NORTH CENTRAL REGIONAL PLANT INTRODUCTION STATION
NC-7 ANNUAL REPORT, JANUARY 1 - DECEMBER 31, 1990

I. PROJECT TITLE: NC-7 "New Crops - The Introduction, Multiplication, Evaluation, Preservation, Cataloguing, Enhancement, and Utilization of Plant Germplasm.

II. COOPERATING AGENCIES AND PRINCIPAL LEADERS:

A. Administrative Advisor — T. A. Fretz, Iowa
B. Acting Regional Coordinator — *R. L. Wilson, Iowa
C. State Experiment Stations Representatives

1.	Illinois	*T. Hymowitz	7.	Missouri	*P. Beuselinck, Chmn.
2.	Indiana	*J. Janick	8.	Nebraska	*D. Andrew8
3.	Iowa	*I. Carlson	9.	N. Dakota'	*J. Franckowiak
4.	Kansas	*c. Wassom	10.	Ohio	*S. Berry
5.	Michigan	*A. Iezzoni	11.	s. Dakota	*A. Boe
6.	Minnesota	*H. Pellett	12.	Wisconsin,	*W. Tracy, Secy.

*Voting members

D. U. S. Department of Agriculture

1.	ARS National Program Staff, Germplasm	*H. Shands
2.	ARS Plant Introduction Office	*G. White
3.	ARS Area Director, Midwest Area	D. Murrell
4.	Cooperative State Research Service	D. Sleper
5.	soil Conservation Service	*E. Jacobson
6.	Northern Regional Research Center, Peoria	*R. Kleiman
7.	National Seed Storage Laboratory	*S. Eberhart

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

1. USDA-ARS Staff

a.	Acting Research Leader	R. Wilson
	Secretary	L. Wilson
b.	Research Agronomist	W. Roath
	Agricultural Research Technician	B. Van Roekel
C.	Horticulturist	M. Widrlechner
	Agricultural Research Technician	P. Ovrom
d.	Research Entomologist	R. Wilson
	(1) Agricultural Research Technician (insects)	S. McClurg
	(2) Biological Research Technician (insects)	C. Abel
e.	Biological Aide	J. Colvin
	Biological Aide	J. Edwards
	Biological Aide	H. Lundgren
	Biological Aide	A. Nielsen
	Biological Aide	Vacant
	Biological Aide	Vacant;,

2. Iowa State University Staff

a. Farm Superintendent	L. Lockhart
(1) Field-Lab Technician III	D. Lutjen
(2) Field-Lab Technician XI	M. Czajkowski
(3) Clerk Typist II	L. Minor
b. computer Coordinator (GRIN) & Corn Curator	M. Millard
(1) Assistant Computer Coordinator (GRIN)	P. Lundeen
(2) Field-Lab Technician II	T. Ladjahasan
c. Research Associate II (Plant Pathology)	C. Block
d. Curator I (Braseica, Grasses)	R. Luhman
e. Curator I (Vegetables)	K. Reitsma
f. Curator I (Sunflowers)	C. Stauffer
g. curator I (Amaranth)	D. Brenner

III. PROGRESS OF WORE

A. General Station

1. Personnel Changes

During 1990, we added 4 1/2 Biological Aides (GS-2) and 1 GS-4 Biological Aide. These positions will be used to give permanent support to our curators. Jeff Pomeroy resigned as sunflower curator and was replace by Cynthia Stauffer. Ray Clark transferred to the PI Station in Pullman, WA. A search was initiated to find a permanent replacement. In the interim, Dr. Richard L. Wilson was appointed Acting Research Leader.

2. Construction

The 30' x 100' greenhouse construction was started and will be completed in early 1991. The Entomology building construction was started and scheduled for completion on December 25, 1990. However, the completion date was not met and the building is scheduled to be finished in April of 1991.

3. Acquisition of New Germplasm 1990

Genus	No. Received
Amaranthus	207
Beta	190
Brassica	20
Chenopodium	57
Cornus	30
Cucumis	138
Cuphea	178
Helianthus	118
Zea	839
All other	366
Total	2,143

B. Horticulture Program (Mark Widrlechner)

1. Coordination of the NC-7 Regional Ornamental Trials:

a. Plant Distribution - 723 plants of 14 accessions were sent on request to regional cooperators for planting at 29 sites (an additional 68 plants of these accessions were sent to arboreta). The trial site at Elsberry, MO was revived after a long hiatus and a new trial site was established in Cincinnati, OH to replace an inactive site at Lexington, KY.

b. Computer-generated "Report of Planting," "Plot Information," "First-year Performance Report," and "Five-year Performance Report" forms were distributed to trial site cooperators this spring along with old-format "Ten-year Performance Report" forms. Returned forms from 1989 were entered into GRIN, and forms returned in 1990 have been compiled and will be entered into GRIN early in 1991.

c. Trial sites in Nebraska, South Dakota, North Dakota, Minnesota and Ohio were visited this spring.

d. Three newsletter updates and a special letter were sent to trial site cooperators in 1990, to keep them informed about current developments at Ames and throughout the program.

e. The Horticulturist gave an invited presentation describing the NC-7 Regional Ornamental Trials to the 1990 meeting of the Metropolitan Tree Improvement Alliance (METRIA) at the Morton Arboretum in June. This presentation will be published in the METRIA Proceedings.

2. Ornamental Germplasm Collections:

a. During 1990, there has been a major transfer of woody ornamental germplasm to the National Arboretum. There is now a repository at the National Arboretum responsible for the maintenance of a large number of ornamental genera. In 1990, 441 packets of seed, 138 plants of 44 accessions, and 616 cuttings of 23 accessions have been sent to the National Arboretum for maintenance. Transfers will continue on a smaller scale in 1991.

b. In 1990, 70 plants and 40 packets of seed have been distributed as a result of requests for ornamental germplasm.

c. The ornamental plant inventory in GRIN was updated in January, 1990. The ornamental seed inventory was taken in December, 1990, with changes to be entered into GRIN in January, 1991.

d. Forty-four accessions of herbaceous ornamentals were increased using bee pollination in cages in 1990.

e. The Woody Landscape Plant Crop Advisory Committee met in July in Washington, DC. Major topics of discussion included the operation of

the repository at the National Arboretum and coordination between the NPGS and a new consortium of gardens that can assist in the preservation of important ornamental germplasm collections. The Horticulturist participated in a aeeting at the Holden Arboretum in October to develop standards for the new consortium.

f. The Herbaceous Ornamental Crop Advisory Committee met in November in Tucson, AZ. Major topics of discussion included the organization and holdings of- the NPGS and the existence of important germplasm collections outside the NPGS.

g. The Horticulturist was named to the founding board of the Center for Development of Hardy Landscape Plants. This non-profit organization will direct a national effort to financially support and coordinate the breeding and selection of superior plants for the American landscape.

h. Pollen, seed and soil samples from populations of native azaleas in Missouri and Illinois were taken in May and October, as part of a study to examine variation in native Rhododendron. Seed samples have been deposited with the Clonal Germplasm Repository at the National Arboretum.

3. Vegetable Germplasm Collections:

a. Fourteen requests for seeds of lines with special characteristics were handled by the Horticulturist, resulting in the distribution of 320 packets of seed.

b. The Horticulturist has assisted in the writing of manuscripts on the NCRPIS collections of Cucurbitaceae (an upcoming HortScience cover story), and on the use of bees and flies to pollinate carrot germplasm (for Plant Genetic Resources Newsletter).

c. The Horticulturist has prepared a manuscript analyzing isozyme data for the NCRPIS collection of Cucumis sativus. These data were collected by a USDA-ARS research team at the University of Wisconsin, led by Dr. Jack Staub, as part of a study to survey genetic variability in Cucumis. The manuscript uses these data to investigate changes in gene frequency brought about by changing from open and sib-pollination to cage pollination at the NCRPIS.

4. Other Cooperative Activities:

a. Results of three years of field tests to evaluate native, perennial Lamiaceae as nectar sources for honey bees were summarized for presentation to the 12th North American Prairie Conference in August. Neil Senechal completed an MS degree on this general topic under the Horticulturist's direction.

b. The Horticulturist is working with the SCS Plant Materials Centers (PMC) to insure that Plant Introductions and other important germplasm collections held by the PMCs are properly maintained by the NPGS, and

more specifically that PMC collections of NCRPIS genera are transferred to NCRPIS whenever necessary.

c. A study of the literature of germplasm preservation, i.e. research on seed, pollen and tissue culture storage and longevity, has been accomplished using citation analysis. The results of this study have been submitted to the Plant Genetic Resources Newsletter for review and possible publication.

d. During 1990, analyses of the essential oils of the leaves and flowers of Aoastache were completed by researchers at Purdue University and Iowa State University, in cooperation with the Horticulturist. Manuscripts describing the results of these analyses are being prepared. The results may be useful in the development of Aaastache as a new crop for the spice and perfume industry.

e. The Horticulturist organized a workshop entitled, "Building Bridges to Preserve Germplasm: Non-governmental Organizations and the National Plant Germplasm System," which was part of the 1990 Annual Meeting of the American Society for Horticultural Science, held in Tucson, AZ in November. The workshop was well-attended with good representation from the plant breeding and germplasm research communities.

f. The Horticulturist also gave presentations to the Iowa Shade Tree Short Course and the 1990 Annual Meeting of the Eastern Region of the International Plant Propagators' Society.

C. Germplasm Maintenance, Evaluation, and Enhancement of Cuphea and other New Crop Species. (W. W. Roath)

1. Progress

a. Field

(1) PI Increase: Eighty accessions representing 21 species were transplanted into the field for cage isolated increase. Honeybees were introduced into cages of 38 accessions, the remainder were self pollinated. Notes were recorded on priority descriptors, and plants photographed. Seventy-eight of these accessions were harvested.

(2) C. viscosissima increase: Thirty-three C. viscosissima accessions were transplanted into the field for seed increase for research uses. Leaves were collected by the entomology group for insect leaf feeding trials.

(3) Pollination efficiency trial: This year was the second year of a trial to test the efficiency of three pollinator species on two cross pollinated Cuphea species. Of the pollinator species used, wild bumble bees were the most efficient pollinators during 1990. Over a two year average, honey bees were equally efficient as the bumble bees. Alfalfa leafcutting bees were not capable of producing significantly more seed than was produced under cages without introducedinsectpollinators. An average of approximately

five grams of seed was produced per year per cage without pollinators. This seed came either from self pollination, insect pollination that inadvertently occurred in the cages, or both. Environment has a significant effect astherewas considerablemore seed produced in 1989 than 1990, and the interaction due to years was significant.

