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

Acquisition:

Twenty-three new accessions were acquired including crownvetch accessions from Bulgaria, and annual Dalea accessions from the National Center for Agricultural Utilization Research.

Maintenance and distribution:

1997	#	% of total number of accessions
Accessions available for distribution	93	42
Seed orders	10	NA
Packets distributed	25	NA
Accessions distributed	20	9
Accessions backed-up at NSSL	106	48
Accessions regenerated in 1997	0	0
Accessions planted in 1997	0	0
Accessions germination tested in 1997	0	0

No accessions were sent for back-up at the NSSL. New PI numbers were assigned to two accessions.

Characterization/taxonomy/evaluation:

Four accessions were re-identified taxonomically.

MELILOTUS: 907 accessions.

Acquisition:

Eleven accessions, including wild collections from Bulgaria and Mongolia.

Maintenance and distribution:

1997	#	% of total number of accessions
Accessions available for distribution	639	70
Seed orders	6	NA
Packets distributed	38	NA
Accessions distributed	19	2
Accessions backed-up at NSSL	720	79
Accessions regenerated in 1997	0	0
Accessions planted for harvests in 1998	18	2
Accessions germination tested in 1997	0	0

No accessions were sent for back-up at NSSL.

Thirty accessions received new PI numbers.

Characterization/taxonomy/evaluation:

One accession was re-identified based on plants grown by Dr. Charles Brummer of the ISU Agronomy Department.

PERILLA: 21 accessions.

Acquisition:

Two accessions were acquired, one is a green, cinnamon-scented ornamental, and the other is a dark red ornamental that has adaptation for seed maturity in Ames, Iowa.

Maintenance and distribution:

1997	#	% of total number of accessions
Accessions available for distribution	19	90
Seed orders	4	NA
Packets distributed	25	NA
Accessions distributed	18	86
Accessions backed-up at NSSL	19	90
Accessions regenerated in 1997	1	5
Accessions germination tested in 1997	0	0

No accessions were sent for back up at NSSL.

Two new PI numbers were assigned.

SPINACIA: 378 accessions.

Acquisition:

Fourteen accessions were acquired from Gatersleben, Germany, including three accessions of the wild species.

Maintenance and distribution:

1997	#	% of total number of accessions
Accessions available for distribution	241	64
Seed orders	10	NA
Packets distributed	1196	NA
Accessions distributed	253	67
Accessions backed-up at NSSL	328	87
Accessions planted for regeneration in 1998	90	24
Accessions germination tested in 1997	0	0

Ninety accessions were sent to Mr. Matt Linder of the Sakata Seed Company in Salinas, California for regeneration using facilities and labor donated without charge by the Sakata Seed Company and by Ed Ryder of the USDA-ARS.

Twenty-six accessions were sent for back-up at NSSL.

All available accessions were distributed from this collection five times, as compared to four times in 1996. This continued high demand is because plant breeders are seeking a source of disease resistance for a new race of downy mildew (Peronospora farinosa).

Plans:

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

Information orders:

I responded to approximately 100 information requests from outside of the NCRPIS, besides seed orders. Some of these requests are time consuming and specialized.

Professional meetings attended:

Amaranth Institute, Ames, Iowa, August 8, 1997.

Association for the Advancement of Industrial Crops, Saltillo, Mexico, September 14-18, 1997. (Including a New Crops CGC meeting.)

Agronomy Society of America, Anaheim, California, October 26-30, 1997. (Including a Trifolium and Special Purpose Legumes CGC meeting.)

Publications and presentations:

Widrechner, M.P., D.M. Brenner, J.W. Van Roekel, M.E. Brothers, and R. Luhmann. 1998. Germplasm for new crops and new products from the North Central Regional Plant Introduction Station. Abstract in the proceedings of The Green Industrial Revolution, an International Conference of the Association for the Advancement of Industrial Crops. September 14-18, 1997, Saltillo, Mexico. I was also the presenting author.

Brenner, D.M. and D.J. Makus. 1997. 'Kerala Red' ornamental amaranth. HortScience. 32:749-750.

Brenner, D.M. 1997. Recent amaranth publications. Legacy 10:4-7.

I edited the tenth issue of Legacy, the Amaranth Institute newsletter. It was the seventh issue that I have edited, and my last. Another editor has offered to continue Legacy in 1998.

Miscellaneous Progress:

I helped organize an Amaranth Institute meeting at Iowa State University in Ames on August 8, 1997. Dr. Richard Wilson and Lori Wilson-Voss were also instrumental in organizing the meeting. Thirty-eight people attended from nine countries. One of the topics under discussion was the availability of 20 million pounds of Chinese-grown amaranth grain from the 1997 harvest.

