NCRPIS Annual Report - 2001
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NORTH CENTRAL REGIONAL PLANT INTRODUCTION STATION
NC-7 ANNUAL REPORT, JANUARY 1 - DECEMBER 31, 2001

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

II. COOPERATING AGENCIES AND PRINCIPAL LEADERS (current):

A. Administrative Advisor — C.E. Woteki, Iowa
B. Regional Coordinator — *C.A. Gardner, Iowa
C. State Experiment Stations Representatives

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

*Voting members

D. U. S. Department of Agriculture

1.	ARS National Program Staff, Plant Germplasm	*P. Bretting
2.	ARS Plant Exchange Office	*E. Garvey
3.	ARS Area Director, Midwest Area	A. Hewings
4.	Cooperative State Research, Education and Extension Service	A. Thro
5.	Natural Resources Conservation Service	*J. Rissler
6.	National Center for Agric. Util. Research	*T. Isbell
7.	National Center for Genetic Resources Preservation	*H. Shands

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

1. USDA-ARS Staff

a.	Research Leader/Coordinator	C.A.C. Gardner
	Supervisory Program Support Assistant	L. Wilson-Voss
	Office Automation Clerk	S. Winter
	Office Automation Clerk	C. McCutcheon
	Biological Science Lab Technician	L. Pfiffner
	Agricultural Research Technician	S. McClurg
	Entomologist	S. Hanlin
	Plant Biologist (GEM)	S. Duvick
b.	Horticulturist	M. Widrlechner
	Agricultural Research Technician	P. Ovrom
	Agronomist	D. Kovach
	Biological Science Lab Technician	vacant
	Biological Science Lab Technician	L. Burke
	Biological Science Lab Technician	M. Arnold
	Germplasm Program Assistant	R. Stebbins
d.	Plant Pathologist	C. Block
	Agricultural Research Technician	J. Van Roekel
e.	Geneticist (GEM)	vacant
	IT Specialist (Data Manager)	vacant
	Biological Science Lab Technician	vacant
f.	Geneticist	M. Brothers
	Biological Science Technician	I. Larsen

2. Iowa State University Staff

a.	Research Station Superintendent II	L. Lockhart
	Farm Equipment Operator III	L. Crim
	Field-Lab Technician II	J. Scheuermann
	Clerk III	L. Minor
b.	Curator II (Maize)	M. Millard
	Field-Lab Technician II	G. Crim
d.	Curator II (*Brassica*, Grasses)	R. Luhman
	Field-Lab Technician II (1/2 year)	S. Bruner
e.	Curator II (Vegetables)	K. Reitsma
	Field Lab Technician II	C. Clark
f.	Curator II (Amaranth)	D. Brenner
	Field-Lab Technician II (1/2 year)	S. Bruner

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

A review of NCRPIS programs was conducted in April, 2001. The review team expressed appreciation for the developmental legacy of the station, and also that IM/IT knowledge and responsibilities are not overly concentrated in a single individual within the organization. The reviewers recommended that we identify and aggressively pursue ways to ensure that the curators' efforts are recognized for their scholarly contributions, and that we track and analyze the human, financial and other resources needed to regenerate and maintain the collections on a by-crop basis. An in-depth analysis of resources needed to accomplish regenerations, ensure availability of germplasm in the future, and resolve backlogs was conducted internally. Results of this analysis are being used to develop proposals for future resource allocations, development of collaborative regeneration relationships, and in planning for additional greenhouse facilities.

The integration of the GEM Project into our unit progressed, with the hiring of a new coordinator/geneticist, Mike Blanco; additional project staff are needed.

Personnel changes:

Cindy McCutcheon was hired as a term, part-time Office Automation Clerk in March.

Scott Wike, Biological Science Technician, resigned in June.

Interviews were conducted for the GEM coordinator position in December.

Construction:

Facility improvements included the addition of a new cold storage area, expansion of the fire suppression system, a large addition to the machine shed which will house dryers and plant materials storage prior to processing, and renovation of existing lab/office space to provide more offices, an improved digital imaging room, and an archival documents storage area.

Equipment:

Field and lab equipment purchases included vehicles, irrigation, viability testing and safety items. We replaced the Kool-Cel cooling system and installed a trellis system in the Entomology greenhouse.

IV PROGRESS IN GERMPLASM AND INFORMATION MANAGEMENT, RESEARCH, AND EDUCATION (C.A. Gardner)

(Part IV. summarizes the accomplishments and progress presented in greater

detail in the individual staff reports later in the document.)

Acquisition:

In 2001, we acquired 986 new accessions, which increased NC-7's collection holdings to 47,098, representing over 300 genera and 1,800 species. The acquisitions included 676 maize accessions; the remainder included *Daucus, Cucumis*, *Brassica*, cultivated *Helianthus*, *Amaranthus, Spinacia,* new ornamentals and miscellaneous umbels. Some of the germplasm was acquired as a result of collection trips by vegetable geneticist Phil Simon in Poland, Alan Whittemore's exploration to the Russian Far East, collaborators funded through a Plant Exploration grant in Turkmenistan, and from Indices Seminum.

Regeneration and Maintenance:

Regeneration efforts were conducted in Ames, IA, Parlier, CA, Davis, CA (Sakata Seeds), Puerto Rico and Hawaii (NC-7 and Pioneer Hi-Bred), Idaho (Seminis Vegetable Seeds), Oregon (Sunseeds) and the Netherlands (Bejo Zaden B.V.). Increases were attempted of over 1900 accessions using hand- or insect pollinator- controlled pollination techniques; over 1500 of these regenerations were harvested. The 2001 growing environment was hot and dry, which affected growth and seed quality of some crops. Viability testing is still in progress for some seed lots prior to storage. Management of foliar leaf diseases was an issue for several crops. A Stewart's bacterial wilt management plan was implemented for maize, consisting of Gaucho insecticide seed treatment, monitoring for flea beetles and spraying as needed. This greatly enhances our ability to produce seed which meets phytosanitary certification standards for export. Across crops, seed harvest amounts were generally average or above. Taxonomic re-identification was accomplished for 159 accessions in 2001. Over 3,100 accessions, or 7% of our holdings, were tested for viability in 2001, including the entire *Panicum* collection.

Distribution:

Over 11,621 NC-7 accessions were distributed in 2001, representing 738 orders. Interest in *Echinacea* and teosinte remains high, as reflected by germplasm requests, and also in the *Brassica* accessions involved in phytoremediation investigations. In general, requests are increasingly targeted more specifically for certain accessions or accessions having specific characteristics or traits.

Evaluation and Characterization:

Over 20,167 accession observations on a wide array of descriptors were loaded into the GRIN database in 2001. A draft descriptor list for *Echinacea* was refined, and data collection completed on a three-year caged planting. A new descriptor list was approved for *Melilotus*; new descriptor lists for *Cucumis* and *Cucurbita* are being developed in conjunction with CGC members and other curators. Oracle forms will be developed in-house to assist in the loading of characterization data to GRIN as these lists are approved.

Many of the tree and shrub seed accessions collected in 1999 in the Ukraine are being cultivated for long-term testing in the NC-7 trials.

Evaluation of sunflower for resistance to sunflower moth, and maize for European corn borer were conducted. The effectiveness of three bee species was evaluated for pollination of sunflower. Evaluation of data from three years of testing for resistance of *Brassica* accessions to green peach aphid was completed.

All *Cucurbita* and *Cucumis* seedlings were screened for squash mosaic virus infection using ELISA techniques prior to field transplantation; infected seedlings were eliminated.

The maize curator provided stover samples of over 500 accessions to a DOE investigator for energy production assays. If analyses are productive, this collaboration is expected to continue. Evaluation data will be posted to the GRIN database when available.

Substantial effort was devoted to improving our digital imaging methods, file naming system, and streamlining image preparation and storage prior to transfer to GRIN.

Information management and computers:

Hardware and software purchasing included new servers, server software, back-up systems, firewall, new desk top and hand-held computers and various network upgrades.

Testing germplasm's germination, viability, and health:

Host range and cross-inoculation studies of *Phomopsis* fungi isolated from amaranth and soybean were conducted. The second year of a maize disease evaluation project for multiple leaf disease, stalk and ear rot disease resistance was completed, with 2976 accessions evaluated by 3 private and 4 public pathologists. Information from year 2000 evaluations is available in GRIN. Collaborations with USDA-ARS investigators in Fargo continued on wild *Helianthus annuus* resistance to *Septoria helianthi*; resistance is definitely correlated with geographic origin of the accessions. Currently, the pathology team is investigating selective agar media for *Erwinia stewartii*, and initiating studies for evaluation of the causal organism of bacterial fruit blotch in stored melon seed.

Insect management:

Investigations designed to understand the biology and control of chalcid insect infestation of coriander were initiated. A planting of 20 mixed genera was utilized to survey and characterize floral visits by native insect pollinators in Ames; research on alternative native pollinator insect choices is one of our high priority needs. Honey bee queen rearing techniques were improved, resulting in a 300% increase in the success rate of queen production. Improvements made in the production of pollen balls used in the establishment of wild bumblebee queen colonies also yielded positive results. Experiments with media and methods for rearing blue bottle flies were initiated in an effort to more easily provide these pollinators on demand and to lower rearing costs. Research on possible pollinators and improved cage systems for use in greenhouse regenerations of *Cucumis* and *Cucurbita* was initiated.

Outreach and Scholarship:

About 440 visitors toured the NCRPIS in 2001.

Staff members continue to participate in teaching students, civic and other organizations about germplasm conservation and management, and the work done at NCRPIS.

Our staff authored or co-authored many journal articles and made presentations at five scientific society meetings. Publication covered the diverse areas of interest of our researchers, ranging from taxonomy of native and invasive plants, climatic adaptation of plants, molecular and biochemical characterization, host plant resistance, and plant pathology epidemiology and germplasm management issues.

NCRPIS staff traveled extensively to present lectures, attend and facilitate workshops, serve on advisory committees and review panels or establish contacts with foreign germplasm researchers. The amaranth curator is serving as President of the Amaranth Institute.

Our Pathologist served on a technical panel to review seed health testing methods for spinach and celery and as Chair of the Sunflower Disease Panel of the National Seed Health System. Our Horticulturist was appointed to a term as Chair of the Written Preliminary Exam Committee for ISU's Plant Breeding and Genetics Advisory Panel.

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V. SUPPORT TEAM REPORTS

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

We supervised and coordinated daily operations at the NCRPIS farm, including management of all facilities, fields, and greenhouse space. We supervised or conducted 94 pesticide applications in the field and/or farm and campus greenhouses. We responded to 79 maintenance requests from staff members at the farm and the campus location. We selected, coordinated and scheduled the student labor force of 20.0 FTE's. We coordinated facility construction and upgrades.

Labor:

During 2001, 89 applications for hourly employment were received and reviewed. There were 56 interviews, resulting in 42 hourly employees hired. Currently there are 40 (16.3 FTE) part-time hourly employees working at the NCRPIS.

NCRPIS Farm Crew:

Larry Lockhart (Station Superintendent II) has been on staff since 1985.

Lloyd Crim (Equipment Operator III) has been on staff since March 1998 and is primarily responsible for facility and field maintenance.

Jerry Scheuermann (Field Lab/Tech) has been on staff since December 1991 and is primarily responsible for general farm equipment and vehicle maintenance.

Wes Haugebak (student employee) assisted the farm staff throughout the year.

Maintenance projects:

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

1) Completed installation of a $250,000 fire suppression system in the headquarters building, cold storage rooms and the walk-in freezer (October).
2) Constructed an asphalt parking lot (70 × 225) to replace space lost to the construction of a new seed cooler (September).
3) Constructed a new seed cooler (20 × 50) to house the GEM Maize collection and expand our crop capacity (December).
4) Constructed a (50 × 75) addition attached to our machinery storage building to provide space for 12 new drying compartments, dried plant storage and additional machinery storage (November-present).
5) Upgraded fuel tanks and pads to meet current EPA guidelines December).
6) Replaced the Kool-Cel cooling system in GH-3 (June).
7) Installed trellis system in Entomology Greenhouse to support vegetable regenerations (March).

Purchasing:

Larry Lockhart coordinated all purchasing for the NCRPIS farm: this task included gathering and summarizing requests, writing specifications, and obtaining supplies for the farm, totaling approximately $84,000. Major purchases included the following:

1) Ford 350 Crew Cab Stake truck for bee project.
2) A JD Gator utility vehicle for general farm use.
4) A traveling irrigation gun.

5) A JD 445 Tractor for mowing.
6) Two double-door germinators.
7) Four Safety Cabinets for Pesticides and Flammable Chemicals.
8) Micro-Batch Seed Treater.

Tours:

This past year, we organized and conducted 35 tours. There were 440 visitors to the NCRPIS during 2001.

Staff Training:

We conducted three Tractor Safety training sessions and several Worker Protection Standard training sessions for the 42 new student employees and existing staff.

Future Plans:

The next year promises to be a busy year with several maintenance and construction projects already in progress:

1) Completion of machine shed expansion.
2) Completion of headquarters renovation project.
3) Purchase and install shelving in the new seed storage room.
4) Plan and design farm irrigation system with possible installation in 2003.
5) Development of needs assessment and design proposal for additional greenhouse capacity.

b. <u>Controlled insect pollination program (S. Hanlin)</u>

Progress:

<u>Cage pollination</u>: Pollinators were supplied to 847 cages for controlled pollination of 109 species. Honey bees were used to pollinate 607 accessions in the field. *Osmia* spp. were used to pollinate 178 Brassicaceae cages. *Bombus* colonies were used in 5 cages of ornamentals and 4 cages of Brassicaceae. A combination of blue bottle flies and house flies was used in 14 field cages of *Daucus* and 126 cages of Umbels in combination with honey bees. House flies and blue bottle flies were placed into 15 greenhouse cages of *Daucus,* a large cage containing *Angelica*, a cage containing *Staphylea*, a cage containing *Foeniculum* and an isolation chamber of umbels.

<u>Beekeeping</u>: Honey bees were over-wintered in the indoor wintering facility with a survival rate of 61% for the parent colonies and 16% for the nucleus colonies. These percentages are much lower than past years of 95% to 85% survival rate for the parent colonies and 56% to 52% survival rate for the nucleus colonies. Bee losses were observed throughout the state of Iowa with the losses being attributed to the long winter, large populations of *Varroa* mites throughout the prior summer and possible “bee paralysis” a viral disease transmitted by the mites. This winter, we placed 89 parent colonies and 161 double-story nucleus colonies in the over-wintering facility. All queens to be used for queen rearing will be selected in the spring or 2002 from surviving colonies.

In spring 2001, 125 two-pound packages of bees were purchased to replace the colonies and nucleus hives which were lost during the winter; 62 packages were placed into hives and 63 were placed into double story nucleus hives.

A new queen rearing technique was used throughout the summer which improved our queen production from 10 to 20 queens produced on a weekly basis to 50 to 60 queens.

Gallon plastic buckets used in the past were replaced with quart plastic containers; this allowed less overall syrup to be used during the summer by reducing the amount of syrup leakage. In addition the new containers also reduced the number of bees escaping and the possible occurrence of cross pollination if a container fell off of the hive. The new containers also reduced the amount of bees "robbing" or feeding on the leaked syrup and the chances of individuals being stung by free-ranging bees.

The mitacide "checkmite@ or coumaphos was used this year instead of Apistan strips for the control of *Varroa* mites. However, very few hives required treatment this fall due to the low populations of mites found in the hives. Half of the parent colonies and nucleus hives to be over-wintered were sampled for *Varroa* mites. One sampling techniques used consisted of the "powder sugar roll" in which 1 tablespoon of powdered sugar is placed into a jar with 100 bees that are randomly sampled from the hive. The jar is shaken, causing the mites to fall from their hosts and into the jar, they are then shaken on to a piece of white paper and counted. The bees were released from the jar and returned to the hive unharmed. A second sampling method used this year involved the uncapping of drone brood, removal of the larvae and examination of the larvae and cell for mites. Both of the sampling methods were used in order to determine that *Varroa* mites were either nonexistent or were lower than the reported economic threshold. All parent colonies and nucleus hives to be over-wintered were fed a total of four feedings of fumidal-B syrup during the fall. This treatment is for prevention of dysentery in the bees while in the over-wintering room.

Bombus: Four queens of *Bombus bimaculatus* were caught by our personnel at the Iowa Arboretum during the spring. By early summer, two queens had become established. Four additional "research" colonies of *B. impatiens* were ordered from a commercial supplier. All of the bumble bee colonies were used for controlled pollination this year, however, the colonies were weak or no longer alive by early fall.

I developed a Bombus key in order to facilitate our personnel's ability to distinguish between *Bombus bimaculatus* and *B. impatiens* species in the future.

The method for producing pollen balls used in the establishment of the wild queen colonies was improved. After using the original method of making the balls from bee pollen and corn syrup, they were dipped into melted bee's wax to coat them. The queens seemed to accept these balls much better and began forming their honey pots more readily than was observed when using the non-dipped pollen balls.

Megachile rotundata: No alfalfa leaf-cutting bees (ALC) were used this year to regenerate plant germplasm accessions. However, eighteen domiciles of ALC were used for a cooperative research project with Dr. Reid Palmer. Six domiciles were placed into cages of *Medicago sativa* and *Trifolium* sp. for a pollination study done by Heathcliffe Riday.

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

A new *Osmia* supplier was used this year; the bees were of lower cost and higher quality then from the source used in the past. Approximately 2200 bees were used to fill 549 straws in 2001. Because of the early warm spring, there was less increase of bees than in the past, and an additional number of bees will need to be purchased in 2002.

Musca domestica: House fly rearing continues in the entomology growth chamber. Two cages of house flies are presently maintained as production colonies to supply flies for pollination. The house flies were used in combination with blue bottle flies and honey bees for the pollination of *Daucus* and umbels in field, and in greenhouse cages of *Daucus*, *Angelica*, *Foeniculum* and *Staphylea*.

Cochliomyia macellaria: A single cage of blue bottle flies was maintained from January to October in the entomology growth chamber. On four occasions during the year, extra supplies of blue bottle flies were purchased from a supplier in Idaho. The flies were used in combination with the house flies and honey bees in field cages of *Daucus* and Umbels. These flies were also used in isolates and greenhouse cages of *Daucus*, Umbels, *Angelica*, *Foeniculum* and *Staphylea*. A colony will be started again in March to supply flies for greenhouse pollination.

Research:

For the third year, a comparison study between two different sized wood domiciles and PVC pipe domiciles was carried out at the Des Moines Water Works Park. Only two sizes were used rather than the original three because we found that the smaller sized domicile was not used by the *Osmia* as an increase domicile. The final test year's results showed that *Osmia* exhibited no preference between the PVC pipe and the wood domiciles.

For a second year, a comparison study was conducted using honeybees and two species of sunflower leaf cutter bee (*Megachile pugnata* and *M. apiculis)*. The three pollinator species were randomly placed into small cages containing either a cultivated species of sunflower or one of two types of wild species. (Because one of the cultivated lines used in 2000 was found to be self pollinating, a different line was used in 2001.) Several *Oenothera* plants were placed in the cages containing *M. pugnata* to assist in the formation of the egg cases. Because of problems during the introduction of the sunflower leaf cutter bees and the use of an incorrect straw size as an ovi-positioning site for *M. apiculis*, results were invalid in 2001 and the trial will need to be repeated in 2002.