(4) Direct seeding trials: Stand establishment from direct seeding has continued to be a problem under rain-fed conditions at Ames. several trials have been attempted over the past four years with little success in establishing adequate stands. During 1989 we replanted a block of material without retilling the plot and were successful in obtaining a more nearly adequate stand. Accordingly in 1990, we tilled the land and left it set for about four weeks before planting. We used different soil packing treatments and drilled the seed at depth of approximately .64 cm or broadcast the seed directly on the top of the soil followed by a soil packer. An average of about 43% of the viable seed planted emerged. Neither the packing treatments nor means of planting, either drilling or broadcasting, significantly affected the number plants emerged nor the amount of seed per unit area produced. Approximately 256 kg/ha seed was produced. This yield, although quite low, compares favorably with yields obtained from transplanted plots during 1990.

(5) Other oilseeds:

(a) Fennel preliminary yield trial; Twenty-two F4-F5 derived lines, increased in Puerto Rico during 1989-90, were planted in a trial with two reps. There was no significant differences observed in date of emergence, bloom-date, nor seed yield. Differences in yield between lines may be obscured by the high CV due to the few reps planted. Available seed restricted the number of reps. Seed weight (average of 0.53 gms. per 100 seed) was low, and might adversely effect oil percentage.

(b) Inheritance-of biennial habit in fennel; Seed of 22 F2 lines were space planted and the number of plants with biennial behavior were counted. The data is inconclusive, but it appears that two independently inherited recessive genes condition the biennial habit. Early maturing single plant selections were harvested.

(c) Vernonia accessions; Four Vernonia accessions with light insensitive flowering habit were obtained from Dr. A.E. Thompson. These four accessions were transplanted into the field. All four lines are segregating for maturity. Several single plant selections with relatively early maturity were harvested.

b. Laboratory/Office research related activities:

(1) Laboratory

(a) We studied plant enzyme polymorphisms of Cuphea viscosissima Jacq. and C. lanceolata Ait. accessions. Starch gel electrophoresis of 10 enzymes including acid phosphatase (AP), alcohol dehydrogenase (ADH), diaphorase (DIA), endopeptidase

(ENP), esterase (EST), glutamateoxacetatetransaminase (GOT), malate dehydrogenase (MDH), menadione reductase (MNR), phosphoglucosisomerase (PGI), and shikimate dehydrogenase (SKDH) from seed cotyledons were analyzed. Enzyme polymorphisms of ADH, DIA, and MNR were found in C. viscosissima and of DIA, EST, and SKDH in C. lanceolata. Zymogram differences betweenthetwo species were observed in DIA, MNR, PGI, and SKDH. These isoenzyme markers are being used in genetic studies of these two species, and in accession identification.

(b) Thirty-two (32) accessions of Cuohea viscosissima collected from East-central U.S. were analyzed for differences in callus growth and ability to regenerate plantlets. Calli were initiated from immature embryos on a modified Murashige and Skoog medium containing 1 mg 2,4-dichlorophenoxyacetic acid (2,4-D) and 1 mg 6-Benzylaminopurine (BAP) per liter. Calli were incubated in the dark for three weeks. Plantlets were initiated by removing the 2,4-D from the medium and reducing the BAP to 0.5 mg per liter. Variability was observed among accessions for callus weight and plantletregeneration. There was no relationship between callus growth and plantlet regeneration. Regenerated plants will be evaluated for somaclonalvariation, and genetic studies of callus growth and plantlet regeneration differences are being conducted.

(2) GRIN

(a) Inventory of the Cuphea collection was completed and seeds of 88 of the accessions increased during 1989 were stored.

(b) Seeds from 172 accessions collected during the first 1989 Brazil trip were received. Passport, and inventory data were entered into GRIN.

(c) Evaluation data collected from 1987, 88, and 89 increase plantings were forwarded for entry into GRIN.

(3) Manuscripts written but not published or accepted to date:

Roath, W.W., M.P. Widlrechner, and R. Kleiman. Variability in Cuohea viscosissima Jacq. collection. To be submitted to J. Assoc. Advance. Industrial Crops.

C. Greenhouse

(1) PI increase

(a) Thirty-five accessions were kept in the greenhouse for seed increase. These accessions were those for which field increase is difficult, or that population numbers were small. One of these accessions is the rare species C. aspera found only in two known locations in Florida. As much evaluation data as could be taken under the greenhouse conditions were recorded for entry into GRIN.

(b) Seed of 22 accessions collected in Brazil in 1989 from species not grown at Ames previously, were started for greenhouse planting. Only six of these accessions germinated. Those not germinating will be regrown, if possible. All accessions will be evaluated for self pollination.

(2) Interspecific crosses

(a) Plants from 34 accessions representing 18 different interspecific crosses accomplished by Dr. A.E. Thompson were shipped to Ames and transplanted into the greenhouse, Most of these crosses are sterile and therefore will be maintained vegetatively.

(b) The crosses between C. viscosissima and C. lanceolata are being used as recurrent parents for backcross for nondormant C. viscosissima. Attempt6 to backcross the C. viscosissima X C. lutea cross to either parent have been unsuccessful to date.

(c) Attempts to cross Pleuroflora anomala, a close reiative of Cuphea, to C. carthaaenensis, even by using embryo rescue techniques, have been unsuccessful.

(3) Selection for seed retention: Selections of C. llavea X C. procumbens (from Dr. A.E. Thompson) for improved seed retention have not been stable. That is, pods with both shattering and non shattering characteristics exist upon the same plant. Samples for cytologicalexsminatibnwere collectedtocheck for aneuploidythat may be the cause of the instability of this character. The few examinations completed indicate no aneuploidy. Several flowers examined had aborted pollen mother cells.

(4) F1 crosses: One hundred forty F1 crosses were completed in the greenhouse. The crosses were for cultivar improvement and backcross for non dormancy in C. viscosissima.

d. Miscellaneous

(1) Supervisory activities

(a) Graduate students:

1. Mr. Chen joined the project initially as a visiting scientist from The Peoples Republic of China, and subsequently as Graduate Research Assistant. His graduate committee is appointed and he has completed his program of study plan. His research project will be to study the enzyme and RFLP variability in C. viscosissima and C. lanceolata, and to establish linkage maps for these characters.

2. Mr. Ben-Salah has completed his first year of studies and is well into his research problem of evaluating callus growthandplantletregeneration, somaclonalvariationand the genetics of differences in callus growth and plant-let regeneration in C. viscosissima.

(b) Research Technician: Ms. Beck resigned, and Mr. Van Roekel was hired temporarily for approximately six months. Subsequently, he has assumed the duties of permanent Research Technician.

(c) Project Review: At the request of the NPS, the project has been reviewed and research direction for the CWU renewal has been agreed upon.' The CWU has been renewed for an additional four year period starting 1 Jan. 1991.

(2) Manuscript review: Several manuscripts were reviewed for various periodicals, primarily Crop Science.

(3) EEO activities:

(a) Attended lecture on minority relations at the National Animal Disease Laboratory.

(b) Attended the Governors Workshop on Women and Minorities in Science and Mathematics.

(c) Attended a workshop on basic employee supervision.

(d) Hired a female high school senior as research associate for the summer months.

(e) Used techniques learned in supervisor training during performance evaluation for technician. Advised technician on EEO rights and responsibilities.

(4) Staff meetings/ university participation;

(a) Attended NCRPIS staff meetings weekly except when outoftown.

(b) Attended Plant Improvement Panel meetings except possible.

(c) Attended Agronomy Faculty meetings when possible.

(d) Appointed to and attended the Outlying Research Station Committee meetings.

(5) Professional meetings attended and papers presented:

(a) Attended the Iowa Academy of Science Conference and presented the paper "Effects of three insect pollinators on seed yield of two Cuohea species".

(b) Other planned conference attendance was canceled due to sequestration of funds during Congressional budget negotiations.

(6) Work related travel:

(a) Traveled to Florida to attend the Oleochemical Technical Committee of the Soap and Detergent Association and reported ARS Cuohea research activities.

(b) Traveled to Oregon State University to review Cuphea research activities and to plan continuing cooperative research.

(7) Short courses attended:

(a) Attended ISU short course on pesticide uses as required to maintain pesticide applicators license.

(b) Attended short course on DNA hybridization techniques.

(8) Other activities: Continued activities as a member of the Education and Materials Committee of the Iowa Foundation for the Advancement of Agriculture.

2. Plans for 1991:

a. Field:

(1) PI increase: Approximately 125 PI accessions will be increased under cage isolation during the 1991 growing season. This will, hopefully, bring most of the old collection up to the minimum number of seed needed for distribution. Evaluation of priority descriptors will be carried out on accessions not previously evaluated. Plants of each accession will be photographed.

(2) F1 crosses: Several C. viscosissima F1 crosses will be transplanted to the field. Seed harvested from these lines will be evaluated for oil content and the best of those entered into the backcross for nondormancy program.

(3) Preliminary yield trial': Accessions of the 1989 C. viscosissima collection will be evaluated for yield, oil content, and fatty acid content. The best of these lines will be used in cultivar improvement crosses.

(4) Genetic5 of flower color markers: Parental, F1, and F2 lines of the. cross between the wild type flower color by the pale blue flower color mutant of C. viscosissima will be planted and the segregation for the mutant flower color will be determined.

(5) Stand establishment of Cuphea: The stand establishment trial with C. lanceolata will be repeated; C. viscosissima will be added to the trial.

(6) Other oilseeds:

(a) The best performing fennel line8 from the 1990 preliminary yield trial will be grown for random mating for selection for improved yield and oil content.

(b) The fennel F3 derived lines and the Vernonia lines selected for early maturity will be grown for random mating for the next selection cycle for early maturity.

b. Laboratory:

(1) Graduate Research Assistants, Mr. Chen and Mr. Ben-Salah will continue their work on enzyme and DNA markers and tissue culture of C. viscoaissima.

(2) C. viscoaissima seed will be stored under ambient conditions, cold room at 40° C. and 40% RH, cold room at 40° C. and 25% RR, and in liquid nitrogen. Four reps of 200 seed for each treatment will be stored until late 1994 and then the effects of these storage treatment5 on germination, enzyme markers, and DNA markers will be determined.

c. Greenhouse:

(1) PI increase: Increase of the hard to grow accession5 and evaluation of pollination characteristics of the Brazilian accessions will both be continued in the greenhouse.