I was elected to the Board of the Amaranth Institute, a not-for-profit foundation, as the Vice President. After the 1998 meeting, I will serve as President of the Institute for a one-year term.

I prepared three written Progress Reports for Crop Germplasm Committees, and presented two of them in person.

I successfully completed two Iowa State University plant breeding classes, Agronomy 421 and Agronomy 521.

Acknowledgements:

Ronald Schweppe worked with me for part of the year but was transferred to another project, and has now retired. I now have only temporary student help. The students on my crew, Todd Steinlage and Debra Stansberry, are both biologists, eager learners, and careful workers.

I am grateful to Linda Minor, our order processing specialist, and her co-workers for gracefully managing seed orders.

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

Acquisition:

In 1997, 106 Helianthus accessions (90 cultivated Helianthus annuus and 16 wild Helianthus species) were received and logged into GRIN. Thirty (30) accessions of Dr. Ben Beard's Helianthus Germplasm Pool lines were received; four lines were new acquisitions and the remaining 26 lines were already in the NPGS.

Ten new miscellaneous asters were received and logged into GRIN: four Eupatorium, two Tithonia, and four Vernonia.

The National Center for Agricultural Utilization Research (NCAUR) miscellaneous asters and Helianthus holdings were reviewed. Twelve of the accessions acquired in 1997 were from the NCAUR.

Maintenance and distribution:

The status of the Helianthus collection is summarized in Table 1. Permanent PI numbers were assigned to 123 Helianthus accessions in 1997.

Seventy-eight (78) of the 288 miscellaneous asters (27%) are available for distribution. Sixty-four (64) accessions (22% of the collection) have PI numbers.

#/% distributed--Seventy-six (76) separate Helianthus germplasm requests (20 foreign and 56 domestic) were received and 3343 packets representing 1396 accessions (38% of the collection) were distributed. Compared to 1996, Helianthus germplasm requests increased 2% and packet distribution increased 7%. Twenty-one (21) requests for information were also received.

In 1997 we received five separate requests for genera in the miscellaneous asters collection (Vernonia - 2 requests, 21 packets distributed; Arctium - 1 request, 1 packet; Eupatorium - 1 request, 1 packet; Rhaponticum - 1 request, 3 packets).

#/% duplicated at NSSL--73 Helianthus accessions were sent to NSSL; 61% (2266 accessions) of the total collection is now duplicated.

Fifty-seven (57) miscellaneous asters (20% of the collection) are duplicated at NSSL.

#/% regenerated--1997 greenhouse regenerations were conducted on 32 cultivated H. annuus accessions with limited original seed quantity or poor seed quality. Eight cultivated accessions were planted for a late-summer greenhouse increase. Hand-pollinated, field increases were attempted on 126 cultivated accessions. Seven additional cultivated H. annuus accessions were insect-pollinated in cages.

One hundred sixty-one (161) wild, annual accessions were germinated for regeneration and 114 of these accessions were transplanted into cages for controlled pollinations. Seven perennial Helianthus accessions were germinated and five were transplanted to the field; three perennial accessions were caged for controlled pollinations and tubers were dug from six H. tuberosus accessions. One H. tuberosus accession was increased at the Parlier, CA regeneration site.

Charles Block, Assistant Scientist II (Plant Pathology) noted a substantial increase in plants infected with downy mildew. Seed produced on such plants is the most common Helianthus importation restriction therefore, infected plants must be removed from the field. In the future, seed will be treated with a fungicide. An infestation of sunflower moths was also noted in Ames during the 1997 regeneration. Although the seed is currently being processed, it seems the sunflower moths did significantly reduce seed quantity. Germination tests will be conducted to determine their effect on seed quality.

1997 field regenerations were attempted on five Vernonia accessions. Four accessions did not germinate and the remaining accession was transplanted into a cage and relocated into a greenhouse in October 1997. Three Tithonia accessions were germinated and transplanted into cages for controlled pollinations. Seed was harvested from two of these accessions.

#/% tested for germinability/viability--Two hundred sixty-four (264) Helianthus viability tests were conducted in 1997.

Characterization/taxonomy/evaluation:

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

Forty-one (41) Helianthus accessions were inactivated, duplication of ten accessions was eliminated by combining similar accessions under one accession (Ames or PI) number, and 111 accessions were re-identified (105 to subspecies, three to other Helianthus species, and three to different genera).