A native pollinator study was set up in a corner of field J-1. The purpose of this study was to determine what types of native pollinators use the crops grown at the station to collect nectar and pollen and to determine if such pollinators could be reared under lab conditions. Twenty-one plant species were established in the plot either by direct seeding or transplanting. After flowering began, observations of insect visitation were made. Climatic conditions such as temperature, precipitation, wind, time of day and cloud cover were also observed and recorded. If an insect was observed to visit the plot on a regular basis, it was captured and placed in a sample container labeled with the date and type of plant it visited. All specimens were identified during the winter months. Based on either sight identification in the field or laboratory research, some of the specimens were determined to be difficult to rear and no further research action will be taken. However, several samples of *Bombus* and *Megachile* appear to have higher potential as pollinator insects which can be reared. This study will be continued in 2002 with increased emphasis on identifying the insects which possibly are of benefit as pollinators.

In order to lower the cost of using the blue bottle flies and to allow more accessibility on demand, a rearing method for promoting the production and collection of eggs was adapted from the techniques used by Dr. Muhammad F. Chaudhury of the USDA screwworm project in Panama. Some of the ingredients, such as spray-dried blood and spray-dried egg, used for the screwworm rearing, were changed to blood meal and freeze dried egg for our rearing. The rearing of these flies was successful. However, several times during the rearing, egg production declined. We suspect a nutrient

may be lacking in the adult diet. Further research will be done to address this issue and improve our rearing technique in 2002.

A comparison study between houseflies and blue bottle flies was done in greenhouse 3. The purpose of the study was to determine if one fly species was more efficient as a pollinator of Umbelliferae or if both insects were comparable as greenhouse and field pollinators. Several problems arose during the summer and only two accessions of *Ammi majus* were used in the cages. Consequently next year, we will continue this study with the addition of a wider variety of plants and a better constructed greenhouse cage.

Another experiment was conducted to determine if nucleus hive placement could be changed to reduce the problem of bees escaping and the possibility of cross-pollination. Nucleus hives were placed completely into the cage rather than partially in. The projects chosen to test this method included fifteen cages in the flax field and nine cages in the sunflower pollination study. Hives were placed into the northwest corner of the cage; entrances to the cages were oriented at the north end rather than the south for easier access to the hives. After a complete summer, we determined that complete enclosure of hives inside the cage was not a practical method. The hives were more difficult to feed and the bees were more easily annoyed. Moving the nucleus hives in and out of the cages was more difficult than partially placing hives inside, and the process required an additional individual to hold the entrance open. Use of this method will not continue, except in the large sunflower cages. In addition, the leakage problem was solved by the use of the new quart feeding containers.

Cooperation:

A cooperative study was carried out in July - August with Dr. Reid Palmer. The purpose of the study was to observe the attractiveness of soybean flowers to alfalfa leaf cutter bees. Eighteen domiciles were placed around the sides of the soybean test plot. Dr. Palmer made all plot data observations. The NCRPIS entomologist supplied all insects needed in the project and the expertise for determining needed colony/domicile numbers.

Several meetings and discussions with Susan Stieve and Dr. David Tay of Ohio State University have been held regarding the types of pollinators needed for regeneration of ornamentals in Columbus, Ohio. In addition to technical advice, assistance was provided by building of pollination domiciles for the project, including nucleus hives, *Osmia* and *Bombus* domiciles.

During February, assistance was given to Lee Matteson a graduate student in horticulture; he was supplied with a contact name in order for him to purchase a “research” *Bombus* hive for the pollination of raspberries in the greenhouse. NCRPIS staff supplied pollen balls used in the initial feeding, instructions on pollen ball production and a small amount of honey bee pollen for additional feedings.

A cooperative study was carried out during the months of July through August with Heathcliffe Riday, an Agronomy Dept. graduate student. Eight cages containing legumes (clovers and alfalfa) were supplied with alfalfa leaf cutter bees and honeybees. The purpose of this study was to determine if there was a difference in the quality of pollination obtained by each type of bee based on a preference of flower colors. Heathcliffe made all observations and collected all data; the entomology staff supplied the bees.

Jeremy Heath, an entomology undergraduate, was supplied with a small amount of honey bee pollen for the purpose of rearing corn pests. Jeremy was later supplied with greater wax moth larvae, which were used for rearing spined soldier bugs, used for biological insect control of corn pests.

On July 23 and 24, local beekeeper John Lowenburg worked with the bee crew to obtained experience in the rearing of queens and production of nucleus hives. John was a participant in the Iowa Honey Producers' field day and had requested additional hands on knowledge.

Presentations:

On July 21, the Iowa Honey Producer's Association had a summer workshop at the NCRPIS. The bee staff taught a queen rearing workshop and spoke during the field tour on how various pollinators are used for germplasm production.

On August 6, a presentation was given to ACPC (Ames Community Preschool Center) on the different types of insects. Discussion topics included benefits and problems related to insects and facts about insect behavior.

On April 24, NCRPIS staff met with Ken Walter, a groundskeeper at the Iowa Arboretum, who was interested in building *Osmia* domiciles and their placement for the collection of bees. The discussion consisted selection of materials for domiciles, contacts to obtain bees from and domicile placement for greatest increase. Several times after this initial meeting, Ken has contacted the staff for further advice.

2002 Research plans:

The sunflower pollination comparison study using *Megachile pugnata*, *Megachile apiculis*, and honey bees will be continued. Last year the suppliers of both *M. apiculis* and *M. pugnata* sent the bees too late in the season and they failed to emerge during the blooming of the sunflowers. Also, straws used to collect *M. apiculis* were much smaller than the ones we have been using. To prevent these problems from reoccurring, contact will be made with suppliers in January and April to assure that we receive the bees in a timely manner. We will obtain smaller straws and hopefully be able to increase these bees ourselves. I will contact the Iowa Department of Agriculture and Land Stewardship, as requested by the Logan, UT USDA-ARS bee lab, to assure that we do not introduce a non-native species.

We plan to continue cooperating with Dr. Reid Palmer and assist in determining the relative attraction of *Megachile rotundata* to male sterile lines of soybeans. We also hope to derive benefit in observation of other possible pollinators through the observation work of Dr. Palmer and his graduate student in Texas. Sample identification and researching possible rearing techniques will be done by NCRPIS entomology personnel; all field observations will be made by Dr. Palmer's personnel.

To continue the native pollinator study: accessions used in the field in 2002 will be repeated from 2001, and we will continue to observation the same variables. The staff will try to collect more information on the insects (several species of *Bombus* and *Megachile*) which showed the most probable benefit as pollinators and determine the possibility of rearing these insects. Identification of additional insects which were not observed and/or sampled during the summer of 2001 is sought. The USDA-ARS "Bee Biology and Systematics Lab@ in Logan, UT will be contacted for assistance in the identification and rearing process.

Research will continue to focus on improving blue bottle fly diets. In order to improve egg production, we will try additional diet materials to find necessary nutrients which are lacking.

Research will be done to determine possible pollinators for the greenhouse, specifically for *Cucumis* and *Cucurbita*. In addition to identifying new pollinators, an improved cage system needs to be established for use with trellised plants. The pollination program will work in collaboration with the vegetable program to identify solutions for both of these issues.

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

Progress:

The Office of Inspector General's (OIG) evaluation in April indicated that our server had no high security vulnerabilities, eight medium security vulnerabilities, and 422 low security vulnerabilities. The medium vulnerabilities were all fixed with one exception. The remaining medium vulnerability and all low vulnerabilities were a function of the Windows NT operating system and supporting software and therefore could not be remedied. Since the OIG's evaluation, we have moved to a Windows 2000 Server. The Windows 2000 server has not been scanned with the same software that was used for the OIG visit. However, we are confident that we have no high vulnerabilities and few, if any, medium vulnerabilities due to our own efforts to resolve security issues.

A new Gateway server was added to our inventory. This server has dual 1000 MHz processors. Windows 2000 Server has been installed on the new system as an organizational unit under the Iowa State University Agronomy Windows 2000 organization unit.

Data storage on our server increased dramatically. A second Mammoth 2 tape drive was purchased to meet data storage needs during backup.

A hardware firewall has been purchased. We have been working with Iowa State University to determine the most effective way of configuring and incorporating the firewall into our system.

We purchased five new workstations, one of which is a laptop with docking station. Memory was added to several other workstations.

We purchased seven Compaq IPAQ handhelds and one Itronix handheld for field data entry and calendar scheduling. Two of these handhelds included barcode readers.

Two Ethernet jacks were upgraded to 100 Mbps. These jacks were upgraded to assist with large file transfers during the 2001 station review, and have substantially improved the quality of electronic presentations given in our conference room on a routine basis.

A 100 Mbps Cisco microswitch was purchased to assist with file transfer between the computers that are used for imaging.

Digital imaging of NCRPIS accessions was greatly increased in 2001. The purchase of two new digital cameras and additional larger capacity memory cards has aided in this endeavor.

As Intranet pages are updated and added they are being done in a manner to enable users with disabilities the ability to utilize the pages, a requirement of Section 508 of the Workforce Rehabilitation Act.

Several of us have experimented with the Release Candidate of Windows XP Professional. We noted many benefits in this operating system therefore we have since upgraded several of our systems to Windows XP Professional.

Several of us have reviewed Microsoft Project 2000 for the purpose of tracking projects and determining cost of various NCRPIS operations. We hope to implement MS Project in 2002.

Additional major software purchases included:

- Microsoft Project (10 licenses)
- Microsoft Office XP (45 licenses)
- Microsoft Exchange Server 2000

Adobe PhotoShop (16 copies)
Adobe Acrobat (17 copies)

The NCRPIS computer intern has continued to work on the image database and weather database.

The in-house Archive and Imaging Committees recommended that an intern be hired to assist with archiving historical documents.

Plans:

We will work with Iowa State University on a continuing basis to ensure that our firewall is configured to protect our systems efficiently and effectively while still allowing communication with the ISU network.

We are considering upgrading our internal network to 100 Mbps transmission. An upgrade to 100 Mbps could assist several users while working with large image files; Iowa State University charges $15.00 per jack per month for the 100 Mbps connections as compared to $7.00 for a 10 Mbps connection.

We will be incorporating the GEM Project team into our computer structure. Considerations in the GEM area include the SCA upgrade of the PRISM software, the possible addition of a PRISM database license to NCRPIS, the addition of email mailboxes to our email server and the transfer of the GEM Project's Internet WEB site (which requires a substantial amount of space) to the NCRPIS servers.

A second Windows 2000 Server will be added to the NCRPIS computer structure. This server will include an Oracle database.

The NCRPIS Horticulture team and the NCRPIS curatorial team have expressed an interest in adding WEB based forms for reporting information back to the NCRPIS. We will be looking at this possibility with system security considerations in mind.

d. <u>Seed Research and Computer Application Development (D. Kovach)</u>

Seed Research:

This year I worked in cooperation with Cindy Clark of the Vegetable Project on seed increases for two *Angelica* accessions. Seed increases were very successful for one accession. This work involved vernalization treatments to induce flowering as well as trying a GA_3 treatment to substitute for vernalization - the GA_3 treatment proved to be unsuccessful.

I also began experiments on viability of *Cuphea* seed originally stored in our cold room that was then moved to the freezer. This was to test the possibility that some accessions of *Cuphea* are damaged by dry storage at below-freezing temperatures. The National Center for Genetic Resource Preservation (NCGRP), formerly known as the National Seed Storage Laboratory (NSSL), suspected this to be the case, as their freezer-stored seed was significantly less viable than was our cold-stored seed. Test results, both from our Station and NCGRP, revealed that some accessions may be susceptible to below-freezing temperatures. The majority of this work is being done by Dr. Chris Walters and Jennifer Crane of NCGRP.

This year I also conducted some germination tests on several *Erysimum* accessions for Rick Luhman, the *Brassica* curator. In one test, three of these accessions were originally tested at constant temperature and had an average germination of 4%. The seeds were retested using an alternating temperature regimen (20°C, dark, 10 hrs; 30°C, light, 14 hrs) for 21 days and the same regimen with the addition of a 4-week prechill (4°C) treatment with 1mM solution of GA_3. The alternating temperature regimen improved

germs to an average of 37%. The addition of the prechill improved germs to an average of 68%.

Germination and TZ tests were conducted on several *Chenopodium quinoa* accessions for David Brenner, Amaranth curator. This was to determine the viability of original seed samples donated to the station that had not responded to normal germination tests. Germination and TZ tests showed no viability for these accessions.

Near the end of last year, I began working with the Seed Infestation Prevention Committee (SIPCO) and individually with Sharon McClurg, Agricultural Science Research Technician (Insects), and David Brenner on literature searches and an experimental design for documenting and controlling Chalcid infestations in Coriander seed. Work is in progress on this project.

Computer Application Development:

I continue to use Oracle Developer software to develop many forms and reports. Although this product is still very useful, the vendor is focusing its attention on the Java programming language, as evidenced by recent product releases. In order to anticipate a probable complete switch to Java by Oracle, I started learning the Java programming language. Although Java is reportedly simpler than other programming languages, when interfacing to relational databases, it becomes quite complex. I may require formal training on this subject in order to become proficient in developing forms and reports with Java.

New forms and reports developed this past year were related to:

- Annual Statistics for Station (used for annual reports)
- Flax Seed Harvest Data Entry
- Flax Observation Data Entry
- 2" x 2" Packet Labels
- New Pathogen Data Entry
- Germination Test Data Transfers (to utilize NCGRP data)
  Status and Distribution Quantity Update (based on germination results)
- NCGRP Low Germinations
- Inventory Group Creation
- Nomenclature Change Monitoring (monitors taxon changes related to NC7 accessions)

Enhancements to previously developed forms were made as requested by users.

This past year I took over responsibility of our station’s internet site. This included reconstructing the site in hopes of creating greater aesthetic appeal and user friendliness. Our site is located at: http://www.ars-grin.gov/nc7/

Inter-Site and GRIN Database related:

I worked with Dr. Quinn Sinnott from the Data Base Management Unit (DBMU) and Julie Fleming of NCGRP to attempt to incorporate NCGRP germination protocols into the GRIN database. We still await action by DBMU before further progress can be made.

Additionally, I worked with Ornamental Plant Germplasm Center (OPGC) personnel in answering questions related to their barcode equipment purchases. In 2002, I plan to visit the OPGC to help set up equipment and software.

Equipment and facilities related:

A new precision seed counter was ordered. After researching several manufacturers' seed counters, a product from the Netherlands was determined to be the best in regards to accuracy.

AutoCAD plans were drawn to assist the Greenhouse Committee in determining station needs and relate those needs to greenhouse design. I also drew plans for the Security Committee for security fencing.

Supervision:

One of our Biological Science Laboratory Technicians, responsible for organizing and conducting seed germination tests, moved to Ohio last summer. This year, we re-advertised the position and will hire a replacement in early 2002.

EEO/HRM/CR and Personal Development:

I arranged for a 3-part seminar on Workplace Violence Prevention entitled 'Mobbing: Emotional Abuse in the American Workplace'. This seminar was presented by Dr. Noa Davenport of DNZ Training International on July 10, 16, 24, 2001 at NADC. http://www.dnztraininginternational.com/

This work involved requesting and obtaining funding for the seminar from Ames Area ARS Civil Rights Advisory Committee. I coordinated scheduling and conference space with Dr. Davenport and Pat Turner of the National Animal Disease Center.

This past year a new Category 3 Scientist position with the position title of Agronomist was created for the station. I was fortunate to be hired to fill this position.

Seminars, Trips, and Other Training:

I attended the 23rd Annual Seed Technology Conference (February 20, 2001) presented by the Iowa State University Seed Science Center, Ames, IA. The topic was: Working with Biotech Seeds: Understanding, Regulation, and Testing.

Plans for 2002

My plans for 2002 include attending a conference this spring on databases and application development tools. This will aid me in installing the latest version of our database software and in learning how to use the development tools of new Java-powered forms.

This year includes work on the seed infestation prevention project, new installation of an Oracle database, continued development of forms and reports for station personnel needs, learning the new Oracle development tools, providing yearly statistics and specially requested statistics, training of the new Biological Science Laboratory Technician, assistance (as requested) to the personnel at the Ornamental Plant Germplasm Center, continue efforts in working with NCGRP and DBMU to get germination protocols on GRIN, continued maintenance on the station's internet site, and providing computer aided drawings for facility improvement as needed.

e. Information Management: Germplasm Program Assistant (R. Stebbins) Germplasm Collections

***Acquisition*:**

The North Central Regional Plant Introduction Station (NCRPIS) acquired 1058 new accessions in 2001. Of these new accessions, 832 were received from within the National Plant Germplasm System (NPGS). The majority of these came from the National Center for Genetic Resources Preservation (NCGRP) in Fort Collins, Colorado. Included in this NPGS group were 636 accessions of *Zea mays* subsp. *mays*.

The remaining 226 accessions, received from outside the NPGS, included 51 accessions of *Daucus*, 46 accessions of *Amaranthus*, 35 accessions of *Zea mays* subsp. *mays*, and 35 accessions of ornamentals. As new accessions are recorded in 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, 159 accessions received taxonomic re-identifications. Among these were 57 accessions of *Amaranthus* and 41 accessions of umbels. Also, 217 accessions were nominated for inactivation, including 170 accessions of *Cuphea*.

Additionally, 481 accessions were assigned PI numbers. Included in this group were 258 accessions of *Zea mays* subsp. *mays* and 102 accessions of *Cucumis sativus*.

Finally, 4 accessions were inactivated due to duplication. The inventory lots of these accessions were combined with the lots of their respective duplicates. This group included 3 accessions of *Amaranthus* and 1 accession of *Cuphea*.

Projects:

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

One of my projects involved working with Mark Widrlechner to prepare 37 accessions of ornamentals for PI number assignment. Any errors in GRIN were corrected, and reports were printed for a final check before requesting PI numbers. I also worked with Kathy Reitsma to update the passport data for 143 accessions of *Cucumis* in preparation for PI number assignment. Finally, passport data for 489 accessions of ornamentals were proofed and corrected in preparation for transfer to the Ornamental Plant Germplasm Center in Columbus, Ohio.

Working together with Rick Luhman, we completed the bulking of 55 *Brassica* accessions which were determined to be similar and thus combined to form 14 new accessions. We also performed separations on 72 accessions of *Panicum* and *Echinochloa*, forming 36 new accessions of *Brachiaria* and 35 new accessions of *Echinochloa*.

Latitudes and longitudes were added for 447 accessions of *Cucumis* from India which had been assigned PI numbers at the end of 2000.

Cultivar names were updated for 13 accessions from the Natural Resources Conservation Service, which were previous donations to the NPGS.

GRIN records were re-created for 7 accessions of *Zea mays subsp. mays* donated by Dr. Henry Shands.

I began entering old passport data from early Ames numbered accession logbooks. This project involves approximately 8000 accessions and is roughly 25% complete.

I collected data regarding taxonomic information in GRIN for the Medicinal and Nutriceutical Plants committee. This originally involved around 1600 species, although work in this area continues to expand.