(2) Cultivar improvement:

(a) Backcross for nondormancy will be continued for C. viscosissima and backcross to either parent of interspecific cross C. viscosissima X C. lutea will be attempted again.

(b) Attempts to cross Pleuroflora anomala with C. carthaqenensis will be continued. Embryo rescue techniques will used and refined.

d. Miscellaneous:

(1) Professional meetings to attend:

(a) Iowa Academy of Science Conference at Dubuque, IA.

(b) Symposium on Plant Breeding at North Carolina stat% University, Raleigh.

(c) International Conference on New Crops at Indianapolis, Indiana.

(d) American Society of Agronomy - Crop Science Society of America meeting5 at Denver, Colorado.

(2) Work related travel:
(a) Oregon State University to review Cuohea research being undertaken by contract.
(b) Plant exploration trip to Southern Mexico.
(3) Papers to be presented:
(a) Iowa Academy of Science;
1. Ben-Salah, H. andW.W. Roath. Callus growth, and plantlet regeneration evaluation of C. viscosissima.
2. Chen, W. and W.W. Roath. Plant isoenzyme evaluation of two Cuohea species.
(b) North Central Branch, Entomological Society of America;
1. Wilson, R.L. and W.W. Roath. Insects on Cuphea.

D. Entomology Program (R. L. Wilson and S. G. McClurg)
1. Progress
a. Field
(1) Corn
(a) Evaluation of PI corn introductions for first generation European Corn Borer (ECB) resistance. A visual rating scale, 1= no damage to 9= heavy damage, was used.
1. General evaluation of PI collection: 1193 accessions tested with 11 rating a 3 or less.
2. Evaluate Peru corns: Craig Abel, M.S. work; 11 of 1288 accessions rated a 3 or less.
3. Evaluate LAMP corns for Linda Pollak (USDA-ARS, Ames, IA): 3 of 146 lines rated a 3 or less.
(b) Evaluation for corn earworm (CEW) resistance. Larvae are placed on fresh field-collected silks and weighed after feeding for 6 days in the laboratory.
1. General evaluation of PI collection: 23 of 162 total accessions had 6-day larval weights lower than the mean weight of the resistant check, "Zapalote Chico (ZC)", PI 217413.
2. Selection of a hybrid sweet corn for use as a check line. The current susceptible check, "Stowell's Evergreen (SEG)", PI 219893, is too long in maturing and tends to be quite variable for larval weights fed on its silks. We tested 13 commercially available varieties.
(c) Resistance to CEW in popcorn. The red inbred popcorn PI 340856 has consistently shown resistance to CEW in several tests.
1. The question was raised: Is red seed color linked genetically to resistance factors in corn silk? To assess this possibility, PI 340856 was crossed with 3 yellow-seeded inbreds. The F_1 crosses were then backcrossed with the parent lines. Larval weights were collected on an individual plant basis for the 4 parent lines, 3 F_1 crosses, and the 6 backcrosses. Data are incomplete at this time.
2. Cooperator Linda Pollak USDA-ARS, completed diallel crosses among 10 CEW resistant inbred popcorns, including

PI 340856. A fresh silk feeding test will be run an these crosses in 1991.

3. We've tested popcorns originally evaluated from 1981-1989, which showed CEW resistance in the year tested. Thirty-two accessions andthetwo check lines (SEC and EC) were planted in a randomized complete block design with 4 replications. Eighteen accessions had mean larval weights significantly lower than SEG and 6 accessions had weights significantly'lower than ZC.

(2) Sunflower

Evaluation for resistance to sunflower moth (SM). Eighty-seven accessions were planted for this test, but due to flooded field conditions, only 38 were harvested. Heads are currently being threshed to retrieve good seed. Data are incomplete at this time.

(3) Amaranth

(a) Evaluate for resistance to Lygus. Fourteen of 43 accessions tested had fewer than 2 nymphs produced per female confined to the terminal head.

(b) Determine the effect of Lygus on the yield of amaranth grown in field cages - 2nd year trial. PI.477913 was grown in 3 replications in a completely randomized block design. (A fourth replication was lost due to flooded fields.) Control cages were sprayed 5 times during the growing season, with Malathion alternated with Pounce. Insect-infested cages received a total of 10 Lygus per plant. There was a highly significant difference in mg of seed produced per mg of dry head weight in the sprayed (mean = 447.2) vs. Lygus-infested cages (mean = 5.6).

(4) Cuphea

(a) Pollination of 2 plant species in field cages by 3 bee species - 2nd year trial. This test was in cooperation with Bill Roath; he will report results.

(b) Evaluate leaf-feeding by ECB and CEW on 33 lines. Insects were fed field-collected leaves for 9 days. Weights were taken on very few surviving larvae and the weights were abnormally low. None of the larvae pupated.

b. Laboratory

(1) Corn

(a) Determine fecundity of CEW moths reared on diets containing resistant (PI 217413 and 340856) versus susceptible (PI 219893) lyophilized corn silks. Two male and 2 female pupae from one diet type were placed in a 5 mm x 10 mm cage lined with cloth. Counts of larvae which resulted from eggs oviposited on the cage liners were made. Although there were fewer larvae produced from the resistant diet types, there was not a significant difference from the susceptible diet type.

(b) Chemical analysis of corn silks known to be resistant to CEW.

1. Soxhlet extractions of lyophilized silks were done with methanol and acetone for PI 219893(S) and 217413(R). Thin

layer chromatography trials were run on the methanol extracts. Results were inconclusive.

2. Fresh silks of 32 popcorns were analyzed for maysin content by Lia Pierson, summer, 1990 USDA-ARS Research Apprentice. The thin layer chromatography technique was suggested by USDA-ARS Research Chemist R.C. Gueldner of Georgia. Lia reported that the test was conclusive when no maysinwas present. She could not accurately reproduce data on quantities of maysin present with the current procedure.

(c) CEW diets containing air-dried corn silks field-collected in Linda Pollak's Puerto Rico plantings. Ninety LAMP corns along with 4 checks were tested. Data has not been analyzed.

(d) We continue to maintain a colony of laboratory reared sunflower moth. , We have been experimenting with collecting eggs on pollen-coated wax paper, and "passive" infestation of larval diet containers, to reduce time and handling of insects.

c. Greenhouse

A cooperativetestwas conducted with Jim Bing, an Iowa State University Entomology doctoral candidate to determine the effect of 3 population levels of corn leaf aphid on the rate of transpiration of two corn inbreds. Data are being analyzed by Dr. Bing.

d. Miscellaneous

(1) S. McClurg supervised 2 part-time workers during the school year; 3 full-time workers during the summer.

(2) S. McClurg actively participated in the planning of the new Entomology building which is under construction at the PI farm site.

(3) S. McClurg attended the Continuing Education Conference on Pesticide Application held in Ames, December 7, 1990.

(4) R. Wilson attended a Performance and Conduct training session held in Ames on November 28.

(5) R. Wilson organized a Sexual Harassment Seminar for PI staff held in Ames November 27.

(6) R. Wilson attended Iowa Academy of Science annual meeting held at Drake University, Des Moines, Iowa on April 20-21.

(7) R. Wilson & S. McClurg participated in Iowa State University Science in Agriculture Day held on campus April 26.

(8) R. Wilson attended the 63rd Annual Great Plains Sunflower Insect Workshop held at Fargo, ND on April 17-18.

(9) R. Wilson attended Plant Resistance to Insects Workshop held in College Park, MD on April 9-12.

(10) R. Wilson attended and presented a paper at the Entomological Society of American, North Central Branch meeting held in Grand Rapids, MI on March 18-21.

(11) R. Wilson attended Governor's Conference on Women and Minorities in Science and Mathematics held in Des Moines on January 18.

2. Plan5 for 1991

a. Field

(1) Corn

(a) Continue evaluation. of PI corns for 1st generation ECB resistance.

1. 980 accessions from general PI collection.
2. 1000 Peru corns;-Craig-Abel, M.S. work.
3. LAMP corn5 for Linda Pollak.

(b) Evaluate 200 lines from general PI collection for resistance to CEW - fresh silk feeding.

(c) Continue work on breeding popcorns resistant to CEW, in cooperation with Linda Pollak.

(d) Compare the weights of CEW larvae feeding on silks in the field to those fed in laboratory.

(e) Determine the effect on the fecundity of Western Corn Rootworm fed resistant vs. susceptible silks and pollen.

(2) Sunflower

(a) Continue evaluation on PI cultivated types for SM resistance.

(b) Develop method for screening wild types for SM resistance.

(c) Compare the effect of bagging and not bagging SM-infested head5 with Delnets^{R}.

(d) Evaluate 10 Hungarian lines in replicated trial for SM resistance. Cooperators are Drs. Gary Brewer and Larry Charlet of Fargo, ND.

(3) Amaranth

Evaluate 50 PI lines for Lygus resistance.

b. Laboratory

(1) Enter the 1986 - 1990 SM resistance data into GRIN in the format requested by the Sunflower CAC.

(2) Corn earworm

(a) Repeat the effect on fecundity when fed resistant vs. susceptible corn silks in diets.

(b) Prepare diets with soxhlet extraction products.

(c) Prepare diets with air-dried corn silks from Linda Pollak's Puerto Rico plantings.

(d) Determine the oviposition preference on fresh silks for moths reared on different diet types.

(3) Sunflower moth

(a) Prepare diets with lyophilized sunflower materials.

(b) Prepare diets with cuphea.

(4) Develop chemical techniques for evaluating the resistance of corn silks to CEW.

(5) Make soxhlet extractions of sunflower pollen.

c. Greenhouse

(1) Explore the use of Cuphea extract as an insecticide for whitefly on sunflower,

(2) Develop techniques forevaluatingwildtype sunflower for sunflower moth resistance.

d. Miscellaneous

(1) Renew commercial pesticide applicator's license by examination in February (S. McClurg).

(2) Move into the new Entomology building when construction is completed (scheduled April 1991).

E. Brassica Curator Report (Rick Luhman)

1. Progress

a. Field

(1) Accessions of Brassica, Crambe, Eruca, Setaria, Panicum, and Echinochloa were increased during 1990. In many cases, increases for an individual accession were attempted from two or more different inventory lots (e.g. an older increase and original seed). This was done so various lots of the same accession could be compared in the field or to insure us of getting an increase. Accessions were increased by starting the seeds on blotter paper or paper towels. Viable inventory lots were transplanted to pots in the greenhouse. Three Brassica increase accessions were started from plant cuttings rather than seed. If it was believed that an accession was a winter annual (Brassica only), the accession was moved to a 45°C environmental chamber for 6 to 8 weeks before field planting. Surviving inventory lots were transplanted to the field during the first week or two of April.