In 1997, Helianthus seed was distributed to evaluate for host-plant resistance to Albugo, rust (races 3 and 4), downy mildew, Sclerotinia head rot, and sunflower moth. Data sets were received and entered into GRIN for the following Helianthus evaluations:

Percentage seed oil

Albugo

Phomopsis

Rust (races 3 and 4)

Sunflower moth

In 1997, 10382 observations were added to GRIN for 1800 Helianthus accessions (49% of the collection).

Professional development (I. Larsen):

Training activities:

Completed the following Iowa State University courses:

Principles of Crop Physiology (Agronomy 318)
Greenhouse and Controlled Environments (Horticulture 318)

Maintained pesticide applicators certification in the following categories:

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

Meetings/Seminars attended:

Sunflower CGC Meeting, January 8, 1997 (Fargo, ND).

The 19th Sunflower Research Workshop, January 9-10, 1997 (Fargo, ND).

Served on the System Support Specialist II selection committee.

Significant accomplishments:

In cooperation with Jerry Scheuermann, a hydraulic fence-post remover was built which provides a safe and efficient means of removing the over 550 fence posts used for sunflower cage stabilization. In addition, Irv learned the GRIN system by storing the 1996 sunflower increases in cooperation with Lisa Burke.

Professional development (M. Brothers):

Training:

Introduction to supervision, January 13-17, 1997 (Ames, IA).

Hazardous waste generators training, March 20, 1997 (Ames, IA).

Shortcuts to creating and maintaining organized files and records, April 11, 1997 (Des Moines, IA).

Meetings/Seminars attended:

Sunflower CGC Meeting, January 8, 1997 (Fargo, ND).

The 19th Sunflower Research Workshop, January 9-10, 1997 (Fargo, ND).

NPGS Focus Group, September 9, 1997 (Ames, IA).

Served on the following: Extension committee, Viability committee, 50th Anniversary Celebration committee, Internship committee, Curators committee, and Office Automation Clerk selection committee.

Presentations or seminars:

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

Cronn, R.C., M.E. Brothers, K.M. Klier, P.K. Bretting, and J.F. Wendel. Isozyme Genetic Markers and Helianthus Germplasm Management. Poster presented at the 19th Sunflower Research Workshop, January 1997 (Fargo, ND).

Cronn, R.C., M.E. Brothers, K.M. Klier, P.K. Bretting, and J.F. Wendel. 1997. Allozyme variation in domesticated Helianthus annuus and wild relatives: a survey of selected accessions from the National Plant Germplasm System. Theor. Appl. Genet. 95:532-545.

Cronn, R.C., M.E. Brothers, K.M. Klier, P.K. Bretting, and J.F. Wendel. Allozyme variation in domesticated Helianthus annuus and wild relatives. Presentation given at the American Institute of Biological Sciences meeting, August 1997 (Montréal, Canada).

Schneider, K.A., M.E. Brothers, and J.D. Kelly. 1997. Marker-assisted selection to improve drought resistance in common bean. Crop Sci. 37:51-60.

Seiler, G.J. and M.E. Brothers. 1997. Oil quality characteristics of achenes of wild sunflower species from original populations vs. germplasm increases. Poster presented at the ASA-CSSA-SSSA meetings, November 1997 (Anaheim, CA).

Widrechner, M.P, D. Brenner, J.W. Van Roekel, M.E. Brothers, and R. Luhman. 1997. Germplasm for new crops and new products from the North Central Regional Plant Introduction Station. Oral presentation at the Association for the Advancement of Industrial Crops Conference, September 1997 (Saltillo, Mexico).

Future plans:

Regenerate 20 accessions in the greenhouse, and conduct hand-pollinated increases of 90 cultivated Helianthus accessions and caged increases of 130 wild annual Helianthus accessions. Future Vernonia increases will focus on accessions with low quantities of original seed.

Helianthus acquisition activities will continue to emphasize ornamental sunflowers.

Review the Helianthus collection for possible duplication of accessions.

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

Table 1. Status of the Helianthus collection (December 31, 1997).

	Accessions	Available accessions		Accessions with PI numbers	
		#	%	#	%
Cultivated accessions	1592	1192	75	979	61
Wild accessions	2119	778	37	1596	75
Total collection	3711	1970	53	2575	70

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

Cuphea

Acquisition:

Eight accessions of Cuphea were added to the collection.

Maintenance and distribution:

Number and percentage of total number of 805 Cuphea accessions.

1997	# of accessions	% of accessions in collection
Available	403	50
Distributed	371	46
Duplicated at NSSL	513*	64
Regenerated	122**	15
Germinated	67	8

* Of this total, 55 accessions were sent to NSSL in 1997.