New procedures were developed for curators to use when requesting PI numbers. These procedures should improve the quality of NC7 accessions receiving PI numbers.

I coordinated communications with 8 foreign and domestic seed banks to request seed of a wide range of genera.

I served as secretary of the Computer Committee. The committee is responsible for maintaining a modern and efficient computer system which includes budgeting, planning, repairing, and purchasing.

I participated on the selection committee for the Seed Germination Technician.

I worked with Mary Brothers and Lisa Burke to produce one section of the presentation given during the Station's External Review in April. I also scanned, shot, and edited several pictures used during many sections of the review presentation.

I had the opportunity to work outside a few days in 2001. I spent one day helping the *Brassica* crew transport cage frames to the field. I helped the GEM project drive sign posts in preparation for their Field Days. I also worked with the GEM project for two days collecting field data.

I processed outgoing seed orders for several weeks while Linda Minor was on extended medical leave. Our farm receptionist, Cindy McCutcheon, was also on sick leave during part of this time. I performed some of her duties as well, including mail delivery and phone management.

Conclusions:

Compared to 2000, new accessions received at NCRPIS were up by 721 in 2001, an increase of 214%. In maintenance areas, re-identifications were up by 49%, nominations to the inactive file were up by 23%, PI number assignments were down by 35%, and duplications were down by 97% compared to their 2000 levels.

All figures for acquisitions and maintenance were below the six-year average, with the exception of PI number assignment, which was 23% above average.

Site Crop	New Accessions	PI Numbers Assigned	Re-Identified	Inactivations
NC7-amaranth	46	40	57	3
NC7-asters	1			
NC7-brassica	16		3	
NC7-celosia	2		1	
NC7-chicory			1	
NC7-crucifers	3		5	
NC7-cucumis.cucs	1	102		6
NC7-cucumis.melo	14	41	1	
NC7-cucumis.wilds			1	
NC7-cucurbita	1			1
NC7-cuphea		1		170
NC7-daucus	51		13	
NC7-echinochloa	35		6	
NC7-euphorbia	1			
NC7-flax.wilds	2		3	
NC7-legumes	4			
NC7-maize	676	258		
NC7-maize.wilds		1		
NC7-melilotus	2			
NC7-ornamentals	36	38	18	6
NC7-ornamentals.p	32			
NC7-parsnips				9
NC7-perilla	1			
NC7-quinoa	1			1
NC7-spinach	24			14
NC7-sun.cults	28			
NC7-sun.wilds			1	
NC7-transfers	36		8	
NC7-umbels	45		41	11
Totals	**1058**	**481**	**159**	**221**

f. Order processing (L. Minor)

During 2001, there were 943 orders entered into GRIN. A total of 19,254 packets were distributed to requestors and evaluators throughout the world. Of the total packets distributed, 24% of these were sent to foreign requestors.

The number of orders entered into GRIN in 2001 was ca. 6% greater than that of 2000. The number of requests received electronically this year was 550, also an increase of ca. 6% over 2000. In contrast, packet distribution was down by 9,141 or ca. 32%. This decrease can be attributed to a single evaluation study conducted in 2000 that examined more than 10,000 maize accessions.

We distributed 339 Initial Accession Performance Report forms in 2001. By the end of the year, 233 (69%) had been returned. The Summary Accession Performance Reports and Final Reports that were mailed out in 2001 totaled 300. Of these, 148 (49%) have been returned. The return rate on the Initial Accession Performance Report forms remained nearly the same as that of 2000.

g. Seed Storage (L. Burke, M. Arnold, M. Block)

In 2001, 3177 lots were stored, including both newly received lots and those either regenerated at Ames or at remote sites. A large storage project involved material from the St. Croix nursery. We created 446 bulk lots from previously stored and recently regenerated St. Croix lots. These are necessary to retain the largest possible population given the amount of seed available for increase from NCGRP. Balanced samples were combined and all lots with 100+ ears in the sample were sent to NCGRP for backup (89 accessions). Inventories of 7173 lots were reviewed to ensure accuracy of seed amounts, and new labels were printed for lots with outdated labels. We prepared 471 original lots for long-term freezer storage.

Seed orders prepared in 2001 included distribution, observation, germination, transfer and backup orders. There were 986 lots (897 accessions) sent to the National Center for Genetic Resources Preservation (NCGRP) for backup. Backup lots were either accessions new to NCGRP or supplemental lots for previously supplied accessions. We distributed 19,254 packets to meet distribution and observation requests. Of these, 14,569 were distributed domestically and 4,685 outside the U.S. We transferred 51 accessions (88 lots) to other NPGS sites.

Major projects for 2001 included: continued the prepacking program for *Amaranthus*, *Chenopodium* and *Celosia*; reorganized the supply area and moved maize extra-seed boxes to accommodate the fire suppression system; reorganized cold room to make space available for temporary use by the GEM Project; reorganized inactive file for ease of use; moved all the NCGRP extra seed bags to storage boxes; re-evaluated all maize lots on holding shelves and finalized their deposition; began work on large PI-number assignment project for maize, checking passport data against information on INIFAP DB and CIMMYT DB (completed 255 of 800+ accessions); and compacted jars on shelves as count reviews progressed.

Training for 2001 included CPR/First Aid re-certification (Lisa Burke); Blood Borne Pathogen re-certification (Lisa Burke); ISU courses Genetics, Agriculture and Biotechnology and Introduction to Plant Breeding (Lisa Burke); USDA ARS IT Security Awareness course (Mary Arnold and Lisa Burke); USDA Supervisor training (Lisa Burke); 10th Annual ALT Symposium (Mary Arnold); Mobbing Seminar (Mary Arnold and Lisa Burke); and fire extinguisher training (Mary Arnold).

In 2001, 159 accessions received taxonomic re-identification. All affected seed samples were re-labeled by seed storage personnel. In addition, seed samples of 221 inactivated accessions were removed from the active collection and placed in inactive storage. PI numbers were assigned to 481 accessions with Ames numbers. New labels were made and cold storage locations and GRIN records were adjusted to reflect these changes. Four accessions were identified as duplicates, and appropriate changes were made to those packets, to their locations and to GRIN.

Inventory actions	Lot activity	Order activity	Packets
NCGRP backup	986	Distribution + Observation	19254
Stored	3177	Domestic	14569
Count reviewed	7173	Foreign	4685
Lots prepared for freezer	471		
Inactivation	221		
Taxonomic re-identification	159		
Duplications resolved	4		
PI number assignment	481		
Transferred accessions	51		

One full-time permanent federal employee (Lisa Burke), one full-time temporary federal employee (Mary Arnold) and one part-time (Mary Block, 20 hours/week, nine months/yr) state employee staffed the seed storage department in 2001.

VII. Curatorial and Scientific Team Reports

a. Entomology (S. McClurg)

Progress:

Field

Maize - European corn borer evaluations in Ames: Seven hundred thirty-five maize accessions were evaluated for leaf-feeding resistance to first-generation European corn borer for curator M. Millard. Twenty-seven accessions were rated as resistant.

Sixteen accessions of Native American maize were tested for Deb Muenchrath (Iowa State University) in a replicated trial for first-generation European corn borer resistance.

Digital photos were taken of representative field plants rated on the 1 to 9 leaf-feeding scale for a graphical rating guide for future first-generation European corn borer evaluations.

Sunflower - Thirty-six accessions of cultivated sunflowers from the core collection were evaluated for resistance to sunflower moth in the field in Ames for curator M. Brothers. Data collection is in progress. I am investigating revisions to the current rating method in order to reduce time required for data collection.

Statistical analysis of year 2000 data from the replicated retest of forty-three accessions of cultivated sunflowers previously reported as resistant to sunflower moth is in progress.

In cooperation with S. Hanlin, M. Brothers, and I. Larsen, three accessions of sunflower were to be evaluated for effectiveness of pollination by three bee species, including two species of sunflower leafcutter bee, in a replicated field test in Ames. The test plot was planted and bees added to cages. Inadequate populations of leafcutter bees emerged from nesting straws, so data were not collected.

Mixed Genera - In cooperation with S. Hanlin, K. Reitsma, C. Clark, M. Brothers, I. Larsen, M. Widrlechner, P. Ovrom, R. Luhman, S. Bruner, L. Burke, and S. Wike, planted and observed 20 accessions of mixed genera for floral visits by native insect pollinators in the field in Ames. Weather data and insect specimens were collected on *Agastache, Pycnanthenum, Monarda, Ocimum, Melilotus, Coriandrum, Anethum, Brassica, Sinapis, Eruca, Matthiola, Hesperis, Linum, Helianthus, Zinnia, and Tithonia*. Literature search on tachinid fly rearing was initiated.

Laboratory

Coriander - In cooperation with D. Brenner, K. Reitsma, M. Widrlechner, D. Kovach, L. Burke, C. Gardner, and S. Hanlin determined initial observations and tests that D. Brenner, D. Kovach, and I could perform on 2001 Ames field increase seed lots to determine the extent of seed chalcid infestation present in coriander curated by D. Brenner. Data collection on 9 accessions is in progress.

Rearing - A colony of sunflower moths is being maintained at NCRPIS in order to provide sufficient numbers of insects for the field and laboratory evaluations.

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

In cooperation with S. Hanlin, researched and developed a protocol for rearing blue bottle flies for use as pollinators of mostly umbel-type plants in field and greenhouse cages. These flies were reared during the spring and summer.

Data Archiving

Brassica - Data from 1,418 *Brassica* accessions that were evaluated for green peach aphid damage in the greenhouse in Ames from 1993 through 1997 were provided to curator R. Luhman for assessment prior to entry in the GRIN database. The greatest resistance was noted in twelve accessions of *B. juncea*, *B. rapa*, and *B. napus* originally from Turkey, India, Pakistan, and South Korea.

Data from 1,659 *Brassica* accessions that were planted in the field at Hermiston, OR with the cooperation of Gary Reed (Oregon State University) from 1997 through 2000 were provided to curator R. Luhman for assessment prior to entry in the GRIN database. R. Wilson had evaluated the plants for damage by natural populations of cabbage aphid. A high level of resistance was noted in eleven accessions, primarily *of B. juncea* originating in India and Pakistan.

During the fall, 2001, I initiated a search for a basic statistical analysis program to replace DOS-based MSTATC and as an alternative to pcSAS. In cooperation with D. Kovach, M. Millard, R. Luhman, C. Block, C. Gardner, M. Brothers, S. Hanlin, M. Widrlechner, and P. Ovrom, various trial programs were tested. I selected StatMost as a program worthy of further trial.

Other Activities:

During the summer, 2001, I took a Molecular Biology Laboratory Techniques class (Iowa State University course Zoology 542A) to enable me to assist NCRPIS curators in the area of molecular marker research as needed.

During the past year I served as the secretary of the Image Archive committee.

Plans for 2002:

I will continue host-plant resistance evaluations in the field, laboratory, and greenhouse with the collaboration of NCRPIS curators and appropriate cooperating scientists from other ARS units. These evaluations include: reaction to first and second-generation European corn borer and corn earworm in maize, sunflower moth in cultivated sunflower, *Lygus* bug in amaranth, and green peach aphid in *Brassica*. We have one final year of field evaluation of cabbage aphid resistance in *Brassica* in Oregon.

I will continue to process, archive and make data publicly available from past evaluations.

I will continue support activities for the NCRPIS insect pollinator program, assisting in the rearing and placement of bees and flies, as well as providing cooperation in pollinator studies proposed by S. Hanlin and NCRPIS curators.

I am looking forward to the addition of a federally-appointed student employee to assist in insect rearing.

b. Horticulture (M.P. Widrlechner, P. Ovrom)

Germplasm Collections

Acquisition: During 2001, we received 69 new accessions of ornamentals (Table 1). The largest groups were 16 accessions received from an exploration to the Russian Far East, led by Alan Whittemore of the National Arboretum, and 9 accessions obtained through Indices Seminum. In 2001, we also re-obtained five ornamental accessions that had been nominated for inactivation.

Maintenance:

Availability:

During 2001, approximately 44% of the ornamental collections and 49% of the mint family plants were available for distribution (Table 1), figures similar to those reported in 2000 (41 and 50%).

Back-up:

Approximately 33% of the ornamental collections and 48% of the mint family plants are duplicated at NCGRP (Table 2), figures similar to those reported in 2000 (29 and 48%).

Regeneration:

Regeneration efforts continued at the levels established in 2000. The harvests listed in Table 2 include 74 successful cage increases and 30 woody ornamental seed increases. There were also 29 accessions of woody plants established from seeds. These numbers are about 60% of the record levels achieved in 2000. In addition, 12 shrub accessions were transplanted to the field to be increased under large cages in 2002.

Viability Testing:

In 2001, 72 ornamental and 53 mint-family accessions were tested for germination (Table 2), bringing the total number of active, ornamental accessions tested in-house to 663 (27% of the collection).

Distribution:

As summarized in Table 3, during 2001, 671 “order items” included all the distributions for the NC7 Trials (described in the following section), along with 10 plants, 50 cuttings and 518 packets of seed, which were distributed to fulfill other requests for ornamental plant germplasm. In addition, 42 seed packets were distributed of mint family germplasm. The 518 packets of ornamental seeds are the most that have been distributed in a single year. This group encompassed 39 genera; those most in demand were: *Echinacea* (272 packets), *Zinnia* (76 packets), *Sanvitalia* (45 packets), and *Spiraea* (15 packets).

Historical Summary of Distribution Activity:

Crop	Years	No. of Orders	No. of Recipients	No. of Items Distributed	No. of Accessions Distributed
Ornamentals	97	85	69	520	269
	98	92	84	531	234
	99	92	83	658	272
	00	84	79	596	282
	01	94	85	671	365
Mint Family	97	3	3	33	18
	98	10	10	85	47
	99	3	3	8	8
	00	3	3	37	35
	01	5	5	42	42

Characterization/taxonomy:

During 2001, the draft descriptor list for *Echinacea* was refined and a data collection completed on the three-year cage field. These data were used to help verify taxonomic identifications. The initial data set has been proofed, and the descriptor list was submitted in November for review and approval by the New Crops Crop Germplasm Committee. Approval of the descriptor list will enable loading of an extensive data set into GRIN in 2002, which will allow the research community to gain a better understanding of our collections and increase the efficiency of their use in research.

All other herbaceous ornamentals in the cage-increase field, and many of the tree and shrub accessions being regenerated, were checked to verify identifications. In all, 18 accessions were re-identified. During 2001, with the assistance of Robert Stebbins and Paul Ovrom, 116 images of ornamentals were added to our local database (see Table 4), bringing the total number of ornamental images to more than 400. These will be loaded to GRIN in the coming year.

Evaluation:

Results from flooding and drought evaluations conducted during June and July 2000 on five *Betula* and four *Alnus* species were prepared for publication and loading into the GRIN database. The publication will appear in print early in 2002 and loading these data should also be completed at that time.

The following evaluation data (see Table 4) were received from NC-7 Trial Site Cooperators and loaded to our Internet database (described further in the section “Coordination of the NC-7 Regional Ornamental Trials”).

Reports of planting (12 accessions distributed in 2001): ca. 1530 data points

One-year reports (12 accessions distributed in 2000): ca. 945 data points

Five-year reports (7 accessions distributed in 1996): ca. 600 data points

Ten-year reports (8 accessions distributed in 1991): ca. 690 data points

Enhancement:

There was no major progress to report with enhancement activities in 2001.

Coordination of the NC-7 Regional Ornamental Trials:

Plant Distribution - In 2001, 722 plants of twelve accessions were distributed to 26 sites for long-term evaluation, with an additional 172 plants provided to arboreta and botanic gardens.

Many of the tree and shrub seed collections made in September 1999 in Ukraine are being germinated and cultivated for long-term testing in the NC-7 Trials, with two overall goals: finding well-adapted, new landscape plants for the North Central Region and testing scientific hypotheses about the relationships between soils, climates, vegetation patterns and woody plant adaptation. The first two of these accessions were distributed to Trial Sites in 2001.

In May 2001, Paul Ovrom delivered plants and met with cooperators at three sites in Kansas and two in Nebraska. In all, 176 plants of 12 accessions were delivered.

Computer-generated, "One-, Five-, and Ten-year Performance Report" forms were distributed to trial-site cooperators this spring. Six updates were emailed or sent to trial cooperators in 2001 to inform them about recent developments in the testing program. One of the major developments that links us more closely to trial sites is the existence of our NCRPIS home page. Paul Ovrom continues to expand our web site by posting trial results, images of trial plants and other information about the trials on the Internet. Evaluation results for plants distributed in 1984-90 and descriptions of all plants distributed for testing between 1990-2002 are now available through this site. Our web site was featured in an article in Organic Gardening magazine in October. Paul also published an article describing eleven of the best performing plants from the Trials in Landscape Plant News.

Germplasm activities in crops other than those curated:

Various requests for accessions with special horticultural or agronomic characteristics were handled by Mark Widrlechner, resulting in the distribution of 39 packets of seed.

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

Mark Widrlechner and Lisa Burke (with much help from Station personnel) wrote a paper that presented analyses of germplasm distribution patterns for the period 1988-1999 for ten major NCRPIS crops. This study demonstrated ways that demand statistics can be used to refine managerial strategies for germplasm regeneration and maintenance. The paper was recently accepted for publication in Genetic Resources and Crop Evolution.

In his role as Co-major Professor, Mark Widrlechner continued to guide Amalio Santacruz-Varela in a research project to elucidate patterns of genetic and morphologic variation among New World popcorn germplasm. Amalio completed his research and successfully defended his dissertation in 2001 and is now preparing his results for publication.

Throughout 2001, Mark Widrlechner actively participated in a university-industry-ARS collaboration to establish the Ornamental Plant Germplasm Center (OPGC), a new National Plant Germplasm System site in Columbus, Ohio, which will focus on the conservation of herbaceous ornamental genera. He serves as the Agency's representative to administer a Specific Cooperative Agreement between ARS and The Ohio State University to fund the OPGC and has been assisting the new OPGC Director and Curator in their efforts to establish the Center and integrate it with the NPGS.

Mark Widrlechner chaired an in-house committee on medicinal/nutriceutical plants, and assembled (with Robert Stebbins' assistance) a database that lists species used in traditional medicine and as nutriceuticals and displays NPGS's holdings for these species. During 2002, we plan to mine this database for information that can be used to develop collection priorities for NPGS and our Station.

Mark Widrlechner's other research and training activities:

Collaborations continue with Welby Smith of the Minnesota Department of Natural Resources in preparing a treatment of *Rubus* for a new book on the woody plants of Minnesota and with the staffs of herbaria at the University of Wisconsin, National Arboretum, and Ohio State University to identify and document their *Rubus* collections.

Mark Widrlechner's presentation analyzing the geographic distributions of non-native woody plants known to be established in Iowa in relation to climatic analogs was accepted for publication in the Journal of the Iowa Academy of Science and will be published early in 2002. As a follow-up project, Jeff Iles, of the ISU Horticulture Department, and Mark analyzed the native ranges of non-native woody plants not known to naturalize in Iowa in relation to the ranges of those species that are known to naturalize. From this analysis, they were able to develop a geographic risk analysis that should be useful in quantifying the risk of invasiveness of new introductions. The results of this work were recently accepted for publication in the Journal of Environmental Horticulture.