(2) The number of Crucifer inventory lots and accessions (in parentheses) attempted and grown for increase in the field are shown in Table 1. Similar data for grasses are shown in Table 2.

(3) open pollinated Crucifer check plots consisted of 30 Brassica (grown as ten accessions replicated three times), two Crambe, two Eruca, and one Sinapis. The seed harvested from these plots will not be stored. Of the Brassica check plots, 24 were grown as winter annuals. The remainder of the check plots were grown as spring annuals. All but four caged Brassica accessions were harvestable. The plants in three of these accessions died before harvest, possibly due to wet conditions early in the growing season. The other accession which was not harvested flowered but produced no seed. First, mid, and last flower, flower color, silique arrangement, plant height, plant count at harvest, and harvest weight for all inventory lots were determined. For Brassica, eight of the inventory lots grown in the field contained species mixtures in which the contaminant was harvested and given a different 1991 lot code. New PI numbers will be considered for these separations.

(4) Check plots consisting of ten Panicum (grown as five accessions replicated two times) and ten Setaria (grown as five accessions replicated two times) were grown with the grass increase. Check plots were not grown for Echinochloa. As with the Crucifers, the seed from these check plots will not be stored. Six of the Setaria inventory lots (three accessions) and one Echinochloa inventory lot did not mature before a severe frost and were therefore not harvested. These accessions may need to

be grown in the greenhouse. In addition, two Panicum accessions were not harvested due to severe shatter and/or poor stands. Beading date, stem number, texture, and habit, leaf number and width, plant height, and panicle width, length, and type were determined for all inventory lots. Two of the Panicum inventory lots which were grown were Setariq separations from an original Panicum introduction. These two lots will be considered for a new PI number.

Table 1. Numbers of Crucifer inventory lots and accessions grown for increase in 1990.*

CROP	ATTEMPT	pollination type: open	pollination type: cage	life cycle: WA	life cycle: SA	FIELD
Brassica	304(286)	107(96)	186(180)	75(72)	218(204)	
Crambe	6(6)	6(6)	0(0)	0(0)	6(6)	
Eruca	3(3)	2(2)	1(1)	0(0)	3(3)	

*Numbers in parentheses indicate the number of accessions attempted or grown.

Table 2. Numbers of grass inventory lots and accessions grown for increase in 1990.*

CROP	ATTEMPT	FIELD
Panicum	45(43)	44(42)
Setaria	39(27)	30(19)
Echinochloa	70(42)	56(37)

*Numbers in parentheses indicate the number of accessions attempted or grown.

b. Laboratory and office

(1) All harvested seed was cleaned and Brassica germination is nearly complete. The sequence of events for Brassica and Setaria cleaning was hammermill, clipper, blower, and pick (if needed). Due to the very wet summer, many Brassica napus accessions germinated in the field and therefore required extensive picking. The sequence of events for most of the Echinochloa and Panicum cleaning was blower and pick (if needed).

(2) In 1989, germinations were started on 5,634 packets of grass seed received in August and October of 1987. This germplasm originated in India and was transferred to us by the PIO office in Beltsville. Germination of that material has been suspended pending a decision on when and if to increase the seed.

(3) In May 1990, the following Brassica lines were requested from the PL-480 project in Pakistan entitled **Screening of Germplasm** of Oleiferous Brassicas for Resistance to Aphids: c a iuncea (CR **168/565,** K-295-S, S-242, E-27-1), **Brassica napus** (zero erucic, E-49, S-619-1, D.G.L., **D.G.L.E., SV69-1247, 0727-A2),** Brassica **rapa** (BA China). This request was made through the **PIO** office in Beltsville, Maryland.

(4) In August 1990, the following seed was requested from The Israel **Gene Bank** for Agricultural Crops: all Brassica niara, all Sinaois **alba,** all **Sinapis** Arvensis, Brassica **napus** (47556 W1467 GALAXY, 44677 W1499 DELTA, 44677 **WW 1449** CANOLA, 47557 WW1427 COMET), Brassica **rapa** (47559 WW1721, 47560 **WW1722),** all Brassica tournefortii, and all Alliaria netiolata.

(5) In November, a seed request for Echinochloa utilis, **E. stagnina, E.** orvzicola, **E.** pvramidalis, and **E. haploclada,** prompted a request through **PIO** to incorporate accessions or additional accessions of these species. **PIO** has since made that request to India, Nigeria, Korea, and Australia.

(6) Transfer of all 92 **Agrostis** accessions from NC-7 to W-6 is underway.

c. Greenhouse

Three Brassica accessions originally started for field increase were allowed to open pollinate in the greenhouse. These accessions flowered concurrently but were separated by as much space as the greenhouse would allow. In May, these accessions were moved outside to different corners of the greenhouse and were allowed to finish pollinating and to mature. Seed set on these accessions was less than 50 grams.

d. Miscellaneous

(1) In April of 1990, I participated in the International Canola Conference in Atlanta, Georgia. During this meeting I had the opportunity to **meet** several individuals who are active in **Brassica/Canola** research. I was a co-author on the following poster presentation:

Hansen, W.R., E.M. Feilmeier, B.C. Abel, and R.L. Luhman. 1990. Screening Brassica spp. accessions and **rapeseed** varieties for agronomic characteristic and adaptability to Iowa.

(2) In June, I became certified for pesticide application in the following **categories: 1A** (Agricultural Weed Control), **1B** (Agricultural Insect Control), **1C** (Agricultural Crop Disease Control), **1D** (Fruit and Vegetable Pest Control), 3G (Greenhouse Pest Control), and 10 (Demonstration and Research Pest Control).

(3) During the Fall of 1990, I enrolled in Agronomy 538 (Seed Physiology) at Iowa State University.

2. Plans for 1991

a. Germination of all 1990 increases will be completed and seed will be stored in the following order: Brassica, Eruca. Crambe, Panicum, Setaria, and Echinochloa. Seed storage will take into account seed number of all lots, germination of all lots, and plant count at harvest.

b. During 1991, up to 172 Brassica (80 winter annual and 92 spring annual), and 125 grass (Panicurn, Echinochloa, and Setaria) accessions will be field in&eased. The Brassica increase will include much of the material received from Peoria, Illinois in 1988.

c. The GRIN database indicates that 193 inventory lots of wild Linum exist at NC-7. These Linum will be inventoried and all lots will be grown out for observation during 1991.

d. I will enroll in Agronomy 521 (Principles of Cultivar Development) at Iowa State University during the spring semester 1991. I also plan to take a class during the fall of 1991.

F. Helianthus Curator (Cynthia S. Stauffer)

1. Progress

a. In the summer of 1990, increases were attempted on 50 accessions of cultivated Helianthus annuus. Due to wet conditions, planting and pollinations were 3-4 weeks later than normal and consequently only 43 accessions were successfully increased.

With the change in curators, no wild H. annuus increases were attempted in 1990.

b. The perennial nursery remains in approximately the same condition as in 1989(101 surviving accessions). Controlled pollinations (cages) were attempted on 17 accessions. No new accessions will be available, but the pollination method of these 17 accessions will be changed from open-pollinated to sibbed. In 1990, 17 additional accessions were started from either rootstock or from tubers.

c. Numerous problems have delayed the final printing of the Helianthus seed list with the new format. It will be available in the near future.

d. Upon completion of data entry, an assessment can be made on the status of all evaluations. Presently, oil percentage data are in GRIN for 783 accessions, and an additional 469 accessions will be taken to North Dakota for analysis in January 1991 (this leaves approximately 400 accessions with over 1000 seed that still need to be analyzed for oil content). Insect evaluation data and disease evaluation data from North Dakota are currently being entered into GRIN. Additionally, Dr. Patrick Duhigg from SeedTec International Inc. is interested in the fatty acid composition of sunflowers in the collection. Since those data are not available, SeedTec is running the analysis on all seedthatwe currently

have available. The results should be available sometime in February of 1991.

e. In addition to computer related issues dealing with Helianthus, there was considerable time spent correcting and updating inventory and passport information of the various other Asteraceae for which I have curatorial responsibility.

f. During 1990, I attended PI staff meetings on a regular basis as well as the P&S staff'meetings on campus. I also traveled to Lincoln, NE to attend the NC-7 Technical Committee Meeting, and to Fargo, ND to visit with cooperating researchers.

g. Twenty-five accessions were planted for increase in the greenhouse this past year. Pollinations were successful on 22, and 18 produced enough seed for future field plantings. Twelve accessions of tubers were harvested in the fall and stored in the cave for distribution and replanting in 1991.

h. Total number of Helianthus Seed lists distributed during 1990 was 10.

2. Plans

a. In the spring of 1991, 125 accessions of cultivated H. annuus and 100 accessions of wild Helianthus will be planted for increase. All of the cultivated accessions will require hand pollination and all of the wild accessions will require cages and bees for pollination. Attempts to obtain control pollinated seed from the perennialnurserywill continue.

b. The narrative and passport information from the last collection trip has been edited and the final corrections will be entered into the GRIN system early in 1991. After all of the corrections are completed, applications for PI numbers will be submitted. Additionally, narrative and passport information from all accessions that have Ames (A) numbers and that have been increased, are being proofed. When all of the corrections are completed, applications for PI numbers will be submitted.

c. I will continue to attend PI staff meeting and P&S (Iowa State University) staff meetings.

d. Twenty-five accessions have been planted in the greenhouse in order to obtain enough seed for future field plantings. These include material from Spain (old open pollinated varieties) and from China. We received a very limited number of seed from both of these collections.