** Accessions grown for seed increase in 1997; seed is being processed at the time of this report.

Characterization/taxonomy:

Significant progress: Characterization data for 1997-increased accessions have been collected.

The 1997 field-increased accessions have been photographed, and accessions being maintained in the greenhouse will be photographed while characterization data for those accessions are recorded when the plants have matured.

Evaluation/Enhancement:

Field evaluation for possible ornamental use of accessions being regenerated will continue to be performed by Dr. M. Widrlechner.

Collaborated with Craig Abel in evaluation of pollinators. In an attempt to find better pollinators for Cuphea, a randomized complete-block experiment with four replications was continued in 1997, testing three pollinators on two Cuphea spp.

The list of Cuphea descriptors, {Cuphea (Lythraceae) Descriptors, L.C.S. Ramos, W. W. Roath, T. B. Cavalcanti, and J. H. Kirkbride, 1992} that was presented to the New Crops CGC in 1996 was approved by the CGC at its 1997 meeting.

Assisted David Kovach in preparing seed for germination and dormancy studies.

Euphorbia

Acquisition:

Seven accessions of Euphorbia were added to the collection.

Maintenance and distribution:

Number and percentage of total number of 93 Euphorbia accessions.

1997	# of accessions	% of accessions in collection
Available	9	10
Distributed	11	12
Duplicated at NSSL	6	6
Regenerated	56*	60
Germinated	4	4

* Accessions grown for seed increase in 1997; seed is being processed at the time of this report.

Significant progress: In 1997, sixty-three accessions were germinated for increase, leading to 56 regenerations.

Characterization/taxonomy:

None.

Evaluation/Enhancement:

When testing for germination in 1997, the effect of various cold treatments on germination rates was tested. This will lead to a protocol for germination testing.

EEO activities:

Mosaic Diversity presentation, May 23, 1997.

Hispanic Heritage Month presentation, September 11, 1997.

Disabilities video presentation, "Bridging the Talent Gap," October 9, 1997.

Native American Month video presentation, "Taking Tradition to Tomorrow," November 5, 1997.

Training:

Introduction to Supervisor Training January 13-17, 1997.

Tractor Safety Training, February 28, 1997.

Worker Protection Standard Training, May 15, 1997.

Completed Botany 306, Plant Taxonomy, Iowa State University, May, 1997.

Pesticide Applicator Continuing Education, Categories 1A, 1B, and 10, December 10, 1997.

Completed Botany 404, Plant Anatomy, December, 1997.

Completed instruction and training in First Aid and CPR, December 16, 1997.

Extension/Outreach:

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

Gave tours of NCRPIS to several groups.

Plans:

While storing seed from the 1997 harvest, I will be determining those Ames accessions that can be assigned PI numbers and backed up at NSSL, based on the amount of seed harvested. Accessions which have not had germination testing within the last five years will be scheduled for testing, and new accessions and those which are not available will be germinated for 1998 increase.

I am currently enrolled in a seed science course, Agronomy 338, at Iowa State University to increase my knowledge and ability in harvesting, processing, and storing seed.

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

Seed Research:

As noted in the 1996 Annual Report, additional research was needed on *Cuphea* species in order to test the effectiveness of GA₃ to promote seed germination. This was accomplished in 1997. The results of all experiments were analyzed and preparations for publication have begun. Selected results from two experiments are shown here.

Variation in the degree of dormancy development from year to year can be seen in Figure 1. Seed grown in 1993 had higher levels of seed dormancy than did the seed grown in 1994, as reflected by the length of time to dormancy release due to cold treatments. Also shown is the effect light has in germination promotion on the 1993 seed. Germination tests were done in a germination chamber temperatures set at 30° C for 14 hrs alternating with 20° C for 10 hrs. Both seed lots came from greenhouse increases of the same parent lot and were conducted during the same period of each year.