Together with colleagues at Iowa State University, Mark Widrlechner continues to assist in the documentation of the flora of Ames and its dynamics by verifying the identification of woody plants and by making field collections, often in the vicinity of the Plant Introduction Farm, a potential introduction source for exotic plants. A paper describing the flora of Ames was published this year (see below), and another publication resulting from this work on the dynamics of the flora has been accepted by the Journal of the Iowa Academy of Science. A third paper resulting from this work, describing the characteristics of the "lost" and "found" species in Ames over time is being prepared for the journal Conservation Biology.

Other Horticultural project training and staff development activities:

Paul Ovrom attended the Woody Landscape Plant CGC held in Ames in June and gained valuable insights on the role that the CGC plays in advising NPGS woody crop curatorial staff. And as part of a project to foster increased understanding of plant propagation techniques and research in landscape plant development, Paul was selected by the International Plant Propagators' Society (IPPS) Eastern Region Board of Directors to visit Denmark and meet with plant propagators and researchers at several public and private Danish institutions. During his visit, he also attended and gave a presentation to the IPPS Scandinavian Region conference in Århus.

Other important aspects of training for the Horticulture project include course work for keeping pesticide applicator's licenses current and improving database skills. Paul Ovrom and Mark Widrlechner attended pesticide continuing education at the Iowa Shade Tree Short Course in March

and a training session in October. In July, Paul attended a course on "Preparing Your Images for Use on the Web," which he was able to apply to the management of the NC-7 Trial website.

Communications Activities:

Manuscript and Proposal Review:

Mark Widrlechner served as a peer reviewer for manuscripts submitted to HortScience, Journal of the American Rhododendron Society, Journal of the American Society for Horticultural Science, and Seed Technology, as a USDA peer-reviewer for a paper from an ARS scientist at the National Arboretum, and as an informal reviewer for a manuscript from a scientist in the Czech Republic. He reviewed grant proposals for the American Rhododendron Society, the Eastern Region of the International Plant Propagators' Society, and the Educational Foundation of America.

Posters, Presentations and Seminars:

Ovrom, A. Paul. 2001. USDA-ARS National Plant Germplasm System and the NC-7 Regional Woody Ornamental Trials. Invited Presentation to the Annual Meeting of the Scandinavian Region of the International Plant Propagators' Society, Århus, Denmark, 12 September.

Ovrom, A. Paul. 2001. Presentation on *Acer tataricum* subsp. *ginnala* Ames 23254, *Caragana rosea* Ames 3020, and *Cornus sericea* 'Ruby' PI 443229 to the New Plants Forum, Annual Meeting of the Eastern Region of the International Plant Propagators' Society, Lexington, KY, 3 October.

Widrlechner, Mark P. 2001. Plant taxonomy. Invited presentation given to the National Council of State Garden Clubs, Gardening Study Course, Iowa Arboretum, Luther, IA, 13 September.

Paul Ovrom and Mark Widrlechner also gave presentations to the External Review Team in April.

Publications which appeared in print in 2001:

Abel, C.A., L.M. Pollak, W. Salhuana, M.P. Widrlechner, and R.L. Wilson. 2001. Registration of GEMS-0001 maize germplasm resistant to leaf blade, leaf sheath, and collar feeding by European Corn Borer. Crop Science 41: 1651-1652.

Norris, William R., Deborah Q. Lewis, Mark P. Widrlechner, Jimmie D. Thompson, and Richard O. Pope. 2001. Lessons from an inventory of the Ames, Iowa flora (1859-2000). Journal of the Iowa Academy of Science 108: 34-63.

Ovrom, Arthur P. 2001. Eleven Plants of Note Evaluated through the NC-7 Regional Woody Ornamental Trials. Landscape Plant News 12(3): 6-11.

Widrlechner, Mark P. and Kathleen A. McKeown. 2001. Assembling and characterizing a comprehensive *Echinacea* germplasm collection. Poster Abstract N-38, Abstracts of the 5th National Symposium on New Crops and New Uses: Strength in Diversity, Atlanta, GA, 10-13 November 2001, p. 129.

Widrlechner, Mark P., Robert E. Schutzki, Vasily Y. Yukhnovsky, and Victor V. Sviatetsky. 2001. Collecting landscape trees and shrubs in Ukraine for the evaluation of aesthetic quality and adaptation in the north central United States. FAO/IPGRI Plant Genetic Resources Newsletter 126: 12-16.

Widrlechner, Mark P. and Warren H. Wagner, Jr. "1998" (published 2001). Occurrence of European dewberry, *Rubus caesius* (Rosaceae), naturalized in Iowa and Michigan. Michigan Botanist 37: 107-112.

Departmental Activities:

Mark Widrlechner continued as an active member of the Crop Seeds Committee and the Plant Breeding and Genetics Advisory Panel of the Agronomy Department at Iowa State University. He was appointed to a one-year term as chair of the Written Preliminary Exam Committee for the Plant Breeding and Genetics Advisory Panel. He completed service as Co-major Professor for one Ph.D. candidate in Plant Breeding, Amalio Santacruz-Varela, who successfully defended his dissertation and graduated in 2001.

Conclusions and Plans for 2002:

Curation

Our expansion of ornamental regeneration efforts, which began in 1999, has produced significant results. During 2001, the availability of ornamental accessions increased by 3%, with *Echinacea* making up most of the newly available accessions. This has led to a large increase in the distribution of *Echinacea* germplasm to the research community, allowing us to meet past demand. These collections will become even more valuable in the coming year, once the evaluation data are loaded into GRIN. In 2002, we will fill gaps in our three-year cage field and begin a formal tracking of resources devoted to regeneration.

With the establishment of the Ornamental Plant Germplasm Center (OPGC) in Ohio and the hiring of permanent staff, we have scheduled the transfer of more than 400 accessions to the OPGC during April 2002. We will ensure that the inventory and passport data for transferred collections are in the best possible condition. These transfers should allow us to focus more closely on a smaller set of herbaceous ornamental genera, especially on those genera that also have medicinal, aromatic or industrial uses, and on woody landscape plants. This topic was discussed at the Herbaceous Ornamental and Woody Landscape Plant CGC meetings in 2001 and will be integrated with the NPGS Status Report that the Woody Landscape Plant CGC plans to complete in 2002.

Research

Considerable progress was made on the following four research projects during the past year: analysis of geographic range and invasiveness of non-native woody plants in Iowa in relation to climatic analogs, description of the dynamics of the flora of Ames, statistical analysis of patterns of germplasm demand, and evaluation of alders and birches for tolerance to drought and flooding stress. By the end of 2001, five publications were in press: two papers related to the analysis of geographic range and invasiveness, one on an analysis of species lost and gained from the Ames flora, one describing the results of the alder and birch evaluation, and one describing efforts to build and evaluate our *Echinacea* collections.

Research efforts during 2002 will focus on developing models that integrate climatic and geographic analogs with risk assessment for invasiveness of non-native woody plants, an examination of long-term germination records and past distributions to estimate quantities of seed needed to meet future requests, and collaborative projects to evaluate our collections of medicinal and aromatic plants. Mark Widrlechner will also participate in the completion of ongoing studies on the genetic diversity of our germplasm collections, including research on popcorn by Amalio Santacruz-Varela and sunflowers by Mary Brothers. Studies will also continue on the biosystematics of *Rubus* and the dynamics of the local flora, with special attention paid to the role of exotic species.

Staff Development

In 2002, Mark Widrlechner plans to visit the Western Regional Plant Introduction Station in Pullman, Washington to observe their operation, looking for “take-home” lessons that can be applied to our efforts.

Paul Ovrom plans to take training to keep his pesticide applicator’s certification current and to improve database and web-design skills, and plans to enroll in ISU Genetics 542, "Introduction to Molecular Biology Techniques."

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

Research Progress:

Amaranthus:
We continued a host range and cross-inoculation study of *Phomopsis* fungi isolated from amaranth and soybean. The *Phomopsis* species causing severe disease in *Amaranthus tricolor* was not able to infect local crop or weed hosts other than redroot pigweed, *A. retroflexus*. Much of this work was conducted by Leilani Robertson, a senior at ISU in Plant Health and Protection.

We identified a species of *Pythium* causing amaranth stem canker and lodging problems in farmer fields in Iowa, Nebraska and Missouri. We have completed Koch’s postulates and conducted preliminary research toward developing a resistance screening method. A literature search indicated that the disease was reported once in 1993 from amaranth in Missouri.

Cucurbits:
We field-screened 155 melon (*Cucumis melo*) accessions for powdery mildew resistance (*Sphaerotheca fuliginea*). The trial was intended to evaluate anthracnose resistance (*Colletotrichum orbiculare*), but little anthracnose developed despite three inoculations. The plants were extensively colonized by powdery mildew and notes were recorded on accession reactions. We tested 151 cucumber (*C. sativus*) accessions in the greenhouse for powdery mildew reaction. None of the melon accessions showed resistance in the field, but five cucumber accessions, PIs 605929-605933, showed an intermediate type resistance in the greenhouse test.

Maize:
We completed the second year of a maize disease evaluation project. There were 2976 accessions distributed to 3 private and 4 public pathologists. We obtained the cooperators’ summer 2000 evaluation data and worked with the maize curator to summarize the information and load the data into GRIN. Information can be queried at http://www.ars-grin.gov/cgi-bin/npgs/html/listdsc.pl?MAIZE. Observations made so far include multiple leaf disease resistance in the Argentine Ladyfinger type popcorns, gray leaf spot resistance in African and related Brazilian landraces, and common rust resistance in several Andean landraces. We still seek better methods for evaluating late maturity materials as well as exotics with poor agronomic performance.

At Ames, we evaluated 619 maize accessions for Stewart’s wilt resistance. The 10 most-resistant accessions included several inbreds and popcorns:
PI 558532 (Mo17) PI 587148 (CI66) PI 340872 (from Tom Thumb popcorn)
PI 550522 (T232) PI 587155 (W182BN) PI 414177 (from Argentine popcorn)
PI 587128 (H84) PI 217407 (Ladyfinger popcorn)
PI 587147 (Pa91) PI 340871 (from Tom Thumb popcorn).

Sunflower:
We tested 50 accessions of wild *Helianthus annuus* for resistance to *Septoria helianthi*. These 50 were selected from a group of 128 accessions evaluated in last year's trial. The entire group was also evaluated for downy mildew and rust resistance by Dr. Tom Gulya (USDA-ARS, Fargo) and the results will be combined. There was a definite correlation between *Septoria* leaf blight resistance and the geographic origin of the accessions. We observed good resistance in several accessions from the Midwest and Texas and extreme susceptibility in all accessions from California and the Pacific Northwest.

Disease notes and phytosanitary activities:
Field observations for plant diseases were made in the seed increase plots for *Brassica*, cucurbits, sunflower, and maize. All accessions were inspected with particular emphasis placed on verifying the presence or absence of diseases of phytosanitary importance.

***Brassica* and related genera:**
The regeneration plot cages were inspected during June 2001 and notes recorded for all diseases present. There were no diseases observed on 61 of 141 accessions. Some black rot infection (*Xanthomonas campestris* pv. *campestris*) was noted in almost half the cages, ranging from a few infected leaves to a fairly heavy infection on about 20 accessions. There was light powdery mildew (*Erysiphe cruciferarum*) infection on 12 accessions and 3 accessions with downy mildew (*Peronospora parasitica*). Heavy aphid infestation caused general yellowing in a few accessions.

Cucumis sativus* and *C. melo:
Disease observation notes were taken on the seed increase accessions (42 cucumber and 79 melon) on Aug 8 and Aug 29. Notes were made for three diseases.

Diseases observed included anthracnose (*Colletotrichum orbiculare*), bacterial leaf blight (*Acidovorax avenae* ssp. *citrulli*) and powdery mildew (*Sphaerotheca fuliginea*). Anthracnose was absent to generally low in level of severity in most of the cages. Anthracnose severity was high in four cucumber accessions and two melon accessions. Powdery mildew disease severity was fairly high starting in early August and probably contributed to early senescence in some accessions. All but three of the melon cages showed some symptoms of bacterial leaf blight infection. Seed harvested from all melon accessions was treated with a 15 minute 1% hydrochloric acid seed disinfectant.

Cucurbit virus-testing:
All *Cucurbita pepo* (pumpkin and squash), cucumber and melon seedlings were tested for squash mosaic virus (SqMV) ELISA before transplanting. Testing is done to prevent the introduction of virus-infected plants into the seed increase field. During May, 4100 plants of 152 accessions were tested. No SqMV was detected among 43 cucumber and 80 melon accessions. Eleven putative SqMV-infected seedlings were discarded from the 749 *C. pepo* plants tested (1.5%). Eight of these 11 plants tested positive and the other three were symptomatic plants that emerged late from accessions with good numbers of plants.

Sunflower:
The main phytosanitary disease for U.S.-grown sunflowers is downy mildew, caused by *Plasmopara halstedii*. All seeds were treated before planting with Allegiance fungicide (metalaxyl), but two infected seedlings were found this year. We suspect this was due to inadequate fungicide coverage and not due to development of a resistant fungal biotype.

By early fall, *Septoria* leaf blight had caused significant defoliation in many of the wild accessions. Disease notes were made in 102 sunflower cages. S*eptoria* leaf blight was the most frequent disease, but lesser amounts of rust and powdery mildew were found, along with a few plants showing *Verticillium* wilt symptoms.

Maize:
We worked with the maize curatorial team to create and implement a Stewart's bacterial wilt management plan. The plan included Gaucho insecticide seed treatment, monitoring for flea beetles, and insecticide spray(s) as needed. No flea beetles were found and no insecticide sprays were applied. The winter was cold enough to kill the flea beetle vectors. We inspected 308 seed increase plots for Stewart's bacterial wilt symptoms during August. Stewart's wilt was not found during the 2001 growing season. Notes were also made on the percentage of plants per accession affected by corn smut. Field inspection results were loaded into GRIN.

Laboratory seed health testing:
We conducted phytosanitary lab tests on 315 maize seed lots for Stewart's wilt, 38 seed lots for Goss' wilt, and 102 seed lots for *Helminthosporium carbonum*, *Helminthosporium maydis*, *Diplodia maydis* and *Diplodia macrospora*. I wrote 27 additional declarations (ADs) certifying freedom from pest problems based on field inspection or lab testing.

All seed testing results were entered into our local database and also uploaded to GRIN. We implemented an Oracle data form (written by Dave Kovach) that speeds the entering of lab testing data and field observations into GRIN. All of the old maize seed testing data was reviewed and any missing data was loaded to GRIN.

Communication Activities:

Meetings and workshops:
Charles Block and Bill Van Roekel attended the Sunflower Research Workshop in Fargo, ND, the Annual Seed Technology Conference in Ames, and the American Phytopathological Society meeting in Salt Lake City.

Charles Block attended the American Seed Trade Association Corn and Soybean Research Conference in Chicago. He gave a report to the NCR-25 Corn and Sorghum Pathology committee on corn research at NCRPIS.

Charles Block attended a 5-day Supervisory Leadership training workshop in Feb. 2001 and a 4-day new USDA scientist training workshop in April 2001.

We participated in the April NCRPIS review and presented the plant pathology program, station staffing history, and curator support services provided by NCRPIS pathology, horticulture and entomology groups.

Other activities:

Charles Block:
- served as chair of the sunflower disease panel for the National Seed Health System,
- served on a technical panel to review seed health testing methods for spinach and celery,
- served as a peer reviewer for manuscripts submitted to Plant Disease,
- tested a new *Aspergillus* identification key being written by Maren Klich, a USDA-ARS scientist from the Southern Regional Research Center,
- served as the NCRPIS liaison with the USDA-APHIS, the Iowa Department of Agriculture and Land Stewardship, and other agencies for phytosanitary issues and regulations,
- served as chair of the NCRPIS safety committee,
- received annual tractor safety training, annual medical review for Occupational medicine health monitoring program, renewed annual pesticide respirator certification, and received pesticide applicator certification in eight categories,
- gave an invited talk to ISU Seed Pathology graduate class on "Statistical Sampling for Seed Health Testing" and presented a seminar to the ISU Plant

Pathology department on the National Plant Germplasm and the NCRPIS.
- appointed USDA Collaborator/Assistance Professor in the ISU Plant Pathology Department

2002 Project Plans:

We are contacting cooperators and planning the third year of evaluations for corn diseases. Our role will be to (1) assemble test groups of germplasm; (2) distribute accessions; (3) receive and process evaluation data; (4) distribute data in other forms to cooperators and the maize breeding community; and (5) provide seed of promising accessions for further testing and development. We will conduct Stewart's wilt evaluations in field plots as we are well equipped to continue this evaluation work.

Two disease-resistant sunflower populations will be prepared for release as public breeding populations. A manuscript will be developed, with Tom Gulya, Mary Brothers and Robert Webster, that describes correlations between ecogeographic variables and one or more disease resistance traits in wild sunflower.

We are investigating selective agar media for *Erwinia stewartii*. There is need for a good selective agar that limits growth of *Enterobacter agglomerans* (*Erwinia herbicola*), a fast-growing, common colonizer of plant and seed surfaces.

We are initiating studies to evaluate the survival of the bacterial fruit blotch bacterium in stored melon seed.

d. Zea Curation (M. Millard, G. Crim, L. Pfiffner)

Construction:

There were no significant construction projects during 2001 affecting the maize project. When the GEM staff moves to the station in 2002, the current imaging room will become the maize curator's office and imaging will be relocated to space formerly allocated to dryers.

Equipment:

A second flatbed Epson flatbed scanner was purchased in fiscal 2001 with a bed size of 12.2 × 17.2 inches. The bed of the scanners previously being used were 8.5 × 14 inches and required from 5 to 9 images to scan the 25 ears of accessions with larger ear sizes. This new scanner is twice as fast and allows 25 ears to be captured in 3 images, freeing a significant amount of manual labor for other tasks. However, it was discovered that both this Epson 1640XL and the Epson 836XL scanners need to be sent to an Epson repairman for cleaning at considerable cost. Additionally, the new Epson 1640XL has difficulty scanning an image with the cover up as has been done with the Epson 836XL and the earlier HP 4C scanners. Unfortunately, this will make it necessary to investigate other solutions.

A 1700 MHz Pentium IV computer was purchased, and a 900 MHz Pentium III was cascaded to the imaging room. The imaging room is now equipped with two 900 MHz and one 1700 MHz machines for accession imaging. All NCRPIS project staff utilizes this facility for image processes, with the majority of usage by maize project personnel.

M. Millard (ISU maize curator II) received a new 1700 MHz Pentium IV computer equipped with a CD writer, which is used for archiving data.

Computers were cascaded within the NCRPIS to update maize room processing computers. Eight machines are now available for data entry by the maize and other curatorial projects. Capacity of these machines ranges from 233 MHz

Pentium II's to 600 MHz Pentium III's with the average machine being a 400 MHz Pentium III. One year ago, the eight machines in use ranged from Pentium 200 MHz to Pentium II 400 MHz, with the average being a Pentium II 200 MHz.