G. Beta-Spinacia Curator Report (Peter Lundeen)

1. Progress

a. Increase of the sugarbeet collection in Utah is continuing. Over half of the seed in the 1988 and 1989 increases was discarded as immature

and we failed to get reasonable germination percentages. Dr. Doney and I believe we have identified the major cause of low germination of the 1988 and 1989 seed increased. It appears many accessions were harvested as soon as the any seed started shattering. In a highly variable accession, this left most of the seed immature. In August, when we helped harvest, mesh strips were layed between the rows to catch seed as it shattered and we directed Stewart Andrew to delay harvest or do partial harvests as necessary. The increase seed NC-7 received in October looks much better. We have not yet begun germination tests on this material.

b. In September, we stored 109 (1988) increases and 121 1989 Utah increases, andreinventoried all seed lots, excluding distribution lots. We received 184 original seed lots in 1990. Of 1218 Beta accessions, 531 have available distribution lots.

c. Germination information is of major concern, to us. Do to the poor germination levels on our first try of 1988 and 1989 material, almost all lots had to be recleaned and regerminated. We were not able to do any 5 year germinations. one or more germinations are available for 590 Distribution lots. No germination data are available for 456 distribution lots and 477 lots have poor germinations. As suggested by Dr. Doney, we will continue to rinse the seeds for 24 hours before planting in towels. We hope this will help our handling of the wild accessions.

d. Data from all but one evaluation study for 1990 have been received and entered on GRIN. Data from all but one study this year were received on disk. Data are being collected on nine pests at 5 locations on an average of 60 accessions each year, as well as agronomic and horticultural characteristics. One accession was found with greater resistance to Root Maggot than previously identified. New lines were found with fair resistance to rhizomania, and rhizoctonia.There are still 658 accessions that haven't been evaluated in any observation test.

e. We finally received PI numbers for a majority of the McFarlane collection of Beta.

f. As of the of 1989, there were 282 accessions of Sninacia in the collection. All but 24 accessions are available for distribution, although only 11 accessions have control pollinated distribution lots.

g. We received 4 new Sninacia PI accessions from Japan in 1990. The accessions have not been increased or issued PI numbers. The accession numbers are Ames 12720 through 12723.

h. There have been 5 seed requests for Sninacia germplasm. Four of those were for all available accessions of Sninacia.

H. Amaranthus Curator Report (David Brenner)

1. Progress

a. Curating duties include the germplasm collections of Amaranthus, Celosia, Chenooodium, Coronilla, **Dalea,** Galeaa, Marina, Melilotus, and Perilla.

b. In 1990, we made progress with each of the assigned crops. As in other years we were handicapped by rapid staff turnover and a shortage of greenhouse space. In 1991, we will have more greenhouse space, and the Amaranth crew will be larger.

c. Many seed **requestors** were referred to commercial sources. These sources provide excellent advanced cultivars for agronomy research projects, Information distribution is comparable to seed distribution. I sent approximately 100 letters and spent hours on the telephone.

d. Amaranth culture is well enough understood so that these plants can be grown without many problems. Our biggest difficulty was watering failure during hot weather, which caused some loss of plants. We had two rotations in the glass house, some bubble house plantings, and field plantings.

e. some innovations this year have improved the greenhouse increases of amaranth. In the event of poor establishment, accessions withlesathan twenty plants were repotted in larger pots to reduce watering frequency, and also get larger harvests per plant. The weak stemmed plants were tied to stiff wire flags to prevent lodging. The bamboo pollination tent frames were replaced with PVC pipe frames, designed by Larry Lockhart to be functional and easily stored, The hand-made plastic pollination tents were replaced with large, commercial, plastic bags.

f. The amaranth inventory is now very accurate and complete. All the lots in the collection were weighed and the backlog of harvests were stored. Ninety-two accessions were sent for backup at NSSL. Many useless seed lots were discarded. The distribution packet size was reduced from one gram to 200 seeds, which dramatically reduces our long-term replenishment costs.

g. Three kinds of promising amaranth germplasm were added to the collection. Ames 13784 has non-splitting utricles which could help reduce shattering. Ames 14356 to 14358 include triazine tolerant material. Ames 10813 "giant amaranth" grows larger than any other amaranth in our collection, it could be useful for biomass or forage production.

h. Two accessions of Celosia **argentea** had excellent seed set in cages with honeybees; improving on the failures in the greenhouse of the previous year. An accession of **C.** triavna was successful in the greenhouse.

i. The Chenooodium collection has two big problems: poor germination percentages, probably due to deterioration in storage, and poor seed set under controlled pollination conditions. Since it is a staple crop in South America, it probably deserves some attention, A pilot study was continued to develop effective seed production methods.

j. When standard Amaranthus methods are used to control Chenopodium pollination; there is flowering, but negligible, seed set. I suspect that humidity and heat kills the pollen grains within the. plastic greenhouse tents or paper bags. Seeds will set if open pollinated. Since most accessions are not adapted to bloom for.seed set in Iowa, we are limited to one accession per greenhouse. In 1990, this seed set problem was verified with trial plantings of three accessions. One of these three, PI 510536, was chosen as a hard-to-pollinate check variety for further experiments.

k. Dr. Duane Johnson, a Colorado State University breeder of Quinoa, offered to field increase all of our accessions. His generous offer was not accepted because adeguate pollination control would not be possible.

1. We harvested the first control-pollinated seed from Coronilla. Twelve accessions were establishedinlong-term field plantings, but somemight not be winter hardy. The new "Pak Ground Cover" plastic mulch helped our weeding but slowed the transplanting. The plants bloomed surprisingly well, but did not set seed when caged with honeybees. A yellow-flowered accession did set 5 seed in the greenhouse after hand-manipulation.

m. Four perennial accessions of Dalea were hestablished in the field. e bloomed in their first year but did not set seed, even with honeybees. Surprisingly, Ames 3111 proved to be a summer-annual, with lemony fragrant foliage. It set seed after hand tripping.

n. Marina is.a genus that is closely related to Medicago. Responsibility for it was assigned to me in 1990.

o. One accession of Galeaa orientalis was established in a perennial planting. I expect it to be winter hardy. The foliage had hopperburn symptoms and some possible rabbit feeding (now protected with a fence). In a long-day growth chamber some plants bloomed, then selfed after hand tripping the flowers.

p. The Melilotus effort was a pilot project to develop horticultural methods after years of discontinuity. Five biennial accessions were planted in October, 1989 for summer harvest, and three annual accessions were planted in March for summer harvest. On the basis of success in 1990, 48 accessions were planted in October, 1990 for harvest in mid 1991.

q. The seed storage staff (Delbert Lutjen and Karen Stansbery) cleaned and documented decades of neglected Melilotus seed lots. The collection is in much better condition then ever before.

r. The cool (40/55° F) unlighted bubble house is an' excellent facility for vernalizing Melilotus biennials, and it avoids crowding the cave. Annual accessions can be moved to a warmer greenhouse- if they-bolt early, so it is efficient to plant both annual and perennials in October. Artificial vernalization with very long days is impractical because the light pollution affects other plants in any greenhouse.

s. Greenhouse seed production of Melilotus is safer and probably cheaper than caged field plants. Unpredictable weather, spray drift, and insects endanger the caged field plantings. In wet weather, field-grown seeds can get discolored by fungus, and the discolored seeds might have a shortened storage life.

t. Melilotus accession PI 532954 was unexpectedly difficult because honeybees did not pollinate it in a cage. It should be regrown with plans for hand cross-pollination (it might not self).

u. Melilotus plants can remain in conetainers for the entire growing cycle. Conetainers are ideal for accessions with 30 to 100 plants. If less then 30 plants germinate, larger pots should be used to get larger plants, with larger yields per plant.

v. This was the first successful year for Perilla since 1967. Because of no germination, five accessions were dead-filed. Other accessions had less than one-percent germination. The adapted accessions were cage increased. The subtropical accessions were grown in the bubble house. Because all accessions selfed well, no insects or other methods were needed for pollination.

w. The bubble house plantings of Perilla (25 April 1990) should have been delayed until early August. Because of planting too soon the plants grew very large and had to be severely cut back twice. Perilla plants can do well in conetainers. The crucial consideration is the short day photoperiod that forces flowering. Each accession had a different and uniform blooming time.

x. We acquired two very distinctive accessions of Perilla: PI 546460 has white seeds, and Ames 13858 has intensely red foliage.

y. Miscellaneous

(1) I participated in The Fourth National Amaranth Symposium, Minneapolis, Minnesota, 23-25 August 1990.

(2) I reviewed two manuscripts, an Amaranthus grant proposal, and a Melilotus secondary compounds paper.

(3) In the course of my personal travel I gave a talk on germplasm at the Geography Department of the University of Oregon, and I studied specimens at the herbarium of the Smithsonian Institution, in Washington DC.

(4) I completed Iowa pesticide applicator certification, by passing five written exams.

2. Plans

a. The emphasis in 1991 should be on documentation and reducing duplication of Amaranthus. Much of the growing, especially in the field,.will be done to compare accessions that might be duplicated. The duplication could be as high as 25%, most of which can be traced with documents already in the office. The entire Rodale Research Collection was sent to us'in 1990, and it still awaits incorporation. Many old accessions will become available with these additional seeds.

b. At the National Amaranth Symposium, in Minneapolis, I became the editor of Lecacv, the newsletter of the Amaranth Institute. This is an ideal platform to announce our germplasm. My first issue should come out in the spring of 1991.

c. The amaranth greenhouse cultivation will be improved in two ways. Our artificial daylength control to induce flowering (of short-day plants) will be reduced to fewer days because of new information (Zabka, Am J Bot 48:21-28 1961). Dr. Leon Weber, an Amaranth researcher, cited this method in his Amaranth symposium presentation. Also, Larry Lockhart and I are cooperating on new ideas to automate the greenhouse watering with long soaker hoses.

d. The Celosia araentea accessions bloom vigorously in short days of the spring and summer. We will plant in July for fall blooming, to take advantage of fall cage availability. They will be cage pollinated in pots during warm days, especially in October. After pollination the plants will be brought inside, for seed maturation. This might be the only way to succeed with poorly-adapted accessions such as PI 288733. Adapted accessions can do well as cage transplants because they bloom in late August.

e. We will attempt growing Chenouodium in a warm, lighted winter greenhouse, in the hope that the plastic tents will be cool enough for pollination. The secondary plan is to pipe cool air from a window type air conditioner into tents at anthesis, as an inexpensive growth chamber equivalent. A literature survey and other sources will be pursued to provide better horticultural methods. I favor the use of freezers and other cryopreservation for Chenooodium seeds. This collection needs germination testing.

f. Solving the pollination problem of Coronilla is a main goal for 1991. Four annual accessions are planted for spring blooming, the perennials will also need pollination. Hand pollination should work, but alternatively bumblebees might be more efficient.

g. We will not plant Dalea and Marina perennials until we have a pollination method that works on those already established. We will

experiment with hand methods and perhaps with bumblebees. Some annuals will be planted in early May for greenhouse harvests in late fall.

h. New plantings of Galeaa will be delayed until we have a successful harvest. Seed reguestors can be referred abroad to Finland, where Galeaa research is more advanced.

i. Melilotus Accessions with self incompatibility (rare in Melilotus) should be detected and caged early enough for bee-pollination. A cage near a water spigot would be idealbecausethese potted plants will need frequent watering.

j. The pollination code (IVPOLL in GRIN) for greenhouse grown plants should be changed from "OP" to "SELF". In preparation for this change I will do a literature survey and phone Melilotus experts.

k. The October 1991 planting of Melilotus should include accessions with DDT treated seeds, so that the treated seeds can be replaced. The collection will be germination tested in 1991.