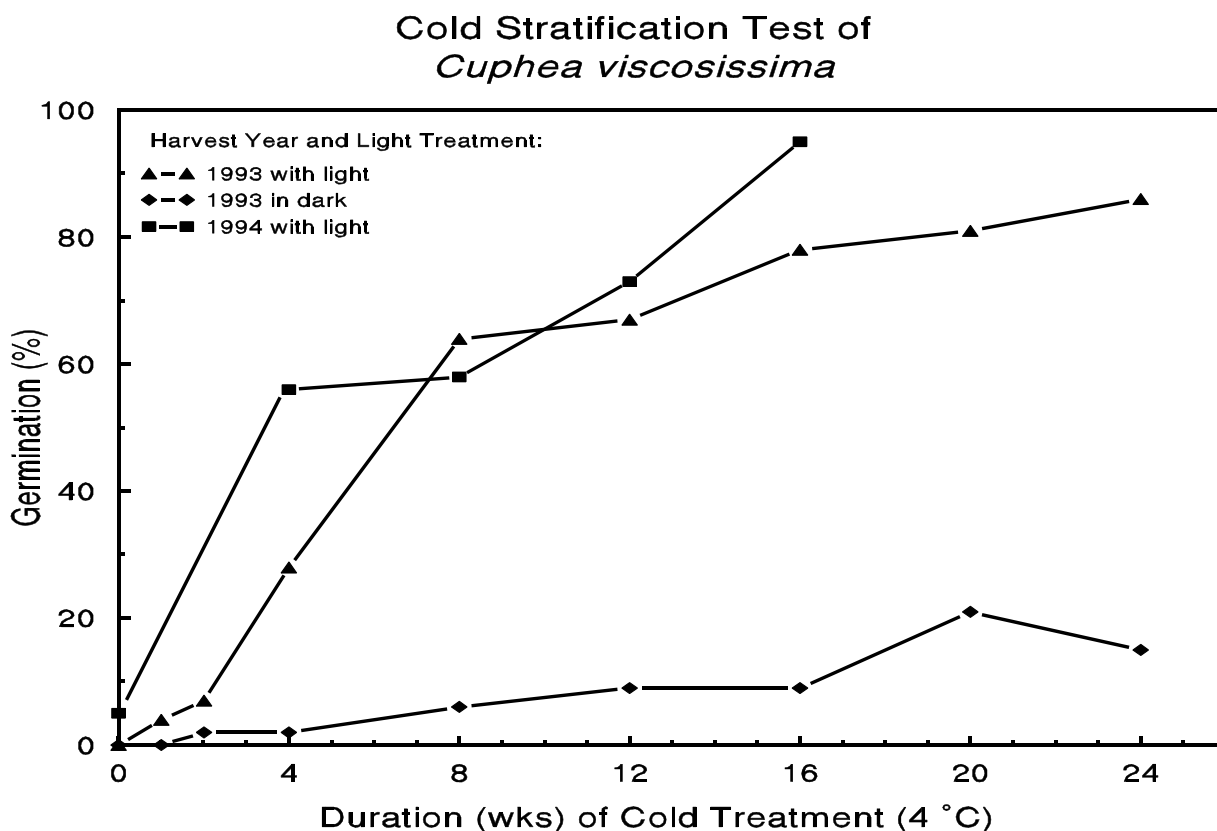


Figure 1. Variation in seed dormancy.

The release of seed dormancy due to after-ripening (or natural ageing) and the ability of *Cuphea* seed to store at room temperature is shown in Figure 2. This test was conducted on the 1993 seedlot. The first point to notice is that under the germination conditions of alternating temperature of 20/30° C with light, the level of seed dormancy is not substantial after 3 years of room-temperature

storage. Approximately 80% of the seeds germinated after this period of storage. No further increase in germination resulted under these germination conditions after 4 years of storage. After using an accelerated after-ripening technique (to be discussed in a manuscript under preparation), the germination of this seed lot was 92% after 4 years of storage, indicating that *Cuphea viscosissima* seed can store fairly well at room temperature. Figure 2 also demonstrates the effect that alternating temperatures has on the release of seed dormancy. Very low levels of germination resulted from a constant temperature regimen of 23° C with light even after 4 years of storage.

In summary, seeds of *Cuphea viscosissima*, and several other species of *Cuphea* (data not shown), require alternating temperatures and light for best germination. The temperatures used in other experiments have shown that an alternating temperature regimen of 15/25° C is safest for the majority of the *Cuphea* species tested. Although *C. viscosissima* germinated best at the 20/30° C regimen, the 20/30° C temperatures reduced germination in several other *Cuphea*