Personnel:

Due to ISU budgetary constraints, a state field technician position, vacated since July 2000 and historically funded 50% by ISU's Agronomy department was eliminated in 2001. The maize project continues to be supported by an ISU field technician, Ms. Gaylan Crim, supported by NC-7 Regional Funds, and by a term federal maize technician, Ms. Lisa Pfiffner, supported by USDA-ARS funds. The ISU maize curator, Mark Millard, is supported by NC-7 Regional Funds, and has 21 years experience. The project is experiencing the benefits of three permanent, experienced FTE's designated for maize curation for the first time.

Research Progress:

The first GEM accession released by ARS in June 2000 continued to be frequently distributed in 2001. GEMS-0001 (PI 614142) has been distributed a total of 59 times since its release. In 2001, it was distributed 36 times of which it was the lone accession in the order 32 times. There has been high interest in it by organic growers interested in non-transgenic alternatives for insect resistance. It has demonstrated resistance to first generation European corn borer unrelated to plant DIMBOA production. It was extracted from PI 503806 (Piura 144) from Peru. The NCRPIS has increased 4 other accessions destined for GEM release by Dr. Craig Abel, also with insect resistance. A negative trait associated with some of these lines is susceptibility to common smut in some environments, no doubt donated by the exotic parent.

The first maize accession images were made available on GRIN in 2000. Availability of images on GRIN expanded in 2001 to over 2000 maize accessions. I chair the NCRPIS Imaging Committee that is reviewing all procedures and priorities involving imaging from accessions to documents. The committee has developed a uniform accession image naming protocol along with specifications on how an image should be obtained and its contents. As the NCRPIS Imaging Committee Chair and as NCRPIS representative to the GRIN Advisory Committee, and in conjunction with the GRIN Database Management Unit (DBMU), I developed protocols for placing full and thumbnail images on GRIN. Thumbnails were deemed important because they allow more rapid presentation of Internet web pages; we recognize that users' computational capacity varies widely. The Internet user can preview images and only view in detail those of interest. This allows GRIN to support the larger image sizes which the NCRPIS feels necessary to provide maximum information.

A project was initiated during the fall of 2001 with Dr. Steven Thomas of the Department of Energy, National Renewable Energy Lab at Golden, Colorado to ship stover samples to Colorado for compositional studies to evaluate the diversity of stalk composition for traits associated with energy production. This may prove valuable for breeding types with more utility for energy production from stover, including ethanol production, thus increasing the value of the crop. DOE supported the collection, drying, and shipping of stalk samples after ear harvest from 240 accessions regenerated in 2001. Data will be loaded on GRIN, should the samples provide useful information.

Acquisition:

During 2001, Table 1 shows 676 accessions were received, up from the 112 accessions received last year and the 278 accessions received the previous year. These included 636 accessions held previously only at the NCGRP, formerly known as the NSSL, and consisted mostly of U.S. populations and inbred lines. The large transfer of accessions from NCGRP represents the majority of NSSL priority maize accessions held before 2001. There are only 143 accessions remaining in this category. Fewer than 100 sweet corn accessions will need to be reviewed

with Dr. Tracy of the CGC to decide disposition; the others appear to be duplicates of NCRPIS accessions. The NCRPIS hopes to eliminate this category of unavailable accessions during the next year. Additionally, the NCPRIS acquired 9 Crop Science registrations, 19 accessions from North Carolina State University destined for future GEM program release, 26 old CI inbred lines previously maintained by the USDA-ARS program at the University of Missouri, and 5 Korean accessions received through quarantine. The Korean accessions represent the first Korean germplasm in the NCRPIS maize collection.

Regeneration:

There were 296 accession regenerations attempted in 2001 in Ames; this compares with 200 accessions in 2000 and 274 in 1999. Regenerations included 129 populations and 167 inbred lines. A number of old synthetics created by Dr. Sprague and state experiment station inbred lines which were held only at NCGRP were increased. A number of Uruguay populations were regenerated due to recent interest in possible insect resistance (corn rootworm), yield potential, and quality traits in this material. CIMMYT was consulted prior to regeneration to ensure that they did not hold excess seed in large supply that the NCRPIS could bring into the collection in lieu of regeneration. They do hold other Uruguay accessions that we are currently importing.

The 2001 growing season was drier than average. The inbred lines were irrigated for the first time in several years; this was possible because of the proximity of the field to old irrigation lines which were supplemented with PVC pipes clamped together with rubber elbows by the farm staff. Without this water, the majority of the inbred line increases would have been extremely poor. A windstorm in July blew down the populations and some of the inbred lines, but we were able to re-stand the planting with additional help from other NCRPIS curatorial projects. The fall was cool but longer than normal prior to frost, enabling late populations and all but one inbred line to mature easily. Seed of inbred lines was treated prior to planting with GAUCHO as a precaution for Stewart’s wilt, but this disease was much less prevalent in the area than in previous years. No increase plots were infected with Stewart’s wilt in 2001. Disease pressure in general was less than normal, due to dry conditions. Seed treatment use to prevent or reduce Stewart’s wilt infestation will continue in the future, in order to ensure that our seed production meets phytosanitary requirement for distribution and to improve seed yield. 2001 harvest amounts appear to be average for the populations due to lodging and slightly below average for the inbred lines. Quality of seed obtained is generally above average.

Over 70,000 seeds were processed from a *Tripsacum dactyloides* accession PI 421612 “Pete” which was grown in isolation during the summers of 2000 and 2001. Harvest of mature seed was improved during 2001 by placing a corn shoot bag over each inflorescence after pollination to catch seed as they mature. Otherwise, much of the best mature seed shatters on the ground before harvest. The maize curator is attempting to make control-pollinated seed available of *Tripsacum* from NPGS because most accessions are currently available only as clones or open-pollinated seed from Miami. There is recurring interest and high demand among maize researchers for maize relatives.

Thirty-four accessions were received from the St. Croix quarantine regeneration in 2001. Planting of maize on St. Croix in 2001 was slowed to allow progress in other species on St. Croix and to allow the NCRPIS to catch up on a processing backlog from earlier regenerations. Adolpho Quiles-Belen took over supervision of the maize regenerations this year. Adolpho has prior experience with maize, having worked with the maize curator during the early 90’s on maize regenerations

at Isabella, Puerto Rico. This St. Croix regeneration was better than that received in several previous years.

Pioneer increased eight accessions at each of their three facilities on the

island of Kauai, Hawaii, on Puerto Rico, and at Weslaco, Texas in 2001. Accessions adapted to mid and lower elevations were quite successful. At Weslaco, late accessions from central Mexico were unsuccessful. Twenty of 24 accessions were successfully regenerated at the 3 locations. The NCRPIS is very grateful for this assistance and thankful that this private regeneration support will continue in 2002. Ten accessions have been sent during the fall in 2001 to Pioneer locations on Kauai, Hawaii and Puerto Rico.

In January, 2001 the GEM Project and NRPIS Maize Project staff provided mutual support in pollinating their winter nurseries at the Illinois Crop Improvement Association (ICIA) station near Ponce, Puerto Rico. Growing conditions during this regeneration and seed quality were excellent. With the addition of GEM staff in 2002, we hope to increase our nursery efforts in 2002. Thirty-two accessions were sent to ICIA at Ponce during the fall of 2001 for pollination in 2002.

Maintenance:

Table 1 indicates that maize availability declined 2% from last year. This was due to the influx of a large number of unavailable new accessions (4%) exceeding the increase in the number of available accessions (202 or 1.9%).

A processing backlog once plagued maize curatorial efforts. In November, 1999, the project had a 2.5 year processing backlog, including St. Croix regenerations. With the addition of Ms. Lisa Pfiffner in November, 2000, and one additional student labor FTE, they, Ms. Gaylan Crim (ISU maize technician) and the other student laborers have completely eliminated the backlog. In the past two years, they have processed 5 years' equivalent of regenerations (backlog plus new crops, including winter nurseries and St. Croix material.) As a result, over 500 accessions have been made available that may not have been available without this effort. We are very optimistic about our ability to make germplasm increasingly available in the future. The 2001 Ames nursery crop is currently being processed and should be finished by March, 2002.

There was significant activity in backing up accessions at NCGRP for the first time in several years, with 205 *Zea* accessions shipped there in 2001. This occurred as a result of a long-planned review of 252 of approximately 1000 accessions of *Zea* from the Goodman regeneration project for PI-number assignment in 2001. After PI assignment, those not held in NCGRP's main inventory or "black box" backup of CIMMYT material were shipped to NCGRP. PI assignment prior to shipment increases the efficiency of the entire backup process.

In 2001, 1567 accessions were germinated as compared to 1876 in 2000 and 3571 in 1999. In 2000, a temporary federal germination technician was hired to coordinate all NCRPIS germinations to reduce the management demands of germinations on each curatorial group and to increase the process' efficiency. This technician resigned in early 2001, thus slowing progress. A new technician will be hired in early 2002. As a result, the maize program reduced germination tests during '00 and '01 and focused on the processing backlog, successfully eliminating it. It is expected that the hire of a germination technician will enabled more germination tests to be performed in 2002; 3000 tests annually are required to maintain reliable viability status on almost 18,000 accessions according to current protocol.

Distribution:

We distributed 7,243 packets (Table 3) in 2001 compared to 18,103 packets in 2000 and 4,545 packets in 1999. Seed packet distribution was similar in 2001 to 2000 if the oil analysis project distribution in 2000 is excluded from the data. The number of orders increased, but the majority of this increase can be accounted for by the 36 orders for GEMS-0001 (PI 614142), with 32 orders for this accession alone. Distributions are expected to continue at this rate in FY'02 as the pathology-screening program continues and more GEM accessions are released.

CROP	Year	No. of Orders	No. of Recipients	No. of Items Distributed	No. of Accessions Distributed
Maize	1997	202	160	5034	3281
	1998	178	137	3297	2184
	1999	231	167	4545	2808
	2000	257	192	18103	10982
	2001	303	209	7243	4569

As stated earlier, the NCRPIS sent 3002 accessions distributed to 3 private and 4 public pathologists in 2001 compared to 2559 accessions to 10 pathologists in 2000.

Characterization:

There were 15,623 data-points on 15 ear descriptors on 847 accessions loaded into GRIN in 2001. This compares to 11,675 data-points on 15 ear descriptors on 798 accessions in 2000.

Imaging work continues at a high speed in 2001. There were 7,010 images obtained on 3,756 accessions in 2001 compared to 7,513 images obtained on 2,190 accessions in 2000 and 6,502 images on 3,256 accessions in 1999. As mentioned earlier, images on 1,327 accessions were loaded into GRIN in 2001 increasing image availability to the public to 2,004 accessions.

The first molecular marker data were loaded into GRIN in 2001 for maize. Observations on 22 isozyme loci on Mexican accessions in NGPS were loaded from data provided by Major Goodman in 2000 from studies conducted in the 1980's. Marker data on inbreds, U.S. and other accessions will continue to be loaded in the future, including SSR and isozyme data from two theses recently completed by students working with NCRPIS staff.

Evaluation:

The maize disease-resistance screening program continued in 2001. There were 3002 accessions distributed to 3 private and 4 public pathologists in 2001, as compared to 2559 accessions to 10 pathologists in 2000. Data from 2001 screening trials were loaded into GRIN for the first time on gray leaf spot, eyespot, anthracnose stalk rot, virulent race Rp1-D of common rust, and maize dwarf mosaic virus. Additional data for northern leaf blight were obtained and loaded into GRIN. Significant observations reported so far provide information on resistance to multiple foliar diseases in Lady Finger type popcorns, possible gray leaf spot resistance in African and related Brazilian landraces, and common rust resistance in multiple Andean landraces. Further discussions among the pathologists and the NCRPIS need to take place to select organisms and to develop methods of evaluating late maturity materials as well as exotics with poor agronomic performance.

There were 735 accessions evaluated for first generation European corn borer in 2001. Twenty-seven of these accessions rated a 2-3 and are classified in the resistant category. These 27 will be retested in a replicated planting.

Growing degree data were loaded for the first time into GRIN in 2001, from 748 accessions grown in the NCRPIS' U.S. maize race observation trial in 2000, and for the eyespot data provided by Dr. Charlie Martinson in 2000.

Communication:

Two replications of a large observation-demonstration planting of 468 accessions from the United States were again planted in Ames in 2001. The purpose of the planting was to observe the variability among U.S. maize races, obtain a second

set of maturity data on these materials, and invite ISU maize researchers and others to observe this variability which most maize researchers never see in one place. Unfortunately a July wind storm during peak flowering time damaged the accessions, flattening the entire planting. Data acquisition and demonstrations were cancelled, but a portion of the later accessions were harvested for the stover project with the Department of Energy.

Several tours of the farm observed the maize imaging project as part of their learning experience. This has been a popular demonstration over the past few years with visitors, and has increased awareness of image availability in GRIN.

2002 Project Plans

Acquisition:

More GEM accessions are expected to be released for distribution by the NCRPIS in 2002.

The NCRPIS will begin procuring the core accessions designated by CIMMYT and published in CD format from the LAMP project that have not already been incorporated into the NCRPIS collection. The NCRPIS will try to fill gaps in races not held currently, and acquire more of the Caribbean accessions from CIMMYT in 2002.

The NCRPIS will continue its program of acquiring public materials and previously Crop Science registered accessions from public institutions. Accessions from Indiana, Missouri, Nebraska, and Kansas programs will be acquired in 2002. The Indiana program refreshed their accessions in 2001 and will ship seed to the NCRPIS in 2002.

Regeneration:

Regenerations in Ames will be maintained at 200-250 accessions annually. Resources need to be increased (or re-directed within the maize project) to allow for 300-400 accessions to be regenerated annually in the future to facilitate accomplishment of this goal.

The private sector will again be asked to help increase tropical accessions during their off season. One company contributed winter nursery resources in 2001-2002 at two locations and one company has offered to increase 10 accessions at one location in 2002. The NCRPIS is approaching other companies to increase between 10 and 100 accessions per year. The NCRPIS will continue its tropical maize increases during FY’02 with 32 accessions planted at ICIA in Ponce, Puerto Rico.

Quarantine regenerations on St. Croix will continue at the 30-50 accession level during 2002.

NCRPIS will try to develop a relationship with CIMMYT and Peruvian collaborators that will enable them to provide us with seed from regeneration of highland tropical accessions that cannot be regenerated in environments currently available to us.

Maintenance:

Viability tests will be maintained at the 1,500 accession per year level and attempts will be made to increase throughput to 3,000 per year, allowing the collection to be completely tested on a five-year rotating basis. We will also evaluate whether protocols can be developed that can identify materials that do not require such frequent testing. Seed of generally good quality and viability is now deposited under better storage conditions than in the past. This causes us to question whether we benefit from spending resources on viability testing for the entire collection every five years, or if they can be better applied without increasing risk to the collections.

The last of the Goodman tropical increases from Mexico will be backed up in 2002 at NCGRP, and 500 kernel samples will be distributed to CIMMYT. Additionally, we are going to send several hundred accessions to CIMMYT from other LAMP countries, which the NCRPIS has received, but CIMMYT has not.

We will try to send several hundred accessions of maize to CIMMYT representing landraces from the U.S. This will enhance CIMMYT's ability to serve as an international center for maize germplasm. It will also indicate to the world the U.S. policy of freely sharing farmer varieties. We have plenty of seed on hand of most of these landraces since increasing them at the 100-ear population size generates large seed quantities.

The NCRPIS, NCGRP, CIMMYT, and Dr. Wilfredo Salhuana will work on a continuing project to develop and cross reference a consolidated list of the holdings of the various countries' collections, the CIMMYT collection, and U.S. collections in order to identify materials that may be at imminent risk of loss.

Evaluation:

The maize curator will continue to work with the NCRPIS pathologist and interested private and public pathologists in systematically obtaining data on maize pathogen resistance in the collection. USDA-ARS-NCRPIS and private in-kind support should allow for preliminary observations to be obtained on 3-4,000 more accessions in 2002. Additional evaluation information will result in more effective use of accessions in the future.

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

Collections curated by the Vegetable Project include *Cichorium* (NC7-chicory), *Cucumis sativus* (NC7-cucumis.cucs), *Cucumis melo* (NC7-cucumis.melo), *Cucumis* species (NC7-cucumis.wilds), *Cucurbita pepo* (NC7-cucurbita), *Daucus* (NC7-daucus), *Ocimum* (NC7-ocimum), and *Pastinaca* (NC7-parsnips). A new site crop was established (NC7-cucurbits.misc) due to the following nomenclature changes in the genus *Cucumis*: *Cucumis asper* is now *Cucumella aspera*, *Cucumis membranifolius* is now *Oreosyce africana*. Statistics for accession numbers and availability for each site crop can be found in Table 1. Inactivations for 2001 were for accessions where the seeds were no longer viable and included 6 *Cucumis sativus*, 1 *Cucurbita pepo*, and 9 *Pastinaca* accessions.

Acquisition

Sixty-five accessions were received and are listed by site-crop in Table 1. Fifty-one of these accessions are and were received as a result of a 2001 collection trip by Dr. P.W. Simon to Portugal.

Maintenance

Actual numbers for regenerations attempted and accessions harvested are found in Table 2. The majority of the 2001 *Cucumis sativus*, *Cucumis melo*, and *Cucurbita pepo* regenerations focused on accessions with low seed quantities for

distribution. The *Cichorium* regeneration focused on accessions where plant populations on previous increases were not well represented due to non-bolting plants, and on never before increased accessions. The *Daucus* regeneration efforts have primarily been directed towards making newly acquired accessions available. Forty of the *Daucus* and all of the *Pastinaca* accessions listed in Table 2 are those that were started in October 2001 for regeneration in field cages in the summer of 2002.

In addition to the regenerations in Ames, we received *Daucus* seed increases from R. Maxwell, Seminis Vegetable Seeds, Idaho (25 accessions); T. van der Horst, Bejo Zaden B.V., Netherlands (22 accessions); and R. Freeman, Sunseeds, Oregon (7 accessions).

As accessions are regenerated, seed samples are sent to NCGRP for back-up. Four of the vegetable collections have better than 75% of their accessions backed up at NCGRP (Table 1). We received substantial original seed quantities on many of the new *Daucus* accessions, and these may be sent to NCGRP for back-up after viability testing in 2002.

In 2001, we performed a total of 233 germination tests (Table 2), most of which were conducted on seed increases from the 2000 regenerations.

Distribution

Packet and accession distributions for *Cichorium*, *Cucumis*, *Cucurbita*, miscellaneous cucurbits, *Daucus*, *Ocimum*, and *Pastinaca* are summarized in Table 3. In 2001, 2140 packets (items) were distributed for these vegetable crops. This is below the five-year average of 3040 packets, but the requests have been more targeted for specific accessions or for accessions having specific characteristics or disease resistance. Distribution history for the last five years can be found in the following table.