1. Perilla, like Chenooodium, has poor seed storage life. It could benefit from improved storage conditions. In 1991 we will not need to grow these because all of them were increased in 1990. After seed storage they will become available for distribution. I expect to get permanent PI numbers for the remainder of the collection.

I. Vegetables Curator Report (Kathleen R. Reitsma)

a. Progress

1. Increases

Astrodaucus: Two accessions were started in January 1990. One accession was transplanted to a cage for honeybee pollination and one accession remained in the greenhouse (one plant) for hand pollination. Neither accession bolted. Both accessions have been placed in the cave for a second vernalization treatment to trigger bolting, and be will placed in the greenhouse or a field cage in 1991 for seed increase.

Ammi: Three accessions were direct seeded in the greenhouse in January 1990. One accession failed to *germinate.* Two *accessions were* hand pollinated in the greenhouse under isolation tents.

Anethum: Twenty accessions were direct seeded in the greenhouse in January 1990. Five accessions failed to germinate. Fifteen accessions were hand pollinated under isolation tents in the greenhouse.

Cichorium: Sixteen accessions were direct seeded in the greenhouse in January 1990. All Accessions were placed in the cave for vernalization treatment for one month. The accessions were transplanted into field cages with Ocimum for honeybee pollination. Fifteen of the sixteen accessions had good seed production.

Coriandrum: Four accessions were direct seeded in the greenhouse in January 1990. One accession failed to germinate. Three accessions were hand pollinated under isolation tents in the greenhouse. Small seed amount5 were produced..

Cucumis melo: In early May, 502 accession8 of melons were direct seeded in. the greenhouse. Eight accessions failed.to germinate, Twenty-. three accession5 were sib-pollinated by hand in the greenhouse, the remaining 471 accessions were transplanted to field cages for pollination by honeybees. Due to the wet summer, plants did not become well established in the field. Fruit production was low. Bacterial disease and Anthracnose produced significant plant and fruit damage.

Cucumis sativus: In early May, 77 accession5 of cucumber5 were direct seeded in the greenhouse. Twenty accessions failed to germinate. Fifteen accessions were sib-pollinated by hand in the greenhouse, the remaining 42 accessions weretransplantedto field cages forpollination by honeybees. Due to the wet summer plants did not become well established in the field. Fruit production was lower than expected. Diseases did not pose a problem with the cucumbers as they did with the melons.

Cucurbita: Seventy accessions were direct seeded in the greenhouse in early May. Nine accessions failed to germinate. One accession was sib-pollinated by hand in the greenhouse (one plant). Sixty accessions were transplanted to the field for sib-pollination by hand. Due to the wet summer, plants did not become well established. Flowering was delayed by the cool, wet weather. Fruit production was low. Diseases and insects destroyed many plants. Many fruit were damaged by animal5 and insects which allowed the development of fruit rots. Only 50 accessions had fruit harvested of which 15 had four or fewer fruit harvested.

Daucus: The biennial carrot5 that were started in November 1989 failed to germinate (see 1989 Annual Vegetable Report). Fourteen annual carrot accessions were started in January 1990. Ten accessions were hand pollinated in isolation tents in the greenhouse. Five accessions were transplanted to field cages for pollination by honeybees (one accession was grown in both the greenhouse and field cage). Only ten accession5 produced seed for harvest. Most of the caged carrots flowered too late.

Foeniculum: Twenty-six accessions were direct seeded in the greenhouse in January 1990. Many failed to produce seed due to a spider mite infestation. Actual results on seed production are. not available at this time.

Ocimum: In April, thirty-seven accessions were started in the germinator to be transplanted into the greenhouse mist bench. Six accession5 failed to germinate. Three accessions were isolated in the greenhouse for self pollination, and 28 accessions were transplanted to field cages for pollination by honeybees. Several accessions were damaged by a wilt disease which reduced yields, but in general, yields were good.

Oriaanum: Three accessions failed to germinate and could not be transplanted to pots in the mist bench.

2. Storage

Due to personnel problems, seed processing for the vegetable crops is behind schedule. The Cichorium and the Ocimum increases-have been hammermilled, clippered, and blown. Hand picking these two crops is underway. Little or no work has been done on the remaining vegetable crops increased in 1990. At this time it is doubtful that any of the seed will be processed and germinated intimeto be stored before spring plantings.

3. Meetings

In November 1990, I met with the Root and Bulb CAC, Leafy Vegetable CAC, and Cucurbit CAC in Tuscon, AZ. The Root and Bulb CAC! was primarily attended by Dr. Mark Widrlechner because the Cucurbit CAC was scheduled at the same time. Dr. Widrlechner and I also attended the Leafy Vegetable CAC. This CAC has had poor attendance and has accomplished little. A drive is under way to recruit new, and hopefully more active, members. The Chair is also looking for other possible meetings that the CAC could meet in conjunction with in order to help boost interest and attendance in the CAC.

The Cucurbit CAC accomplished very little this year. Most of the meeting was spent discussing the lack of descriptor and evaluation data on GRIN. Dr. Jack Staub submitted data for several disease evaluations to be entered on GRIN with the CAC's approval two years ago. The evaluation data was "lost". (The information'was not channeled through me before it was submitted to the computer people for entry onto GRIN.) This had the CAC members very upset. I suggested that any future data submitted for entry onto GRIN be sent directly to the curator of the crop. It is the curator's responsibility to work with the computer personnel to see that the data are entered onto GRIN.

Since the Cucurbit CAC meeting, data for four of Dr. Staub's evaluations have been found. Mark Millard, Charlie Block and I are working on preparing the data for entry onto GRIN. Charlie kept copies of his data submitted to Dr. Staub on two diseases, and that data will be put on GRIN. Mark is still searching for the three remaining data sets. A recent conversation with Dr. Staub suggests that only two sets of data are missing Dr. Staub was not sure if one of the evaluations was done.

I also attended the first meeting for the National Cucumber Conference (NCC) in Tuscon. The conference was generally a repeat of papers, seminars, and presentations from other meetings and conferences in the past two years. The question was raised as to whether such a conference as NCC was needed with all of the opportunities afforded cucumber researchers and breeders to present their research. It was agreed that the NCC should continue, but only meet in odd-numbered years. This is subject to change.

b. Plans For 1991

In November 1990, 60 accessions of biennial Daucus and 23 accessions of Pastinaca were direct seeded in the greenhouse for field cage increase in 1991. In late January or early February, 15 to 20 accessions of Cichorium will be started for field cage increase. In March, various accessions of annual vegetable (herb) crops will be started in the greenhouse to be paired with the biennial vegetables in field cages. (The genus and number of each will be subject to the survival rate of the Daucus and Pastinaca in the cave, and subject to the results of I.990 harvests.)

In late April, 80 accessions of Cucurbita will be started in the greenhouse for sib-pollination by hand in summer field increases. The number of Cucumis within species is dependent on the number of cages available and the greenhouse space available.

A proposal submitted two years ago to the Cucurbit CAC for a review of the Cucurbita collections in the NPGS has now been funded. Laura Merrick is scheduled to visit the NC-7 station this summer to check for mistaken identifications with in our Cucurbita collection. Laura will make reidentifications from observations of field plots and by inspection of the seed in the jars. In preparation for her visit, a seed list and inventory of our collection has been sent for review. She will let us know if she would like to see any accessions in the field. We will also grow out in an observation plot any accessions we have questioned the identity.

c. Miscellaneous

Seedlists have been completed on the Cucumis and Cucurbita collections. Work is progressing slowly on the remaining vegetable crops.

Five year regermination8 of the Daucus, Petro, and some of the miscellaneous herb collections have been pulled. A schedule for running these germinations has not been determined.

A more concerted effort will be made to increase pesticide treated seed lots. My concern is that we will only be able to remove the treated seed as the stock year in the Cucumis melo collection. We will not be able to discard the seed because in most cases (ca. 958) this is all the seed we have. There is no more original seed so the stock year now serves as the original sample.

J. controlled Pollination Progress Report (Craig Abel)

1. Progress

a. Cage pollinations: Controlled pollinations using insects beganthisyear with the oilseed brassicas on April 27th. Pollinations ended this year with Melilotus increases on Oct. 12th. Accessions numbering 1,036 were increased this year using our controlled pollination method. Because some of our nucs may be reused in the same season and some cages contained more than one species of plant, 774 nucs were needed to do the pollinating of the 1,036 accessions.

The Cuphea controlled insect pollination study was continued this year. Honeybees, alfalfa leafcutting bees, and bumble bees were used in eight cages each. This study will try to find the better of the three insects to control pollinate Cuohea for increase purposes. Bill Roath reports the results.

Our nucs have been painted.5 different colors: white, blue, yellow, green, and orange. Honeybees can differentiate between'these five colors. In the past we have had a severe problem with bees drifting in the field so that the colonies in the center of the field became weak or dead whereas those on the outer edges of the field became quite strong. After two years of observing, we found that having different colored hives in the field reduced drifting. I was not completely satisfiedwiththe results because some drifting was still taking place. This year we began experimenting with a new shifting pattern and sequence and this has further helped reduce drifting. I believe from now on our curators will see larger and more uniform seed increases from their cage pollinated accessions.

b. Beekeeping: We supplied all of our nucs with our own queens this year saving the Plant Introduction Station an estimated $6,000. My queen rearing proficiency has improved from 54% last year to 86% this year. Besides saving money, using our own queens allows us to select for certain traits that we want in our own hives. We keep notes on our hives giving certain characteristics a weighted value. We select .for certain traits such as: disease resistance, productivity, gentleness, and pollinating potential. Consequently, the stock we use to raise our own queens are highly productive, and gentle. Gentleness is important to breed into our bees because of the large number of people working and observing around our hives each summer.

The first year I began working with the bees, 50 hives were overwintered with only 2 surviving. This was an expensive loss as well as an inconvenience because established colonies are much easier to make nucs from than first year colonies started from packages. Last year 150 hives were overwintered with all but two surviving. This year we are going into this winter with 182 colonies. Eventually I hope to be able to winter 250 colonies a year. We could then discontinue purchasing bees from the south, saving us money and the many potential problems associated with buying bees from the south. We could eliminate such problems as Africanization, Tracheal and Varroa mites, and an ever present threat of acquiring some other unwanted disease or trait.