Ageing / Seed Dormancy Study of *Cuphea viscosissima*

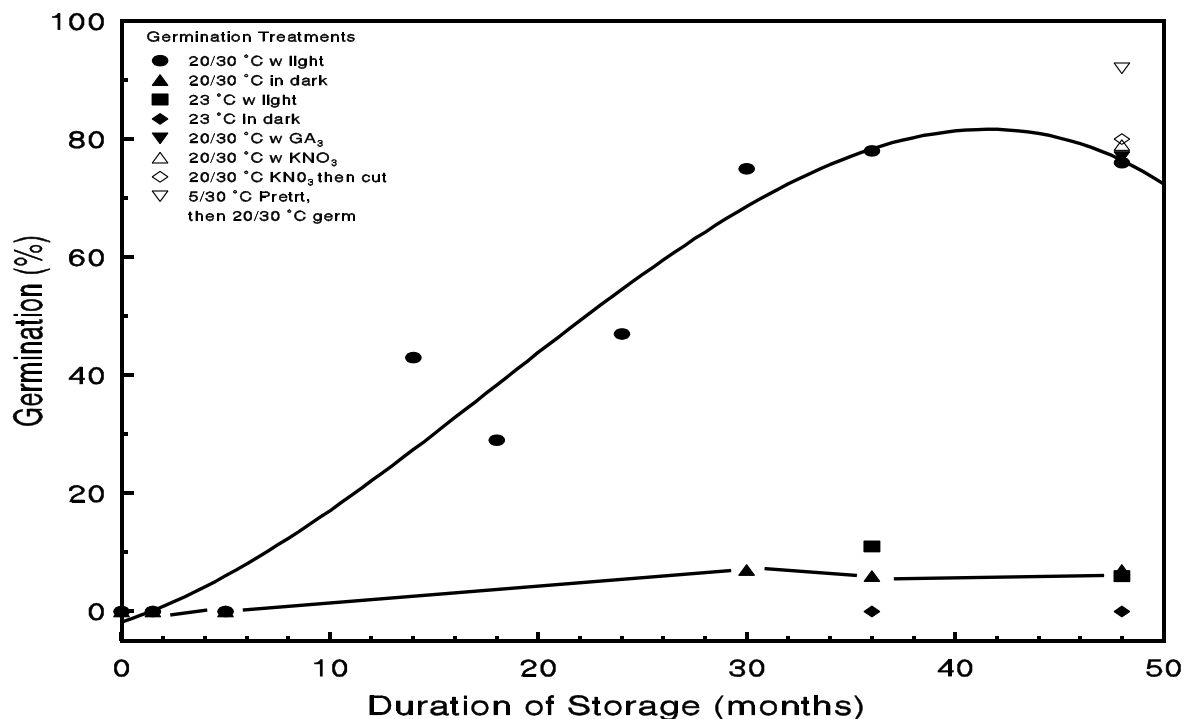


Figure 2. Release of seed dormancy.

species.

Research was also conducted on an historic *Zea mays* collection obtained from Dr. Walton Galinat. Two methods were tested with the hope of obtaining higher germination levels for this old seed than could be achieved with standard germination tests. One method involved a pre-humidifying treatment at temperatures around 20° C, which was suggested for very dry seeds by Ellis, Hong, and Roberts (1992. J. Exp. Bot. 43:239-247). Another method involved direct imbibition of the seeds, but at lower temperatures than some of the standard methods. The results of these experiments are shown in Table 1.

Table 1. Preliminary results of studies on Galinat collection.

Accession	Standard germination results	Best treatment results	Seed type
Ames 16475	5%	60%	flour
Ames 17349	na	100%	popcorn
Ames 17350	na	93%	popcorn
Ames 17351	na	97%	popcorn
Ames 17352	na	73%	popcorn
Ames 17353	na	90%	popcorn
Ames 17354	na	100%	popcorn
Ames 16456	0%	0%	sweet
Ames 16623	3%	20%	mostly flint

na = not attempted

If this initial trial is a fair assessment of the general condition of these kernels, one can see from Table 1 that the popcorn stored very well, even after more than 50 years. The flour seedlot stored fair, whereas the flint and sweet did not store well. However, I suspect there are other methods that will perform even better than the pre-humidifying treatment and lower temperatures tried here. I plan to try several other methods to "rescue" this collection.

Seed De-treatment:

Some of the seed received at NCRPIS have been chemically treated. Unfortunately, we do not often know what kind of chemical was applied. This is especially true of seed that was accessioned several years ago. These chemicals represent a possible danger for personnel who work with this seed. Additionally, it has generally been accepted that chemically-treated seed does not store as well as untreated seed. This problem was mentioned in a recent seed industry publication (Corn, Sorghum and Soybean, Technology 1998. A special supplement to Seed Trade News). In one article, Clive Holland of Pioneer Hi-bred International is quoted as saying,

"Treated wheat and soybeans that go unsold must be carried over or discarded. Disposal is expensive and often treated seed that is carried over does not meet minimum quality standards the next year."

What is alarming about this statement is the speed at which treated seed may deteriorate. This, as well as the issue of personnel safety, has caused us to look into the matter of 'de-treating' the seed. We have used manual washing and drying of chemically treated seed. However, to do a better and safer job, we plan to construct an automated, closed-system de-treatment device. Design software has been ordered and hopefully this project will be completed during the coming year.