Crop	Calendar Year	No. of Orders	No. of Recipients	No. of Items Distributed	No. of Accessions Distributed
Cichorium	1997	4	3	22	20
	1998	4	4	76	39
	1999	6	5	123	115
	2000	5	5	52	52
	2001	6	6	288	175
Cucumis	1997	50	41	2910	1866
	1998	49	40	1585	995
	1999	54	46	3064	2085
	2000	60	45	1555	1235
	2001	59	49	1230	934
Cucurbita	1997	15	15	275	249
	1998	15	15	114	98
	1999	16	15	170	137
	2000	19	18	457	363
	2001	22	20	288	156
Cucurbits - Mics.	1997	0	0	0	0
	1998	1	1	1	1
	1999	2	2	2	1
	2000	0	0	0	0
	2001	2	2	2	1
Daucus	1997	13	11	271	204
	1998	19	16	922	525
	1999	20	16	481	331
	2000	11	11	205	203
	2001	13	12	235	211
Ocimum	1997	3	3	91	46
	1998	7	7	211	70
	1999	7	7	206	88
	2000	7	7	245	75
	2001	5	5	97	79
Pastinaca	1997	2	2	16	13
	1998	0	0	0	0
	1999	2	2	8	8
	2000	0	0	0	0
	2001	0	0	0	0

Characterization and Taxonomy

Digital images, along with basic notes for taxonomic identification and accession characterization, are recorded during regeneration (Table 4). Data for approximately 17 descriptors, primarily fruit descriptors, are recorded at harvest for *Cucumis* and *Cucurbita* accessions. Plant habit, flowering dates, and life-cycle notes are recorded for *Cichorium* and *Daucus*. Data will be loaded to GRIN for the cucurbit crops once their descriptor lists have been revised and approved by the Cucurbit Crop Germplasm Committee. All four RPIS's currently have responsibility for various *Cucurbita* species, and each station uses a different set of descriptors. A standardized list of characterization descriptors will be presented for approval at the next CGC meeting (as yet, unscheduled). Images will be made available on GRIN once the NCRPIS Imaging Committee establishes guidelines for naming and loading images to the database.

With the assistance of the Dr. Mark Widrlechner (Horticulturist), taxonomic identities are reviewed and confirmed as each accession is regenerated. The 2001 re-identifications included: 2 *Cucumis* to other *Cucumis* species; 28 *Daucus* to 5 *Daucus carota*, 5 *Daucus broteri*, 3 *Daucus* sp., 2 *Ammi*, 4 *Caucalis*, 3 *Orlaya*, 1 *Pimpinella*, 3 *Torilis*, 1 *Turgenia*, and 1 unidentified Apiaceae.

Evaluation/Utilization

Dr. Charles Block (Pathologist) continued to screen all *Cucurbita* and *Cucumis* seedlings grown for regeneration for the presence of squash mosaic virus with an ELISA protocol before seedlings can be transplanted to the field. He also visually inspected all cucurbit field plantings for disease during the 2001 growing season. Seed-borne diseases are of specific interest, with bacterial fruit blotch in *Cucumis melo* being of greatest concern since phytosanitary issues have prevented the distribution of *Cucumis* germplasm to some countries. The WRPIS transferred an accession of *Cucumis sativus* reported to be infected with an unknown virus. We regenerated the accession in the greenhouse, and Dr. Block attempted to identify the virus which remains unknown. We are hoping that some of the seeds extracted from the 3 fruit will prove to be virus free. The accession is unusual in that the entire plant and the fruit are free of spines and hairs. The accession is difficult to regenerate as it primarily produces female flowers.

We are awaiting oil analysis and DNA fingerprinting data for the NPGS *Ocimum* collection from Dr. Katerina Svoboda and her student Senga Kyle, at The Scottish Agricultural College Auchincruive, Ayr, Scotland, UK. Dr. Widrlechner and I are collaborating on a publication with Svoboda and Kyle regarding the evaluation work.

Future Plans

Regenerations: I was recently contacted by a researcher who has been collaborating with others on evaluating the evolution of *Cucumis melo* and *Cucurbita pepo*. She wishes to donate the germplasm her group has collected from around the United States as part of their research. This germplasm includes approximately 60 accessions of wild type *Cucumis melo* and approximately 50 accessions of wild *Cucurbita pepo*. I will incorporate these materials into the cucurbit regeneration program for the summer of 2002 if they are received before May. Previous experience with the wild type *Cucurbita pepo* indicates that, due to the small flower size and poor male-female flower ratios, these accessions will best be regenerated in field cages using honey bees as pollinators instead of hand pollination. We have been warned that the percent germination of these samples may be very low or even zero percent. In addition to the new accessions of *Cucumis* and *Cucurbita*, we will continue to increase accessions where distribution quantities and percent germination have fallen below critical values as set on GRIN.

Forty new accessions of *Daucus* were started in the greenhouse in October 2001 for the summer 2002 field cages. Taxonomic identification and unknown life cycles are still an issue with *Daucus* regenerations, and continue to cause difficulty with planning for greenhouse and field space usage. Many of the newly acquired accessions have proven to be mixtures of annuals and biennials which require that their plant population be regenerated in both a greenhouse cage and field cage with resulting seed increases being bulked before storage.

Twenty-six accessions of *Pastinaca* were planted in the greenhouse in November 2001 for summer 2002 field cages. The remaining twenty-three unavailable parsnip accessions will be started in November 2002 for regeneration in the summer 2003 field cages.

Regeneration of hard to handle and wild *Cucumis* species will continue in the greenhouse as time, space, and labor allocation permits. We hope to regenerate approximately 18 accessions in two regeneration cycles in the Entomology greenhouse facility.

Germinations: In April 2002, viability testing will be performed on seed lots resulting from the 2001 cucurbit regenerations. Viability testing will continue during the summer months on the 2000 and 2001 *Daucus* regeneration lots, and on 5-year germination testing to monitor the viability of the distribution lots in the vegetable collections.

Characterization: Revised descriptor lists will be developed for *Cucumis* and *Cucurbita* by working with members of the Cucurbit Crop Germplasm Committee and other NPGS cucurbit curators. Once the descriptor lists have been approved, Oracle forms can be developed to assist in loading newly acquired characterization data and existing characterization data into GRIN.

Evaluation: The Pollinator Program and the Vegetable Program will collaborate on some small pollinator tests. One test involves evaluating whether blue-bottle flies will pollinate umbels more efficiently than houseflies in greenhouse isolation cages. A second collaborative project is planned to develop a cage and pollinator program for regenerating *Cucumis* and *Cucurbita* in the greenhouse.

Other: I am currently working with CGC members to review the cultivar lists of accessions held at the National Center for Genetic Resources Preservation (formerly National Seed Storage Laboratory) for possible inclusion in the working collections of the NCRPIS vegetable collections.

f. Crucifers and Grasses (R. Luhman and S. Bruner)

The collection:

Sixteen new *Brassica* accessions were added to the active collection during 2001 (Table 1). Fourteen of the new *Brassica* accessions are bulks created from third year grow outs of 55 accessions received from the National Center for Agricultural Utilization Research in 1988. These bulks were based upon field morphological comparisons, oil analyses and other seed characterization data. The remaining two *Brassica* accessions included one *B. rapa* donated from New York and one *B. napus* donated from Arkansas. Seven *Brassica* accessions were re-identified (three *B. rapa* to *B. rapa* var. *parachinensis* and four *B. juncea* to *Sinapis alba*)

New crucifer accessions included two *Mattioloa* accessions (one collected in France and one collected in Portugal) and one *Crambe* accession (donated from Poland). One *Erysimum* accession was re-identified from *Erysimum* sp. to *Erysimum gomez-campoi*.

Percent of available *Echinochloa* has dropped approximately seven percent, mostly

due to low germination. Percent available in each of the remaining groups that I curate has changed less than five percent.

Regeneration and Maintenance:

In 2001, 78 Brassicaceae accessions were stored from the harvests completed in 2000. In 2001 we attempted regenerations for one hundred fifty *Brassica* and eight miscellaneous crucifers (Table 2). More than 95% of the material attempted was harvested.

Germination testing of the entire *Panicum* collection was initiated in 2001 (Table 2). It had been seven years since the last germination. Germinations on the 2000 regenerations were also completed.

The percentage of the *Brassica* collection backed up at the National Center for Genetic Resources Preservation increased slightly in 2001 (Table 2). Material sent for backup either replaced lots currently held with better quality seed or provided new material.

Distribution:

During 2001, we distributed 1166 packets domestically and 690 packets internationally of the crops that I curate (Table 3), representing 973 accessions domestically and 632 accession internationally. The table below indicates that the increasing trend for *Brassica* orders (as reported in last year's annual report) reversed in 2001. However, the number of items distributed also decreased. Therefore, it is believed that the *Brassica* orders are more research-objective focused then they were five years ago. One focus continues to be related to phytoremediation (at least 10 orders). There are four *Brassica* accessions generally supplied for phytoremediation requests. These four accessions were described in a paper published by Kumar et. al. in 1985 titled "Phytoextraction: The Use of Plants to Remove Heavy Metals from Soils". There was also a request in 2001 for the entire *Eruca* collection for a CGC approved evaluation on flea beetle resistance and quality as leafy green vegetable.

Crop	Year	No. Of Orders	No. of Recipients	No. of Items Distributed	No. of Accessions Distributed
Brassica	1997	39	36	2267	973
	1998	36	32	1560	1201
	1999	53	46	2181	1123
	2000	69	56	1245	862
	2001	36	33	469	414
Crucifers	1997	17	13	334	297
	1998	18	17	403	303
	1999	15	13	299	227
	2000	16	15	72	66
	2001	22	18	640	268
Echinochloa	1997	0	0	0	0
	1998	8	7	52	46
	1999	2	2	9	8
	2000	5	4	166	149
	2001	4	4	36	33
Wild *Linum*	1997	0	0	0	0
	1998	2	2	19	19
	1999	3	3	26	16
	2000	0	0	0	0
	2001	2	2	22	19
Misc. Grasses	1997	2	2	4	4
	1998	3	3	11	9
	1999	1	1	1	1
	2000	0	0	0	0
	2001	3	3	7	6
Panicum	1997	4	4	52	47
	1998	7	7	34	34
	1999	2	2	7	7
	2000	9	8	58	49
	2001	8	8	662	650
Setaria	1997	6	6	251	235
	1998	7	7	57	51
	1999	7	6	27	26
	2000	13	12	795	757
	2001	6	6	20	19

Observations:

We continued to perfect methods for capturing digital images of crucifers during maintenance operations (Table 4). Digital photographs were taken at full flower in JPEG format, downloaded to our server, and manipulated with Adobe PhotoShop. Full flower images were also taken by collecting a plant sample and scanning that sample in TIFF format with a flat bed scanner. We also continue to record images

of silique samples on a flat bed scanner in TIFF format. The NCRPIS Imaging Committee is developing standards for loading images to GRIN. Once these standards are in place, plant images from the last three years and silique images from the last four years will be loaded to GRIN.

Descriptor observations were recorded during regeneration, and plant samples were taken for later descriptor observation data (Table 4). Two-thousand eighty-four observations representing 386 accessions were collected in 2001. Observations for 97 accessions were transferred to GRIN in 2001.

Visitors and Meetings:

I attended the Crucifer CGC at the American Society for Horticultural Science (ASHS) meetings in July 2001. Additionally, the Crucifer CGC chairman, Dr. Mark Farnham, and I met with other *Brassica* researchers at the Agronomy Society meetings (October 2001) to discuss the establishment of an oilseed meeting within the United States.

I attended the Forage and Turfgrass CGC at the Agronomy Society Meetings (October 2001)

Future Plans:

The 2002 growing season is currently underway. Biennial *Brassica* was started in the greenhouse in December. Annual *Brassica* accessions will be started in the greenhouse during March and will be transplanted to the field in early April. We anticipate regenerating ca. 100 accessions in 2002.

We plan to regenerate the entire collection of wild flax in 2002. Perennial wild flax was started in the greenhouse in December. Annual wild flax will be started in the greenhouse in March. Wild flax will be transplanted to the field in late May or early June.

We also may have a 2002 millet regeneration field.

I plan to work closely with a new graduate student in Agronomy as he develops his PhD program in some aspect of *Brassica* germplasm maintenance

g. *Amaranthus, Celosia, Chenopodium, Coronilla, Dalea, Galega, Marina, Melilotus, Perilla* and *Spinacia* (D. Brenner and S. Bruner)

Acquisition and inactivation (Table 1)

Fourteen *Spinacia* accessions, including seven wild *Spinacia tetrandra* accessions, were acquired through collaboration with collectors in the country of Georgia. This acquisition is the result of a grant proposal I prepared with Georgian scientists, and funded by the NPGS Plant Exploration office for 2001. In addition, two more *Spinacia tetrandra* accessions were collected in Armenia by an exploration project sponsored by the Western Regional Plant Introduction Station. These new accessions will be of interest to scientists seeking improved disease resistance in spinach.

People in countries where wild *Spinacia* is native should be recruited for collecting germplasm to improve our holdings. To this end, I am communicating with potential collectors in Pakistan.

Thirty accessions of miscellaneous Umbelliferae were transferred here from the National Center for Genetic Resources Preservation (NCGRP), completing the transfer of this group, which greatly facilitates management.

Fifteen of the 46 new *Amaranthus* accessions were collected in the wild. These include three *Amaranthus* species new to the collection, collected in the

Southwestern US by Donald Pratt, an ISU Botany graduate student funded by an NPGS Plant Exploration grant. With these new acquisitions, 37 of the estimated 60 *Amaranthus* species are now represented in our collection. Thirty diverse accessions were donated by Xi Xiang Li, Institute of Vegetables and Flowers, Chinese Academy of Agricultural Sciences. Three accessions within the collection were identified as duplicates and eliminated.

The Universidad Nacional Technica del Altiplano in Peru donated our first accession of an unusual type of *Chenopodium quinoa* (Ames 26191) with seeds that pop like popcorn. Dr. Sven Jacobsen of CIP facilitated this donation.

Maintenance and distribution (Tables 2 and 3)

***Amaranthus* and *Chenopodium*:**

The seed storage staff, primarily Mary Arnold, pre-packaged distribution seed samples. Pre-packaging speeds seed-order preparation, and accuracy. We now have 244 accessions of my crops pre-packed.

Following negative germination testing results, David Kovach performed tetrazolium tests on six accessions of *Chenopodium* to verify that the seeds were not viable, and the accessions were inactivated.

***Melilotus* and other legumes**

A regeneration planting of 21 accessions started in the fall of 2001 included accessions with uncertain taxonomic identities and members of the core collection.

Spinacia:

Thirty-three *Spinacia* accessions were sent to Mr. Matt Linder of Sakata Seed Company in Salinas, California for regeneration in cooperation with Dr. Ed Ryder of the USDA-ARS. They delivered 56 new harvests from accessions planted in 2000 and harvested in early 2001. Because most of the *Spinacia* accessions are now available for distribution, cooperation with the Salinas groups will continue, although on a reduced scale.

Miscellaneous Umbelliferae:

After the completion of seed storage in early 2002, 28% of the miscellaneous Umbelliferae are available for distribution, an improvement from only 17% in the previous year. Most of the newly available accessions are *Anethum* and *Coriandrum* grown in the field in 2000. One-hundred nine accessions harvested in 2001 await storage in 2002. After 2001, the backlogs of easier-to-grow annual genera are virtually completed. Regeneration progress will be more gradual in 2002 and beyond as my attention shifts to the more difficult to grow genera, such as *Angelica*.

One-hundred forty-two annual accessions were directly seeded into the field on April 18, 2001. These were mostly *Coriandrum,* but also *Ammi*, *Anethum*, *Bifora*, *Foeniculum* and *Pimpinella*. An additional 11 accessions, primarily *Pimpinella*, were transplanted into the field. Twelve accessions that did not flower during the summer were transplanted out of the field into pots, and remained healthy in GH 3 during the fall. Two *Torilis japonica* accessions flowered during the winter, after transplanting, indicating that they could be winter flowering annuals. Twenty-one biennial accessions of *Petroselinum* and *Carum* were planted on September 27, 2001 for field-cage pollination in 2002.

The miscellaneous umbels directly seeded in the field were planted with the genera alternating as they came out of the Kinze tractor-mounted planter. This allowed me to detect planting errors. Among the 125 genera planted, about 5 rows had at least one seedling of the wrong genus. I cannot be certain that wayward seeds were not sticking to people’s feet or carried by

water, etc., but an approximately 4% plot contamination rate indicates a better way to plant these small, oddly shaped seeds is needed.

Some of the field-grown *Coriandrum* and *Foeniculum* seeds were damaged by *Systole* sp., a seed Chalcid wasp. We started a *Systole* working group that includes active research efforts by David Kovach and Sharon McClurg. The group is conducting experiments designed to understand infestation and emergence of *Systole* insects in seeds.

Characterization/taxonomy/evaluation (Table 4)

A productive collaboration with Mei Sun and her molecular genetics group at the University of Hong Kong resulted in the resolution of two long-standing problems in *Amaranthus* taxonomy. PI 274275, an important plant breeding parent, is now identified as *Amaranthus hypochondriacus*, and an aberrant type of *A. cruentus*, with some flower traits of another species is now understood to be purely *A. cruentus* and not of hybrid origin. The *A. cruentus* project will be submitted for publication. This formula for molecular research collaboration can be expanded to other *Amaranthus* taxonomic issues, including an investigation of *A. blitum* in 2002.

Donald Pratt published the results of his graduate study of two similar wild *Amaranthus* species, *A. rudis* and *A. tuberculatus*. He concludes that they are a single species and should be combined as *A. tuberculatus*. In early 2002 John Wiersema made this change in the GRIN database.

REFERENCE:

Pratt, Donald B., and Lynn G. Clark. 2002. *Amaranthus rudis* and *A. tuberculatus* – one species or two? J. Torrey Bot. Soc. 128:282-296.

Corinne Johnson Rutzke of Cornell University completed a study of most of the *Spinacia* collection for potential cultivation as a food in outer space. Her data are the most complete descriptions of our collection, available online at <http://www.cornellcea.com/Research_Archive/index.htm>. These data include images, days to first flowering, and seed type descriptions. We will be linking her data to the GRIN database. An additional spinach research project led by Beiquan Mou, USDA/ARS Salinas, California, is collecting images and plant architecture data on most of our collection, and is willing to share data with GRIN.

The first two *Chenopodium* descriptors, seed weight and male sterility, were approved by the New Crops CGC, loaded into GRIN, and pertinent data entered.

I helped improve our procedure for assigning PI numbers; we now can assign PI's when the original seed has demonstrated viability and there are no passport data issues. Formerly, regeneration was required prior to PI number assignment. This change will help reduce our backlogs of temporary-numbered accessions.

Accession distributions 1997-2001

Crop	Year	No. of Orders	No. of Recipients	No. of Items Distributed	No. of Accessions Distributed
Amaranth	1997	53	40	444	186
	1998	63	57	2746	1786
	1999	62	50	3682	2487
	2000	44	37	860	451
	2001	51	37	985	604
Celosia	1997	3	3	3	2
	1998	2	2	6	5
	1999	3	3	24	17
	2000	6	6	11	8
	2001	2	2	12	11
Legumes	1997	9	7	25	20
	1998	6	5	34	16
	1999	4	4	32	32
	2000	7	7	16	13
	2001	4	4	7	7
Melilotus	1997	5	5	38	19
	1998	11	9	213	154
	1999	9	9	287	254
	2000	16	12	712	554
	2001	13	11	57	49
Perilla	1997	4	4	25	18
	1998	1	1	3	3
	1999	4	4	61	20
	2000	6	6	41	21
	2001	7	7	41	22
Quinoa	1997	8	7	18	16
	1998	13	12	121	92
	1999	10	10	294	163
	2000	21	19	342	149
	2001	18	15	239	173
Spinach	1997	10	8	1196	253
	1998	13	11	1395	309
	1999	11	10	1061	332
	2000	7	7	670	348
	2001	12	11	1736	354
Umbels	1997	8	8	325	183
	1998	9	9	127	116
	1999	14	13	150	87
	2000	11	11	107	88
	2001	15	13	105	94

Enhancement and/or utilization:

AMARANTHUS:

The enhancement project to reduce seed shattering in grain amaranths continues. Ten new breeding lines were grown in Ames, Iowa, and also by David Baltensperger, Univ. of Nebraska, Scottsbluff, Nebraska. Both observation plots were direct seeded; seedlings were previously transplanted into observation plots. Direct seeding was successful in reducing labor and better approximating field production conditions.