We experimented with some 3 lb. packages this year, instead of the normal 2 lb. package, and found that it'was not cost effective. It is better to purchase extra 2 lb. packages, which are cheaper, and save them for making nuc for the next year.

The slides that are used on the nuc bottom boards were improved this year to create a better seal and also to wear longer. All of the slides have been replaced using this new design.

Warping of nuc lids has been a continual problem in the past. This year we did a number of trials using different forms of sealants and paints but found none that was satisfactory. Next year other materials besides wood products will be tried.

Another problem has been the lack of bee forage area for our large number of colonies. In the past, considerable feeding and buying bees in the spring had to be done to remedy this situation. This year a solution has been found. With the help of Ted Lambi (Coordinator, Farm Service) we now have six beeyards instead of one. These additional yards also offer us a number of backups in case a Certain area is hit with a natural disaster. Next year, we hope to be able to increase the number of yards to eight.

We combined 436 nucs in the fall this past year to make 36 new colonies and are feeding them sugar syrup to see if nuc combining is an effective way of creating and overwintering more colonies.

2. Future plans: Besides fine tuning the things that we are working on now, here are a few other items that we hope to implement in the future.

a. We plan to remodel an existing garage stall into a winter housing unit for honeybee nucs. Each year, the insect pollinated brassicas need bees at an earlier date than we can prepare nucs with bees. Also, making 175 nucs for Brassica pollination in the early spring is more devastating to our honeybee parent colonies thanmaking 600 nucs in late spring due to the timing. Overwintering honeybees in buildings has been done successfully for years in the U.S. and Canada. The estimated costs per hive for wintering colonies indoors have been figured at $28.00 a colony. For early spring pollinations here at the station, one package colony is required for each nuc. With packages costing $22.00 and labor costs for "nucing" the colony at $15.00, the savings for each nuc would be around $9.00 by overwintering them indoors. In summary, this system would not only allow us to get insect pollinators into the Brassica cages when they are needed, but also , it would supply us with nucs for the whole year and at a reduced cost.

b. Hive records will be converted to a database system for easier evaluation and faster use of colony records.

c. A concise and thorough report and accompanying schedule will be produced. This will be helpful to me and to future persons hired for this position. I also receive about ten requests a year for information on how we run our controlled pollination system.

d. I plan on furthering my education and gaining additional contacts at local meetings with the hope of continually improving the bee operation.

e. Bumble bee queens will be captured to rear a few of bumble bee colonies for use in cage pollinations.

f. A set of management strategies for the inevitable tracheal mite infestations and the possible varroasis and Africanization of *our* bees will be established.

g. I would like to take a closer look at cross-pollinations, using our present honeybee controlled pollinating system, especially with crops where no research has been done before.

3. Personal achievements:

a. Gave 19 presentations to tours and individual visitors at the Plant Introduction Station.

b. Hosted a queen rearing seminar for the Iowa Honey Producers Association on June 2 and gave two short presentations.

c. Was invited to speak at the American Honey Producers annual meeting last January but was unable to attend.

d. Received a certificate-of appreciation from the Iowa Honey Producers Association for the Plant Introduction Station and myself at the annual Iowa Honey Producers meeting in Newton, Iowa. This was in recognition of the field tour we hosted for them in 1989 and-the queen rearing seminar this past June.

e. Took graduate level courses in Germplasm and Statistical Methods.

K. Plant Pathology Progress Report (Charlie Block)

1. Progress

a. Field

(1) Sunflower evaluation: Over *300* sunflower PI's were evaluated for Alternaria leaf blight resistance (152 wild annuals and 160 cultivated types). The best cultivated types were moderately resistant and were repeats from previous tests including PI's 162675, 378894 and 462125 (Argentina); 170390 (Turkey); *380562* (Kenya); 480472 and 480473 (Zambia). Several wild sunflowers had much better resistance including the H. debilis PI's 494583, 494584 and 494585; H. praecox - 413176, 468848, 494601 and 494606; H. debilis x H. praecox - 413009; and H.nuttallii - 420182.

(2) The corn seed increase plots were rated for disease problems. Predominant diseases were common rust, common smut and northern leaf blight.

(3) Two serious diseases developedinthe Cucumismelo plantings. Anthracnose - a fungal disease, and a bacterial disease similar to that described on melons in Georgia, presumably caused by Pseudomonas alcaliaenes subsp. citrulli. *Ten* accessions, out of 550+, were free of both diseases. Copper fungicide sprays were ineffective as a control.

(4) Continued study on potential seed transmission of Erwinia stewartii in corn. No results to report.

b. Laboratory

Developed a rapid, simple method for producing large quantities of high quality Alternaria spores. The fungus was grown on filter paper saturated with a leaf extract instead of using agar media.

C. Greenhouse

(1) Seventy-five wild sunflowers were tested for Alternaria resistance under greenhouse conditions. Much individual plant variability exists within accessions and further testing is required.

(2) A species of the fungus Phomopsis was isolated from severely diseased stems of Amaranthus tricolor. Plants of several Amaranthus species were inoculated. A. caudatug, A. hvoochondriacus, A. cruentus, and A. dubius and A. retroflexus were resistant. Only A. tricolor was susceptible, A range of potential hosts, 18 genera and 22 species, was inoculated in efforts to determine a possible source of-field inoculum, but none was susceptible.

d. Miscellaneous

(1) Meetings attended- Sunflower Research workshop -January 1990 - Fargo, ND.

(2) Paper presented at Sunflower Research Workshop on Alternaria evaluations.

(3) Guest lectured on disease evaluation to Agronomy 523 class.

(4) ISU classes attended: Biochemistry, Plant Disease Physiology, Genetic Engineering, Bacterial Diseases of Plants.

2. Plans for 1991

a. Field and greenhouse.

(1) Continue Alternaria evaluations on sunflower.

(2) Continue research on biology of Erwinia stewartii seed transmission.

b. Laboratory

(1) Attempt to develop a leaf disk assay to test sunflowers for Alternaria resistance. Purpose is to avoid problems of other diseases and environmental problems that affect field plots.

(2) Continue research on biology of Erwinia stewartii seed transmission.

L. Farm Superintendent Annual Report (Larry Lockhart)

1. Progress

a. Labor

Approximately 150 applications were received and reviewed during 1990. There were 97 interviews resulting in 69 hourly employees hired.

b. Maintenance Projects

(1) Planning and construction of 29' x 100' greenhouse to be used for seed increase.

(2) Planned and cooperated with the Experiment Station, University Facilities and University Farm Service Maintenance to install water meter pit and water line in order to upgrade irrigation capabilities.

(3) Installation of cold storage shelving in new building. Completed eight long carriages and ordered materials to complete 6 more long and 3 short carriages.

(4) Squared and benchmarked Entomology field plot area and remainder of PI farm which was not completed the previous year.

(5) Gathered requests and allocated field and greenhouse space. Supervised and/or applied all pesticide applications on PI farm.

(6) Wrote specs and ordered Lithium Chloride Dehumidifier for seed storage.

(7) Worked as a liaison between contractor, ISU Experiment Station, USDA and utility providers during construction of Entomology Building.

c. Tours

This past year I have organized and conducted 17 tours ranging from a single visiting scientist to groups as large as 80 people.

d. Conferences, Training, Etc. attended

(1) Numerous Departmental Seminars

(2) Supervisory Training Seminars - ISU

e. Purchasing

Continued to serve as centralized purchasing person for PI farm. Duties performed are gathering and summarizing requests, writing specs, and obtaining supplies to be used at the PI farm.

2. Goals and plans for 1991

a. Installation of Dehumidifier for cold storage room

b. Completion of greenhouse

c. Help plan entomology greenhouse

d. Recover end walls of Bubble greenhouse

e. Rebuild cold frame (if funding is available)

f. Move Entomology staff to the new building and reorganize office space in headquarters building

g. Construct second phase of Cold Storage Shelving

h. Expand dry storage and seed threshing rooms

i. Installation of carpet in seed picking room

M. Zea Mays Report (Mark Millard, Curator)

1. Progress in 1990

a. Field work

(1) Ames Seed Increases

Four hundred eighty-two accessions were increased, of which 300 were supplemental increases of 1989 Chile increases. The increase has been planted, pollinated, and harvested as of 1/1/91. Processing and storage remains.

(2) Puerto Rico Increases

a. Puerto Rico 89-90 Increase

The top 116 Caribbean and Peru LAMP (Latin American Maize Project) accessions were increased. Several Southeastern U.S. and Nigerian tropical inbreds were increased. These increases have been planted, pollinated, harvested, shipped, and processed as of 1/1/91. Only Storage remains.

b. Puerto Rico 90-91 Increase

One hundred seven accessions from the Dominican Republic along with other top LAMP accessions from Brazil, Argentina, the U.S., and the tropics were planted for increase. Pollinations will be performed in 91.

(3) St. Croix Quarantine Increases

a. St. Croix 89-90 Increase

In December, 79 accessions from Algeria, Burkina, Guinea, Madagascar, Mali, Oman, Togo, and Zambia were planted. In January, 50 accessions from Burkina, Sudan, and Togo were planted. We did not have accessions from any of these countries until these increase were made. All accessions have been stored. These are the first increases done on St. Croix to satisfy quarantine requirements.

b. St. Croix 90-91 Increase

In December, 50 accessions included accessions from Burkina, Mauritius, Tanzania, and Togo were planted. Pollinations will be performed in January 1991 and a second planting will be made in February 1991.

(4) Goodman managed Tropical Increases

a. We received 336 Accessions from the Mexican National bank. We had already received 99 of these at NC-7 and an additional 87 CIMMYT lines had been deposited at NSSL (but not at NC-7).

b. We received 235 Accessions from the Peruvian National bank. We had already received 4 of these at NC-7 and an additional22 CIMMYT lines had been deposited at NSSL (but not at NC-7).

c. No Accessions were received from Colombia.

(5) Other outside Increases

a. Dr. Larry Darrah (USDA-ARS) at the University of Missouri was sent 9 accessions of the Missouri state collection for increase. We received only 2 successful increases due to flooding in his fields.

b. **Office/Seed room**

(1) Germination tests were performed on 1630 increases and those needing the 5 year retest.