Computer Application Development:

This past year, two basic germination data entry forms were developed. Some bugs still need to be worked out, but one form seems to be emerging as the preferred version.

Completed this past year was the Oracle Reports version of the Sunflower seedlists. Other Oracle reports completed include several types of seed inventory and plant inventory reports.

Committees:

Ames Area Civil Rights Committee

Seminars, Trips, and Other Training:

Symposium on Seed Biology and Technology: Applications and Advances. August 13-15, 1997. Fort Collins, Colorado.

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

Germplasm Collections

Acquisition:

The North Central Regional Plant Introduction Station (NCRPIS) acquired a total of 768 new accessions in 1997. Of these new accessions, 199 were received from within the National Plant Germplasm System (NPGS). The majority of these came from the National Seed Storage Laboratory (NSSL) and the Northern Crops Research Laboratory in Fargo, North Dakota. Included in this group were 82 accessions of Zea mays and 80 accessions of Helianthus.

The remaining 569 accessions were received from outside the NPGS. Included in this group were 207 accessions of various ornamental crops, 88 accessions of Cucumis, and 83 accessions of umbels. 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, 436 accessions received taxonomic re-identifications. Among these were 269 accessions of Amaranthus and 108 accessions of Helianthus. Also, 234 accessions were nominated for inactivation. The inactivations included 156 accessions of various ornamental crops and 41 accessions of Helianthus.

Additionally, 326 accessions were assigned PI numbers. Included in this group were 123 accessions of Helianthus, 95 accessions of various ornamental crops, and 40 accessions of crucifers.

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 seed material. This project involves locating paper files of accession information, corresponding with collectors and donors, searches of the internet, and researching maps and GIS databases.

One of my projects involved preliminary work to prepare accessions of Cucumis sativus for PI number assignment. The accessions were collected in India and had

vague collection site descriptions. An effort was made to pinpoint coordinates of latitude and longitude for each accession.

I entered citation records for a large group of Helianthus accessions that had been Crop Science registered. Originally, these citation records were absent or incomplete in GRIN, but were updated after researching and locating the articles.

I coordinated communications with approximately one dozen foreign seed banks to request seed. The requests covered many different crops at NCRPIS.

I worked closely with the NCRPIS horticulturist to prepare a list of seed requested from the National Center for Agricultural Utilization Research (NCAUR) in Peoria, Illinois to acquire for our collection. We determined which accessions had passed through NCAUR and been assigned PI numbers. Many of the accessions in question were not in GRIN. We eventually went through the Plant Introduction books crop by crop to identify NCAUR material.

I chaired a committee to develop and implement two new forms at NCRPIS. One form is used to assign PI numbers, and the other form is for handling duplicate accessions. Instructions were written to accompany the new forms. Updated instructions were also written for inventory lot code assignment and the nomination to inactive file form.

I served as a member of the Computer Committee for the entire year, and acted as committee chair from July to September. The committee is responsible for maintaining a modern and efficient computer system which includes budgeting, planning, repairing, and purchasing.

I began to use a flatbed scanner to capture images of incoming seed. This procedure was first tested on the Echinacea collections which arrived as intact seed heads. Since the coneflowers are destroyed when the seed is threshed, saving their images prevented the loss of information. The heads were scanned both in whole form and as half cross sections. This procedure will become more routine as standards are developed.

Training received:

In February, I joined three other staff members at a seminar entitled "Thinking Outside the Lines". We were encouraged to look at the world as we never had before. The intended result of this seminar was to become a more effective problem solver through the use of creative thinking.

I began the use of an Oracle form developed by David Kovach to enter new accessions into GRIN. The form is extremely user friendly and required little training. With further development, the form will make the use of "prep" tables obsolete for the mass loading of data.

I spent approximately one week this summer working with the sunflower crew. My goal was to learn more about other processes at NCRPIS that are necessary to maintain germplasm. I accomplished this by aiding with the pollination of Helianthus. I found it to be a time-consuming, labor-intensive undertaking that involved concentration and teamwork.

Conclusions:

Compared to the previous year, new accessions received at NCRPIS were down by 536 in 1997, a decrease of 41%. In other areas, re-identifications were up by 25%, nominations to the inactive file were down by 53%, and PI number assignments were up by 88% compared to their 1996 levels.

Although it is not reflected in the numbers, 1997 was a busy year. Many of our

efforts will not be realized until 1998 when the germplasm arrives from NCAUR and the flax collection is transferred to NCRPIS. Several new procedures were developed to improve efficiency such as new forms for assigning PI numbers and handling duplicate accessions and new Oracle forms for data entry. Scanning seed has become an additional method of documenting an accession.