An F1 population was found to be 100% male sterile, indicating possible cytoplasmic inheritance of male sterility; it derives from a cross between PI 568125 (male sterile) and PI 538323. The male sterile hybrid set seed well when open pollinated in the field. In 2002 we will determine if male fertility is restored in these open pollinated progeny. These parents could someday be useful for hybrid seed production.

The University of Nebraska Scottsbluff amaranth breeding project will advance 31 lines from, or derived from, my breeding lines. Most of these lines are non-shattering. Performance concerns in Nebraska include poor yield of non-shattering lines, due to poor seed set, and lodging. The question of poor seed set should be studied in 2002 with microscopic dissection of the seed heads. Lines with non-lodging stems are needed and will be selected for.

A windy thunderstorm struck our *Amaranthus* observation plot in Ames on Sept. 7 causing many of the plants to blow over. Generally amaranths have good tolerance to wind, but this storm was unusually late in the season, after the inflorescences had expanded and the plants were top-heavy. PI 604461 (*A. hypochondriacus*) had good resistance to wind damage, even though it was growing in an exposed location. PI 576447 (*A. cruentus*) also had good wind resistance. These accessions may be good choices of breeding parents for these traits.

Collaboration was continued with Charlie Block to enhance cultivated *A. tricolor* for disease resistance to *Phomopsis amaranthicola*. In late 2001, F2 hybrid seeds of a cross between disease-susceptible and disease-resistant accessions were produced. These progeny can be used to study the inheritance of disease resistance and for selection of new disease-resistant vegetable lines.

MELILOTUS:

An active breeding program working with fine-stem, and low-coumarin traits is led by Dr. G. Ray Smith, of Texas A&M University. I hope to visit his research plots in April of 2002.

Publications and presentations and grants:

D.M. Brenner and Maia Akhalkatsi, Grant Proposal: Plant exploration in the country of Georgia to collect spinach germplasm for use in crop improvement. April 6, 2001. Funded by USDA/ARS NPGS Plant Exploration.

D.M. Brenner. Project report: *Amaranthus, Celosia, Chenopodium, Perilla, Spinacia*, miscellaneous Forage Legumes and Umbelliferae. April 12, 2001, Oral presentation. North Central Regional Plant Introduction Station, Program Review.

D.M. Brenner. Promising Amaranth Germplasm. Oral presentation. Amaranth: A promising new crop alternative. August 16-17, 2001. Amaranth Institute meeting. Columbia, MO.

D.M. Brenner*, D.D. Baltensperger, C.C. Block, R.L. Myers, and I.Simon. Amaranth: Progress and problems. Abstract and oral presentation, p. 31. In Nov. 10-13, 2001. Abstracts, 5th National Symposium, New crops and new uses: Strength in diversity. Atlanta, GA. *presenting author

D.M. Brenner. Regenerating Germplasm: Some methods used with *Amaranthus* and other Crops at the North Central Regional Plant Introduction Station. November 14, 2001. Oral presentation, Plant Genetic Resources Conservation Unit, Griffin, GA.

I prepared written Progress Reports for three Crop Germplasm Committees: Clover and Special Purpose Legumes, Leafy Vegetable, and New Crops.

Plans:

I am revising the *Melilotus* crop descriptors for GRIN and am completing a paper for publication on regeneration of *Melilotus* germplasm.

Aspects of curation other than regeneration are priorities for most of my crops. Passport, and characterization data and thousands of growing-plant images await loading into GRIN. In 2002, I hope to direct much of my hourly support help to work on these information backlogs. Development of new software that will facilitate loading images into GRIN on a large scale is needed.

The *Amaranthus* collection is large and diverse enough to be a substantial aid in resolving taxonomic controversies. I collaborate with others to resolve some of these long-term issues. Mihai Costea of the University of Guelph and Mei Sun at the University of Hong Kong are both very important in this effort.

Acknowledgments:

Sam Flomo, formerly with the *Brassica* Project, is now assisting my project. Stephanie Bruner, my shared technician, was permanently transferred to the *Brassica* project in March. Jon Behrens and Reggie Graeve were my project's student workers. Beatriz Spalding, recently a botany instructor, worked on my project in the spring, and helped with taxonomic determinations in *Celosia*.

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

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

Acquisition
Twenty-eight cultivated sunflowers were acquired in 2001. These accessions were either requested from the National Center for Genetic Resources Preservation (NCGRP, formerly NSSL) for regeneration and inclusion into our collection or were materials recently assigned Crop Science Registration numbers.

Maintenance
For the flax and miscellaneous asters collections, there was relatively little change in the percentage of available accessions in 2001 from 2000 (Table 1). Availability for the wild and cultivated sunflower collections combined increased almost 3 percent.

Regeneration activities for 2001 are summarized in Table 2. The cultivated sunflower regenerations were affected by windstorm on July 25 which caused severe lodging in many accessions and by the subsequent hot, dry weather. This past summer, a *Helianthus bolanderi* accession was regenerated in the greenhouse; regeneration attempts on this species had been unsuccessful in the past. Greater emphasis was placed on obtaining seed increases from perennial *Helianthus* species. In 2001, 17 perennial accessions were caged and insect pollinated in comparison to the four perennial accessions that were caged in 2000. Accessions of *H. anomalus* and *H. deserticola* (one each) were sent to the National Arid Land Plant Genetic Resources Unit (NALPGRU) in Parlier, California, to test the regeneration potential of that location for these desert *Helianthus* species.

As accessions are regenerated, we continue to send samples to NCGRP for back-up. Nearly the entire flax collection is duplicated at NCGRP, as well as 92 percent

of the cultivated *Helianthus* collection, 58 percent of the wild *Helianthus* collection, and 20 percent of the miscellaneous asters (Table 2).

In 2001, 322 germination tests were conducted, including scheduled five-year tests and initial germination tests on new inventory lots (Table 2).

A pollinator study conducted in cooperation with the Entomology team was repeated in 2001 to test the effectiveness of various *Helianthus* pollinators. Unfortunately, due to an unreliable external source for pollinating insects, this study was not successful and will be repeated in 2002.
A study was initiated in 2001 to determine the effect of concentrated populations of potential insect pollinators on the rate of outcrossing in flax, a predominantly self-pollinating crop.

Distribution
The packet and accession distribution summaries for the miscellaneous asters, flax and *Helianthus* germplasm collections are provided in Table 3. In 2000, almost 80 percent of *Helianthus* germplasm packets were sent to requestors outside the United States. However, in 2001, the reverse was true; 83 percent of *Helianthus* germplasm packets were distributed domestically and only 17 percent of packets were sent outside the United States.

Year 2001 requests for sunflower germplasm increased two-thirds compared to 2000. The distribution history for the miscellaneous asters, flax, and *Helianthus* germplasm collections is provided in the following table.

Crop	Calendar Year	No. of Orders	No. of Recipients	No. of Items Distributed	No. of Acc. Distributed
Misc. Asters	1997	6	6	29	21
	1998	8	7	132	67
	1999	8	8	15	14
	2000	8	8	87	40
	2001	6	5	10	7
Flax[⊥]	1998	8	7	66	62
	1999	14	13	297	259
	2000	8	8	120	118
	2001	14	14	268	223
Cult. *Helianthus*	1997	57	40	2882	1025
	1998	43	31	1855	916
	1999	55	39	2114	1095
	2000	28	27	884	740
	2001	46	33	1500	766
Wild *Helianthus*	1997	28	25	492	355
	1998	28	22	547	426
	1999	35	29	704	448
	2000	21	15	820	588
	2001	36	29	1322	879

[⊥] The flax collection was transferred to the NCRPIS January 1998.

Characterization/taxonomy
Plant and achene data were recorded for *Helianthus* increases, and plant data were recorded for flax increases (Table 4). Characterization of flax seed is now recorded on GRIN using an Oracle-based form developed by D. Kovach. The form allows for direct entry into GRIN, and various record-keeping procedures related to inventory maintenance are streamlined. We also initiated a project to capture

digital images of *Helianthus* and flax seed, and 379 images were recorded in 2001 (Table 4). Also added to GRIN were oil percentage data for 300 *Helianthus* accessions.

Evaluation/Utilization
For a third year, eight *H. debilis* ssp. *debilis* accessions were evaluated by M. Brothers and M. Widrlechner for their potential as a bedding plant.

In 2001, *Helianthus* seed was distributed for evaluation of host-plant resistance to downy mildew, sunflower moth, and stem weevil.

Enhancement
C. Block continued an enhancement program to develop wild *H. annuus* populations resistant to *Alternaria helianthi*, *Septoria helianthi*, and powdery mildew.

Future Plans
In cooperation with Maria Jenderek, NALPGRU, we will establish Parlier, California as an alternate regeneration site for wild annual and perennial *Helianthus* species. We anticipate having 20 large pollination cages available for regeneration on a yearly basis. In total, we estimate that 113 perennial *Helianthus* accessions and 86 annual *Helianthus* accessions could be regenerated at this location. Additionally, 71 *Vernonia* accessions and five accessions of other genera from the miscellaneous asters collection potentially could be regenerated at the NALPGRU.

In 2002 we will initiate a study to determine the effect of harvest date on seed quality in wild annual *Helianthus* species. We have selected two *H. petiolaris* ssp. *petiolaris* accessions and four *H. annuus* accessions for this investigation.

As part of a station-wide effort, we will begin tracking labor requirements for the various germplasm regeneration and maintenance processes.

i. *Cuphea* and *Euphorbia* (J. W. Van Roekel)

Cuphea

Acquisition:

There were no *Cuphea* accessions added to the collection in 2001 (Table 1).

Maintenance:

Maintenance of the collection has been limited to maintaining greenhouse plants that are sterile, or that have not been successfully regenerated. There were 170 *Cuphea* accessions that were inactivated. These could not be grown because the seed was not viable, and attempts to obtain additional seed were not successful.

Distribution:

Distributions for *Cuphea* are included in Table 3. The distribution history for the last five years is provided in the table that follows.

Crop	Calendar Year	No. of Orders	No. of Recipients	No. of Items Distributed	No. of Accessions Distributed
Cuphea	1997	18	14	680	371
	1998	6	5	25	18
	1999	12	11	110	98
	2000	10	8	122	89
	2001	16	12	713	498

Characterization/taxonomy:

None.

Evaluation/Enhancement:

Although no active evaluation or enhancement of *Cuphea* is being done at NCRPIS, information, training, and germplasm are being shared with researchers who are actively pursuing commercialization of the crop.
In collaboration with Dr. Steven Knapp (Oregon State University), one accession of an improved *Cuphea* line was increased to provide more seed for further enhancement and evaluation by his research group and other collaborators.

Future Plans:

Regeneration efforts for this growing season will be considered based on viability, seed availability, and resources available for the coming season. Discussions have been held to determine if this species should in whole, or in part be transferred to another location.

Euphorbia

Acquisition:

One new accession of *Euphorbia* was added to the collection in 2001. (Table 1)

Maintenance:

Regeneration has been limited in 2001 to harvesting existing plants in the greenhouse and to vernalizing some accessions to induce flowering and seed production in the greenhouse.

Distribution:

Distributions for *Euphorbia* are included in Table 3. The distribution history for the last five years is provided in the table that follows.

Crop	Calendar Year	No. of Orders	No. of Recipients	No. of Items	No. of Accessions
Euphorbia	1997	4	4	18	11
	1998	0	0	0	0
	1999	2	2	2	2
	2000	3	3	37	37
	2001	1	1	1	1

Characterization/taxonomy:

None.

Evaluation/Enhancement:

None.

Future Plans:

At this time, regeneration efforts will be limited to using vernalization to induce flowering of greenhouse plants. These will be harvested as appropriate.

Year 2001 **Table 1**[1] **# Accessions, # Acquired, # Available**

CURATOR	GENUS_CROP	# Accessions	# Accs Acquired	% Acquired	# Available	% Available	% Avail Last Yr
Brenner	NC7-amaranth	3326	46	1	2994	90	87
	NC7-celosia	54	2	4	19	35	33
	NC7-legumes	231	4	2	105	45	43
	NC7-melilotus	922	2	0	679	74	74
	NC7-perilla	22	1	5	22	100	100
	NC7-quinoa	236	1	0	166	70	70
	NC7-spinach	401	24	6	351	88	86
	NC7-umbels	990	44	4	252	25	16
	Sub-Total:	6182	124	2	4588	74	71
Brothers	NC7-asters	311	0	0	84	27	27
	NC7-flax	2807	0	0	2791	99	100
	NC7-sun.cults	1662	28	2	1388	84	81
	NC7-sun.wilds	2152	0	0	1110	52	47
	Sub-Total:	6932	28	0	5373	78	76
Luhman	NC7-brassica	1970	16	1	1573	80	80
	NC7-crucifers	1098	3	0	646	59	58
	NC7-echinochloa	268	0	0	187	70	66
	NC7-flax.wilds	157	2	1	18	11	10
	NC7-grasses	116	0	0	14	12	11
	NC7-panicum	969	0	0	857	88	87
	NC7-setaria	995	0	0	891	90	90
	Sub-Total:	5573	21	0	4186	75	74
Millard	NC7-corn.kin	33	0	0	6	18	18
	NC7-maize	17723	676	4	10975	62	64
	Sub-Total:	17756	676	4	10981	62	64
Reitsma	NC7-chicory	249	0	0	175	70	70
	NC7-cucumis.cucs	1347	1	0	1262	94	90
	NC7-cucumis.melo	3046	14	0	2187	72	71
	NC7-cucumis.wilds	327	0	0	116	35	32
	NC7-cucurbita	943	1	0	787	83	82
	NC7-cucurbits.misc	2	0	0	1	50	0
	NC7-daucus	1088	51	5	613	56	58
	NC7-ocimum	96	0	0	84	88	75
	NC7-parsnips	71	0	0	22	31	26
	Sub-Total:	7169	67	1	5247	73	72
Van Roekel	NC7-cuphea	650	0	0	487	75	59
	NC7-euphorbia	217	1	0	43	20	20
	Sub-Total:	867	1	0	530	61	51
Widrlechner	NC7-mints	120	0	0	59	49	50
	NC7-ornamentals	2499	69	3	1101	44	41
	Sub-Total:	2619	69	3	1160	44	42
	Total:	**47098**	**986**	**2**	**32065**	**68**	**68**

Year 2001 **Table 2** **# Germed, # Regenerated, # Backed Up**

CURATOR	GENUS_CROP	# Accessions	# Accs Germed	% Accs Germed	# Attempted Regen	# Harvested Regen	# Perm Perennial	# Perennial Harvested	# Accs Backed Up for YR	Total # Accs Backed Up	% Accs Backed Up
Brenner	NC7-amaranth	3326	169	5	188	184	0	0	20	2986	90
	NC7-celosia	54	14	26	5	4	0	0	1	16	30
	NC7-legumes	231	0	0	0	0	0	0	0	110	48
	NC7-melilotus	922	0	0	0	0	0	0	0	738	80
	NC7-perilla	22	1	5	1	1	0	0	2	22	##
	NC7-quinoa	236	13	6	7	5	0	0	0	183	78
	NC7-spinach	401	0	0	60	56	0	0	54	361	90
	NC7-umbels	990	246	25	159	109	0	0	33	264	27
	Sub-Total:	6182	443	7	420	359	0	0	110	4680	76
Brothers	NC7-asters	311	4	1	1	0	0	0	0	62	20
	NC7-flax	2807	102	4	28	28	0	0	0	2801	##
	NC7-sun.cults	1662	91	5	104	82	0	0	51	1525	92
	NC7-sun.wilds	2152	125	6	146	99	8	15	114	1241	58
	Sub-Total:	6932	322	5	279	209	8	15	165	5629	81
Luhman	NC7-brassica	1970	34	2	150	148	0	0	23	1861	94
	NC7-crucifers	1098	143	13	8	6	0	0	40	749	68
	NC7-echinochloa	268	0	0	10	5	0	0	39	210	78
	NC7-flax.wilds	157	4	3	0	0	0	0	9	12	8
	NC7-grasses	116	0	0	4	1	0	0	0	37	32
	NC7-panicum	969	249	26	23	13	0	0	5	878	91
	NC7-setaria	995	0	0	23	16	0	0	7	929	93
	Sub-Total:	5573	430	8	218	189	0	0	123	4676	84
Millard	NC7-corn.kin	33	0	0	0	0	1	1	0	8	24
	NC7-maize	17723	1567	9	376	334	6	3	205	12878	73
	Sub-Total:	17756	1567	9	376	334	7	4	205	12886	73
Reitsma	NC7-chicory	249	0	0	74	43	0	0	12	158	63
	NC7-cucumis.cucs	1347	44	3	45	77	0	0	37	1236	92
	NC7-cucumis.melo	3046	74	2	82	77	0	0	33	2319	76
	NC7-cucumis.wilds	327	17	5	18	9	0	0	14	123	38
	NC7-cucurbita	943	34	4	26	24	0	0	16	738	78
	NC7-cucurbits.misc	2	0	0	0	0	0	0	0	1	50
	NC7-daucus	1088	0	0	91	115	0	0	33	642	59
	NC7-ocimum	96	64	67	0	0	0	0	18	86	90
	NC7-parsnips	71	0	0	35	0	0	0	6	12	17
	Sub-Total:	7169	233	3	371	345	0	0	169	5315	74
VanRoekel	NC7-cuphea	650	17	3	0	0	0	0	9	561	86
	NC7-euphorbia	217	0	0	0	0	0	0	0	53	24
	Sub-Total:	867	17	2	0	0	0	0	9	614	71
Widrlechner	NC7-mints	120	53	44	16	10	0	0	1	58	48
	NC7-ornamentals	2499	72	3	232	64	30	29	121	830	33
	Sub-Total:	2619	125	5	248	74	30	29	122	888	34
	Total:	**47098**	**3137**	**7**	**1912**	**1510**	**45**	**48**	**903**	**34688**	**74**