(2) Dr. Galinat's catalogue of 2000 accessions was converted from a handwritten form to a computerized form. He will be proofing the information so it can be entered into grin,

(3) Approximately 4-5,000 original collection sheets from the National Research Council sponsored collections of the 1950's was received from NSSL. We began entering this data into GRIN for those accessions held by NPGS.

(4) Inventory, pedigree, and passport information was converted to LAMP compatible format on approximately 300 accessions evaluated by Dr. Pollak.

(5) Passport and evaluation information on approximately 1300 accessions from Argentinawas data-entered for crosschecking and eventual entry into GRIN.

(6) Twenty accessions of North American Indian derivation were grown to provide demonstration ears for a Living History Farms corn display. European corn borer damage was excessive and the experiment may need to be repeated. Most of these are Northern 8-Row types and evidently do not possess any resistance. We planted the material in two replications and removed all tillers on one replication. We are evaluating the data to see if this gives larger and more uniform ears, Removing tillers does change the plant morphology.

c. **Greenhouse**

The Zea project made no use of these facilities in 1990 mainly because there was a lack of space and personnel rather then a lack of need.

d. **Miscellaneous**

(1) Dr. Misra (Iowa State University) in Seed Technology has a graduate student working on computer analysis of photographs of maize ears. He has concluded a shape analysis portion of the project and is currently working on color analysis. He consulted us for our needs and opinions relating to this work. Ultimately this system can be used for a computerized photographic catalog of the Maize collection.

e. **Work related travel**

(1) St. Croix for 1 week to introduce Mr. Cesar Cardenas to the pollination and note taking techniques required for quarantine maize increases and to examine conditions there. A second 2 day follow-up was taken during the following Puerto Rican trip.

(2) My technician and I each spent a little over three weeks in Puerto Rico pollinating the 1989-90 seed increase.

(3) I attended the North Central Corn Breeders Meeting in Chicago to exchange ideas on current research interests relating to corn.

(4) I travelled to Denver for a week to visit with the GRIN database management team and other GRIN site personnel including NSSL, NSGC, COTTON, POTATO, and FLAX groups. We were to make recommendations on the acquisition of a larger GRIN computer to be purchased in 1994-95.

(5) A trip was planned to the Seed Trade Association meetings to attend the Maize Crop Advisory Meetings. I was unable to attend due to bad weather.

(6) Dr. M. Widrlechner drove to Massachusetts to pick up the Galinat-Mangelsdorf seed collection. It contained over 2000 old accessions of tropical maize dating back to the 1936-1955 period. Most accessions have very low numbers of seed and probably are poor in germination although they have been kept under good conditions since their acquisition.

2. Plans for 1991

a. Field work

(1) Ames Seed Increase5

We plant to increase 400-500 accessions of corn during the 1991 season. A number of regrows of Chilean materials are planned. Lamp accessions from Uruguay and Argentina will also be increased.

(2) Puerto Rico Increases

a. Puerto Rico 90-91 Increase

We planted 107 Accession8 that will need hand pollinating. My technician and a biological aide from NC-7 will perform the pollinations.

b. Puerto Rico 91-92 Increase

To continuethetropical increases, 100 accessions will need to be grown. There are still many more accessions of tropical maize in the NPGS which need increasing.

(3) St. Croix Quarantine Increases

a. St. Croix 90-91 Increase

We will process 100 accessions planted there for increase.

b. St. Croix 91-92 Increase.

We plan to plant 100 accessions but there are discussions going on to increase this number because. there are a lot of outside inquiries to NPGS to donate additional corns needing quarantine increase.

(4) Goodman Tropical Increases

a. We hope to receive at least 300 accessions from the Mexican National bank. We have been notified that they have increased several hundred accessionswhichhave not yet been shipped.

b. We hope to receive at least 250 accessions from the Peruvian National bank, but this number could be several hundred more. Two hundred fifty accessions would approximately equal 1990'5 receipts.

c. No accessions were received from Colombia in 1990. Therefore, we should expect to receive 1989 and 1990 increases during 1991. This could be as many as 500 accessions.

(5) Other outside Increases

a. Dr. Larry Darrah (USDA-ARS) at the University of Missouriwillbe sent the 7 accessions which did poorly last year. We-may send as many as 10 additional accessions.

b. We need to arrange with Kansas to have their State collections increased. They have indicated in the past that they lack funds to do this.

c. We will try to arrange-with Wisconsin an increase of NSSL's holdings of the Crookham sweet corn inbred collection.

d. Northrup King has expressed an interest in increasing 50 accessions of tropical corns.

(6) Experimental Hawaii location for Highland maize

Approximately 10 accessions will be planted in the spring to judge the suitability of a Hawaiian location for increasing highland maize.

b. Seed room

Germination tests will need to be run on 700 accessions needing a 5 year retest. Also, all of the 1000-2000 increases pending processing will need germination tests.

c. Greenhouse

The Zea project plans to make considerable use of the Greenhouse facilities in 1991. There are many accessions needing an increase which have very low amounts of seed and where maturity and disease resistance is unknown. Also, the 2000 Galinat-Mangelsdorf collection will need to be first grown in the Greenhouse.

d. Miscellaneous

(1) Graduate Students

a. The corn imaging project with Dr. Misra (Iowa State University) in Seed Technology should complete initial stages this year with the current graduate student finishing his work. Dr. Misra is currently trying to obtain fundingto work out the feasibility of a computer image database.

b. Mytechnicianwillbe attending Graduate school starting in the fall. He will be working on a Ph.D. thesis problem relating to maize germplasm.

e. Work related travel

(1) I will travel to St. Croix for 2-3 days to monitor the quarantine increases.

(2) My technician will travel to Puerto Rico for the 1990-91 increase pollinations. He will have a biological aide from

NC-7 help him. Between the 2 of them, they will there over a 5 week time period.

(3) I plan a trip to the Seed Trade Association meetings in December to attend the Maize Crop Advisory Meetings. The Sweet Corn Breeder8 meeting will probably also be held at that time.

(4) Travel may be necessary to Hawaii in 1991 to initialize cooperators in methods for making tropical increases and to check on the suitability of locations.

IV. Publications:

Auld, D.L., D.A. Erickson, L.A. Field, and W.W. Roath. 1991. Registration of a sunflower restorer germplasm population. Crop Sci. Accepted Sept. 1990.

Block, C.C. 1990. Screening of sunflower germplasm for Alternaria helianthi resistance. Proc. Sunf. Res. Wrkshp. Jan 8-9, Fargo, ND. (MEETING PROCEEDINGS)

Brenner, D. and R. Clark. 1989. Special purpose legumes at the Ames, Iowa Plant Introduction Station. Progress Report Clovers and Special Purpose Legumes Research, 22:35.

Brenner, D. 1989. Some minor fruits of temperate Pakistan. Annual Report of the Northern Nut Growers Association, 80:67-70.

Brenner, D. and H. Hauptli. 1990. Seed shattering control with indehiscent utricles in grain amaranths. Legacy, 3:2-3.

Brenner, D. 1990. The grain amaranth gene pools. Proceedings of the Fourth National Amaranth Symposium: Perspectives on Production, Processing and Marketing, Minneapolis Minnesota, August 23-25, 1990, pages 193-194.

Brenner, D. 1990. Sugestiones Para Los Usuarios de Germplasma de Amaranthus. Amarantos Novedades e Informaciones, 5:6-7.

Flint, Harrison L. and Mark P. Widrlechner. 1990. Field notes: Caraaana frutex. American Nurseryman 172(10): 138.

Knapp, S.J., L.A. Tagliani, and W.W. Roath. 1991. Fatty acid and oil diversity of Cuohea viscosissima: A source of medium-chain fatty acids J. Amer. Oil Chem. Soc. :in press.

Ramos, L.C.S., W.W. Roath, T.B. Cavalcanti, and J.H. Kirkbride 1991. Cuphea (Lythraceae) Descriptors. Iowa State University Ex. Stn., Ames, IA. Accepted Dec. 90.

Reed, G.L., Grimmer, J.A. and Wilson, R.L. 1990. Corn earworm resistance in popcorn. Abstracts of Northwest Vegetable Insect Conference.

Roath, W.W. 1990. Effects of harvest methods and storage conditions on seed germination of two Cuohea species. Proc. 1st Int'l. Conf. New Industrial Crops and Products. (Abstr.).

Roath, W.W., R.L. Clark, M.P. Widrlechner, and R.L. Wilson. 1990. Germplasm resources at the North Central Regional Plant Introduction Station. pp. 84-90. In J. Janick (ed.) Advances in new crops. Timber Press, Portland, OR.

Roath, W.W., R.L. Wilson, and C.A. Abel 1990. Effects of three insect pollinators on seed yield of two Cuohea species. J. Iowa Acad. Sci. 6:A5.

Thompson, M.M. and D. Brenner. 1990. Northern Pakistan explored for temperate fruit and nut germplasm. Diversity, 6(2):12-13.

Widrlechner, Mark P. in press. NC-7 Regional Ornamental Trials: Evaluation of new woody plants. Proceedings of the Metropolitan Tree Improvement Alliance. Accepted 6 August 1990.

Widrlechner, Mark P. in press. Seed storage for the commercial propagator. Combined Proceedings of the International Plant Propagators' Society. Accepted 13 December 1990.

Wilson, R.L. and Olson, D.L. 1990. TPB bug, Lygus lineolaris (Palisot de Beauvois) (Hemiptera: Miridae) oviposition site preference on 3 growth stages of a grain amaranth, A. cruentus. J. Kan. Entomol. Soc. 63:88-91.

Wilson, R.L., Wiseman, B.R. and Reed, G.L. 1990. Evaluating selected plant introduction popcorns for resistance to corn earworm and fall armyworm. Abstracts of Submitted Papers, N. Cen. Branch, Entomol. Soc. Am.: 131.

Wilson, R.L. and Olson, D.L. 1990. Field cage study of the effect of tarnished plant bug on a grain amaranth. Program Abstracts 102nd Sessions Iowa Acad. Sci., No. 7 :A5.

Wilson, R.L. 1990. Rearing the sunflower moth (Lepidoptera: Pyralidae) for use in field evaluation of sunflower germplasm. J. Kan. Entomol. Soc. 63:201-210.

Wilson, R.L. 1990. Iowa report. Ann. Plant Resist. to Insects Newsletter 16: 54-54.

Wilson, R.L. 1990. Insect and Disease Pests of Amaranth. Proc. 4th Nat. Amaranth Symposium: Perspectives on Production, Processing and Marketing :163-169.