This year much of my time will be spent logging in new accessions. Already during the first month of 1998, the total number of new accessions at NCRPIS has exceeded last year by a factor of four. Scanning incoming seed will become more widespread. I will also begin scanning the documentation accompanying new seed with the use of text recognition software. I plan to intensify my training with SQL programming and eventually write my own queries of GRIN to retrieve data. New procedures are being developed to simplify data retrieval from GRIN for composing future annual reports. I have undergone basic training for geographic information systems (GIS) which will soon be implemented at NCRPIS. The possible uses for such a tool are limitless. I plan to take advanced training in GIS later this year.

N. Order processing (L. Minor)

During 1997, there were 762 orders entered into GRIN. A total of 18,284 packets was distributed to requestors and evaluators throughout the world. Of the total packets distributed, 38% of these were sent to foreign requestors.

On August 1, approximately 1500 cooperators receiving germplasm during 1992-1996 were sent a Retroactive Accession Performance Report. During that time period, the regular Accession Performance Report was not mailed out because it was being considered for revision. About 40 hours were spent in preparing this mailing. Files were set up in preparation for mailing the newly revised Accession Performance Report beginning January 1998. The Accession Performance Report will be sent out on a monthly basis approximately one year from the date the germplasm was received by the requestor. Cooperators are notified about this on the response card that was implemented for inclusion in seed shipments effective January 1, 1996. The return on these response cards has been ca. 67%.

Committees:

Accession Performance Report
Archives
Courtesy
Selection Committee for Office Automation Clerk
Selection Committee for Systems Support Specialist

Training:

Shortcuts to Creating & Maintaining Organized Files & Records, April 11, 1997
Franklin Time Quest Day Planner, July 23, 1997.

O. Seed Storage (L. Burke)

In 1997, 3220 seed lots were stored, including both newly received lots and those regenerated either at Ames or at remote sites. Inventories of 12,067 lots were reviewed to insure correct seed amounts. Lots from the maize reference collection were repackaged and their counts reviewed. By the end of 1997, this project was approximately 50% complete. Re-inventorying of the maize distribution samples is now underway. We began with the first jar in the collection and will continue bay by bay. New labels are printed for these jars.

By early 1997, we completed the movement of Ames-numbered original packets of amaranth to the freezer. We then transferred to the freezer original samples of ornamentals, legumes, mints, and Chenopodium. Approximately 6800 packets were moved into the freezer in 1997.

Over 700 accessions were renumbered or reidentified in 1997. All of these samples were re-labeled by seed storage personnel. In addition, seed samples of 235 inactivated accessions were removed from the active collection and placed in inactive storage.

There were 599 Distribution/Observation orders (22663 packets) filled by seed storage personnel. About a quarter of these orders involved nonstandard order amounts (quantities differing from standard distribution samples). About one third of the Helianthus orders and over half of the maize orders were nonstandard.

Three hourly laborers worked in seed storage in 1997.

Training:

Lisa Burke completed the required annual training for the First Responders. The Iowa State University course, Plant Disease Epidemiology (PlP 543), was completed in May of 1997. In September, Lisa attended the American Genetic Resources Alliance Customer Focus Group meeting in Ames.

P. Computers and Telecommunications: (R. Luhman, M. Millard, C. Block, D. Kovach, R. Stebbins, R. Wilson, P. Bretting)

Personnel: As with 1996, the computer-telecommunications responsibilities were shared by many NCRPIS staff members: R. Luhman, M. Millard, C. Block, and D. Kovach. However, as the year progressed R. Luhman became the first contact for most of the computer related duties. In September 1997, the NCRPIS hired a student as a part-time hourly employee to assist with many of the routine computer tasks. The NCRPIS Computer Committee met periodically to help determine hardware, software and personnel needs.

R. Luhman attended a session on network software training for managing the NCRPIS's Novell local area network. This session covered Intranet applications.

Equipment: A new Pentium server, six new Pentium workstations, two scanners, a tape backup unit, and two palmtop computers were purchased in 1997.

Software: We upgraded our Novell software from Version 4.0 to 4.11. This upgrade gave us the ability to incorporate an Intranet into our operations. We have also upgraded many individuals to Microsoft Office97.

Progress: Establishment of an Intranet has given us the ability to enhance NCRPIS communication via static and interactive Intranet pages. All NCRPIS staff also have the means by which to establish pages on that Intranet. The Oracle form for Germination entry has been undergoing Beta testing.