Year 2001 **Table 3** **# Distributed, # Orders, # Recipients**

CURATOR	GENUS_CROP	# Accessions	# Items Dist Domestic	# Items Dist Foreign	# Accs Dist Domestic	# Accs Dist Foreign	# Accs Dist Total	% Accs Distributed	# Orders	# Recipients	Order Sum*	Recipient Sum*
Brenner	NC7-amaranth	3326	198	787	157	563	604	18	51	37	738	536
	NC7-celosia	54	10	2	10	2	11	20	2	2	738	536
	NC7-legumes	231	2	5	2	5	7	3	4	4	738	536
	NC7-melilotus	922	21	36	19	36	49	5	13	11	738	536
	NC7-perilla	22	33	8	22	8	22	100	7	7	738	536
	NC7-quinoa	236	207	32	173	25	173	73	18	15	738	536
	NC7-spinach	401	1371	365	354	338	354	88	12	11	738	536
	NC7-umbels	990	19	86	14	81	94	9	15	13	738	536
	Sub-Total:	6182	1861	1321	751	1058	1314	21				
Brothers	NC7-asters	311	8	2	6	2	7	2	6	5	738	536
	NC7-flax	2807	43	225	38	188	223	8	14	14	738	536
	NC7-sun.cults	1662	1052	448	651	319	766	46	46	33	738	536
	NC7-sun.wilds	2152	1299	23	871	23	879	41	36	29	738	536
	Sub-Total:	6932	2402	698	1566	532	1875	27				
Luhman	NC7-brassica	1970	90	379	78	357	414	21	36	33	738	536
	NC7-crucifers	1098	371	269	199	234	268	24	22	18	738	536
	NC7-echinochloa	268	5	31	5	31	33	12	4	4	738	536
	NC7-flax.wilds	157	22	0	19	0	19	12	2	2	738	536
	NC7-grasses	116	7	0	6	0	6	5	3	3	738	536
	NC7-panicum	969	654	8	650	7	650	67	8	8	738	536
	NC7-setaria	995	17	3	16	3	19	2	6	6	738	536
	Sub-Total:	5573	1166	690	973	632	1409	25				
Millard	NC7-corn.kin	33	12	1	7	1	7	21	7	7	738	536
	NC7-maize	17723	6704	539	4506	442	4569	26	303	209	738	536
	Sub-Total:	17756	6716	540	4513	443	4576	26				
Reitsma	NC7-chicory	249	282	6	175	6	175	70	6	6	738	536
	NC7-cucumis.cucs	1347	393	282	333	220	477	35	23	20	738	536
	NC7-cucumis.melo	3046	157	330	134	322	409	13	38	33	738	536
	NC7-cucumis.wilds	327	58	10	41	10	48	15	10	10	738	536
	NC7-cucurbita	943	119	169	101	103	156	17	22	20	738	536
	NC7-cucurbits.misc	2	1	1	1	1	1	50	2	2	738	536
	NC7-daucus	1088	54	181	51	176	211	19	13	12	738	536
	NC7-ocimum	96	18	79	17	79	79	82	5	5	738	536
	NC7-parsnips	71	0	0	0	0	0	0	0	0	738	536
	Sub-Total:	7169	1082	1058	853	917	1556	22				
VanRoekel	NC7-cuphea	650	691	22	480	18	483	74	16	12	738	536

	NC7-euphorbia	217	0	1	0	1	1	0	1	1	738	536
	Sub-Total:	867	691	23	480	19	484	56				
Widrlechner	NC7-mints	120	42	33	41	33	42	35	5	5	738	536
	NC7-ornamentals	2499	671	328	277	194	365	15	94	85	738	536
	Sub-Total:	2619	713	361	318	227	407	16				
	Total:	**47098**	**14631**	**4691**	**9454**	**3828**	**11621**	**25**	**738**	**536**		

* Order and Recipient sums are station totals

Year 2001 **Table 4** **# Obs in GRIN, # Images in GRIN**

CURATOR	GENUS_CROP	# Accessions	# Acc Obs Trials	# Acc Obs by Curator	# Obs in GRIN for Year	# Acc Obs in GRIN for Year	# Acc Obs in GRIN Last Year	# Acc Obs in GRIN (all yrs)	# Acc Image taken by Curator	# Acc Image in GRIN for Year	# Acc Image in GRIN (all years)
Brenner	NC7-amaranth	3326	60		56	25	1137	3200	220	0	221
	NC7-celosia	54	0		0	0	0	2	4	0	3
	NC7-legumes	231	0		0	0	0	84	0	0	0
	NC7-melilotus	922	2		0	0	45	543	0	0	0
	NC7-perilla	22	0		0	0	0	0	1	0	1
	NC7-quinoa	236	0		499	235	0	235	5	0	1
	NC7-spinach	401	0		0	0	0	0	0	0	1
	NC7-umbels	990	2		0	0	0	2	121	0	0
	Sub-Total:	6182	64	0	555	260	1182	4066	351	0	227
Brothers	NC7-asters	311	1		0	0	0	3	1	0	0
	NC7-flax	2807	1	28	589	105	2790	2804	168	0	0
	NC7-sun.cults	1662	65		6864	999	1390	1607	85	0	0
	NC7-sun.wilds	2152	64		6245	560	699	1720	125	0	0
	Sub-Total:	6932	131	28	13698	1664	4879	6134	379	0	0
Luhman	NC7-brassica	1970	1	192	341	37	87	1538	157	0	2
	NC7-crucifers	1098	4	68	546	60	102	386	4	0	0
	NC7-echinochloa	268	0	4	0	0	0	10	4	0	0
	NC7-flax.wilds	157	0	0	0	0	2	2	7	0	0
	NC7-grasses	116	0	1	0	0	0	1	0	0	0
	NC7-panicum	969	0	15	0	0	0	0	15	0	0
	NC7-setaria	995	0	16	0	0	0	74	16	0	0
	Sub-Total:	5573	5	296	887	97	191	2011	203	0	2
Millard	NC7-corn.kin	33	0		0	0	0	0	1	0	0
	NC7-maize	17723	3877		30459	5467	11734	14499	3756	1327	2004
	Sub-Total:	17756	3877	0	30459	5467	11734	14499	3757	1327	2004
Reitsma	NC7-chicory	249	0	48	0	0	0	0	59	0	0
	NC7-cucumis.cucs	1347	0	42	0	0	631	845	40	0	0
	NC7-cucumis.melo	3046	0	77	0	0	1091	2409	72	0	0
	NC7-cucumis.wilds	327	0	9	0	0	11	96	15	0	0
	NC7-cucurbita	943	0	23	0	0	446	447	0	0	0
	NC7-cucurbits.misc	2	0	0	0	0	0	1	12	0	0
	NC7-daucus	1088	0	77	0	0	0	455	0	0	0
	NC7-ocimum	96	1	0	0	0	0	0	0	0	0
	NC7-parsnips	71	0	0	0	0	0	0	0	0	0
	Sub-Total:	7169	1	276	0	0	2179	4253	198	0	0

VanRoekel	NC7-cuphea	650	0	0	0	0	0	326	0	0	0
	NC7-euphorbia	217	0	0	0	0	0	0	0	0	0
	Sub-Total:	867	0	0	0	0	0	326	0	0	0
Widrlechner	NC7-mints	120	0	0	0	0	0	0	0	0	0
	NC7-ornamentals	2499	19	74	0	0	2	30	116	0	0
	Sub-Total:	2619	19	74	0	0	2	30	116	0	0
	Total:	**47098**	**4097**	**674**	**45599**	**7488**	**20167**	**31319**	**5004**	**1327**	**2233**

Year 2001 **Table 5** **Five-Year Summaries for Orders**

CURATOR	GENUS_CROP	TIME_PERIOD	# Orders	# Recipients	# Items Distributed	# Accessions Distributed
Brenner	NC7-amaranth	01/01/1997 - 12/31/1997	53	40	444	186
		01/01/1998 - 12/31/1998	63	57	2746	1784
		01/01/1999 - 12/31/1999	62	50	3682	2485
		01/01/2000 - 12/31/2000	44	37	860	451
		01/01/2001 - 12/31/2001	51	37	985	604
	Total:		273	221	8717	5510
	NC7-celosia	01/01/1997 - 12/31/1997	3	3	3	2
		01/01/1998 - 12/31/1998	2	2	6	5
		01/01/1999 - 12/31/1999	3	3	24	17
		01/01/2000 - 12/31/2000	6	6	11	8
		01/01/2001 - 12/31/2001	2	2	12	11
	Total:		16	16	56	43
	NC7-legumes	01/01/1997 - 12/31/1997	9	7	25	20
		01/01/1998 - 12/31/1998	6	5	34	16
		01/01/1999 - 12/31/1999	4	4	32	32
		01/01/2000 - 12/31/2000	7	7	16	13
		01/01/2001 - 12/31/2001	4	4	7	7
	Total:		30	27	114	88
	NC7-melilotus	01/01/1997 - 12/31/1997	5	5	38	19
		01/01/1998 - 12/31/1998	11	9	213	154
		01/01/1999 - 12/31/1999	9	9	287	254
		01/01/2000 - 12/31/2000	16	12	712	554
		01/01/2001 - 12/31/2001	13	11	57	49
	Total:		54	46	1307	1030
	NC7-perilla	01/01/1997 - 12/31/1997	4	4	25	18
		01/01/1998 - 12/31/1998	1	1	3	3
		01/01/1999 - 12/31/1999	4	4	61	20
		01/01/2000 - 12/31/2000	6	6	41	21
		01/01/2001 - 12/31/2001	7	7	41	22
	Total:		22	22	171	84
	NC7-quinoa	01/01/1997 - 12/31/1997	8	7	18	16
		01/01/1998 - 12/31/1998	13	12	121	92
		01/01/1999 - 12/31/1999	10	10	294	163
		01/01/2000 - 12/31/2000	21	19	342	149
		01/01/2001 - 12/31/2001	18	15	239	173
	Total:		70	63	1014	593
	NC7-spinach	01/01/1997 - 12/31/1997	10	8	1196	253
		01/01/1998 - 12/31/1998	13	11	1395	309
		01/01/1999 - 12/31/1999	11	10	1061	332
		01/01/2000 - 12/31/2000	7	7	670	348
		01/01/2001 - 12/31/2001	12	11	1736	354
	Total:		53	47	6058	1596
	NC7-umbels	01/01/1997 - 12/31/1997	8	8	325	183
		01/01/1998 - 12/31/1998	9	9	127	116
		01/01/1999 - 12/31/1999	14	13	156	93
		01/01/2000 - 12/31/2000	11	11	107	88
		01/01/2001 - 12/31/2001	15	13	105	94
	Total:		57	54	820	574
Total:			**575**	**496**	**18257**	**9518**

Brothers	NC7-asters	01/01/1997 - 12/31/1997	6	6	29	21
		01/01/1998 - 12/31/1998	8	7	132	67
		01/01/1999 - 12/31/1999	8	8	15	14
		01/01/2000 - 12/31/2000	8	8	87	40
		01/01/2001 - 12/31/2001	6	5	10	7
	Total:		36	34	273	149
	NC7-flax	01/01/1997 - 12/31/1997	0	0	0	0
		01/01/1998 - 12/31/1998	8	7	66	62
		01/01/1999 - 12/31/1999	14	13	297	259
		01/01/2000 - 12/31/2000	8	8	120	118
		01/01/2001 - 12/31/2001	14	14	268	223
	Total:		44	42	751	662
	NC7-sun.cults	01/01/1997 - 12/31/1997	57	40	2882	1025
		01/01/1998 - 12/31/1998	43	31	1855	916
		01/01/1999 - 12/31/1999	55	39	2114	1095
		01/01/2000 - 12/31/2000	28	27	887	740
		01/01/2001 - 12/31/2001	46	33	1500	766
	Total:		229	170	9238	4542
	NC7-sun.wilds	01/01/1997 - 12/31/1997	28	25	492	355
		01/01/1998 - 12/31/1998	28	22	547	426
		01/01/1999 - 12/31/1999	35	29	704	448
		01/01/2000 - 12/31/2000	21	15	820	588
		01/01/2001 - 12/31/2001	36	29	1322	879
	Total:		148	120	3885	2696
Total:			**457**	**366**	**14147**	**8049**
Luhman	NC7-brassica	01/01/1997 - 12/31/1997	39	36	2267	973
		01/01/1998 - 12/31/1998	36	32	1560	1201
		01/01/1999 - 12/31/1999	53	46	2181	1123
		01/01/2000 - 12/31/2000	69	56	1245	862
		01/01/2001 - 12/31/2001	36	33	469	414
	Total:		233	203	7722	4573
	NC7-crucifers	01/01/1997 - 12/31/1997	17	13	334	297
		01/01/1998 - 12/31/1998	18	17	403	303
		01/01/1999 - 12/31/1999	15	13	299	227
		01/01/2000 - 12/31/2000	16	15	72	66
		01/01/2001 - 12/31/2001	22	18	640	268
	Total:		88	76	1748	1161
	NC7-echinochloa	01/01/1997 - 12/31/1997	0	0	0	0
		01/01/1998 - 12/31/1998	8	7	52	46
		01/01/1999 - 12/31/1999	2	2	9	8
		01/01/2000 - 12/31/2000	5	4	166	149
		01/01/2001 - 12/31/2001	4	4	36	33
	Total:		19	17	263	236
	NC7-flax.wilds	01/01/1997 - 12/31/1997	0	0	0	0
		01/01/1998 - 12/31/1998	2	2	19	19
		01/01/1999 - 12/31/1999	3	3	26	16
		01/01/2000 - 12/31/2000	0	0	0	0
		01/01/2001 - 12/31/2001	2	2	22	19
	Total:		7	7	67	54
	NC7-grasses	01/01/1997 - 12/31/1997	2	2	4	4
		01/01/1998 - 12/31/1998	3	3	11	9
		01/01/1999 - 12/31/1999	1	1	1	1
		01/01/2000 - 12/31/2000	0	0	0	0
		01/01/2001 - 12/31/2001	3	3	7	6
	Total:		9	9	23	20

	NC7-panicum	01/01/1997 - 12/31/1997	4	4	52	47
		01/01/1998 - 12/31/1998	7	7	34	34
		01/01/1999 - 12/31/1999	2	2	7	7
		01/01/2000 - 12/31/2000	9	8	58	49
		01/01/2001 - 12/31/2001	8	8	662	650
	Total:		30	29	813	787
	NC7-setaria	01/01/1997 - 12/31/1997	6	6	251	235
		01/01/1998 - 12/31/1998	7	7	57	51
		01/01/1999 - 12/31/1999	7	6	27	26
		01/01/2000 - 12/31/2000	13	12	795	757
		01/01/2001 - 12/31/2001	6	6	20	19
	Total:		39	37	1150	1088
Total:			**425**	**378**	**11786**	**7919**
Millard	NC7-corn.kin	01/01/1997 - 12/31/1997	9	8	15	4
		01/01/1998 - 12/31/1998	11	10	23	7
		01/01/1999 - 12/31/1999	8	8	19	6
		01/01/2000 - 12/31/2000	9	9	20	7
		01/01/2001 - 12/31/2001	7	7	13	7
	Total:		44	42	90	31
	NC7-maize	01/01/1997 - 12/31/1997	202	160	5034	3281
		01/01/1998 - 12/31/1998	178	137	3297	2184
		01/01/1999 - 12/31/1999	231	167	4545	2808
		01/01/2000 - 12/31/2000	257	193	18526	10990
		01/01/2001 - 12/31/2001	303	209	7243	4569
	Total:		1171	866	38645	23832
Total:			**1215**	**908**	**38735**	**23863**
Reitsma	NC7-chicory	01/01/1997 - 12/31/1997	4	3	22	20
		01/01/1998 - 12/31/1998	4	4	76	39
		01/01/1999 - 12/31/1999	6	5	123	115
		01/01/2000 - 12/31/2000	5	5	52	52
		01/01/2001 - 12/31/2001	6	6	288	175
	Total:		25	23	561	401
	NC7-cucumis	01/01/1997 - 12/31/1997	50	41	2910	1866
		01/01/1998 - 12/31/1998	49	40	1584	995
		01/01/1999 - 12/31/1999	54	46	3064	2084
		01/01/2000 - 12/31/2000	60	45	1555	1235
		01/01/2001 - 12/31/2001	59	49	1230	934
	Total:		272	221	10343	7114
	NC7-cucurbita	01/01/1997 - 12/31/1997	15	15	275	249
		01/01/1998 - 12/31/1998	15	15	114	98
		01/01/1999 - 12/31/1999	16	15	170	137
		01/01/2000 - 12/31/2000	19	18	457	363
		01/01/2001 - 12/31/2001	22	20	288	156
	Total:		87	83	1304	1003
	NC7-cucurbits.misc	01/01/1997 - 12/31/1997	0	0	0	0
		01/01/1998 - 12/31/1998	1	1	1	1
		01/01/1999 - 12/31/1999	2	2	2	1
		01/01/2000 - 12/31/2000	0	0	0	0
		01/01/2001 - 12/31/2001	2	2	2	1
	Total:		5	5	5	3
	NC7-daucus	01/01/1997 - 12/31/1997	13	11	271	204
		01/01/1998 - 12/31/1998	19	16	922	525
		01/01/1999 - 12/31/1999	20	16	481	331
		01/01/2000 - 12/31/2000	11	11	205	203
		01/01/2001 - 12/31/2001	13	12	235	211

	Total:		76	66	2114	1474
	NC7-ocimum	01/01/1997 - 12/31/1997	3	3	91	46
		01/01/1998 - 12/31/1998	7	7	211	70
		01/01/1999 - 12/31/1999	7	7	206	88
		01/01/2000 - 12/31/2000	7	7	245	75
		01/01/2001 - 12/31/2001	5	5	97	79
	Total:		29	29	850	358
	NC7-parsnips	01/01/1997 - 12/31/1997	2	2	16	13
		01/01/1998 - 12/31/1998	0	0	0	0
		01/01/1999 - 12/31/1999	2	2	8	8
		01/01/2000 - 12/31/2000	0	0	0	0
		01/01/2001 - 12/31/2001	0	0	0	0
	Total:		4	4	24	21
Total:			**498**	**431**	**15201**	**10374**
Van Roekel	NC7-cuphea	01/01/1997 - 12/31/1997	18	14	680	371
		01/01/1998 - 12/31/1998	6	5	25	18
		01/01/1999 - 12/31/1999	12	11	110	98
		01/01/2000 - 12/31/2000	10	8	122	89
		01/01/2001 - 12/31/2001	16	12	713	483
	Total:		62	50	1650	1059
	NC7-euphorbia	01/01/1997 - 12/31/1997	4	4	18	11
		01/01/1998 - 12/31/1998	0	0	0	0
		01/01/1999 - 12/31/1999	2	2	2	2
		01/01/2000 - 12/31/2000	3	3	37	37
		01/01/2001 - 12/31/2001	1	1	1	1
	Total:		10	10	58	51
Total:			**72**	**60**	**1708**	**1110**
Widrlechner	NC7-mints	01/01/1997 - 12/31/1997	3	3	33	18
		01/01/1998 - 12/31/1998	10	10	85	47
		01/01/1999 - 12/31/1999	3	3	8	8
		01/01/2000 - 12/31/2000	3	3	37	35
		01/01/2001 - 12/31/2001	5	5	75	42
	Total:		24	24	238	150
	NC7-ornamentals	01/01/1997 - 12/31/1997	85	69	520	269
		01/01/1998 - 12/31/1998	92	84	531	234
		01/01/1999 - 12/31/1999	92	83	656	271
		01/01/2000 - 12/31/2000	84	79	585	281
		01/01/2001 - 12/31/2001	94	85	999	365
	Total:		447	400	3291	1420
Total:			**471**	**424**	**3529**	**1570**
Station Total:			**3774**	**3132**	**103363**	**62403**