

ANNUAL REPORT OF COOPERATIVE REGIONAL PROJECTS
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PROJECT: NORTH CENTRAL REGIONAL PROJECT NC-7
Introduction, Multiplication, Evaluation, Preservation,
Cataloguing, Enhancement, and Utilization of Plant Germplasm

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III. PROGRESS OF WORK AND PRINCIPAL ACCOMPLISHMENTS

A. Introduction of new germplasm

New accessions entering the NC-7 program in 1989 totalled 2005, including 1182 corn, 127 Cucumis species, 9 Cuphea species, 80 Cucurbita species, (mostly C. pepo), 79 Helianthus species, 54 Brassica spp., 46 Beta, 36 Amaranthus, 35 Panicum, 17 Daucus, 14 Melilotus, 14 Setaria, 13 Potentilla, 11 Sorbaria, 11 Sninacia, and 10 Sorbus.

B. Germplasm multiplication

Seed increases were attempted on nearly 2500 accessions again in 1989, including over 900 corn at Ames, 100 in Puerto Rico, and 50 in a post-entry quarantine growout on St. Croix; 517 Cucumis (445 cantaloupe, 72 cucumber): 344 Helianthus, 194 annual and biennial vegetables and spices (carrots, parsley, basil, coriander, fennel); 76 pumpkins: 100 beets: 80 oilseed rape; and 74 amaranths.

Pollination control on all these out-crossing species is maintained by hand (corn, sunflowers, pumpkins) or cage increases using honey bees as pollinators (cantaloupe, cucumber, wild sunflower, carrot, parsley, basil, chicory, coriander). The beet and amaranth increases are carried out in pollen-proof tents with periodic agitation to accomplish pollen shed inside each tent.

C. Germplasm distribution

There were 660 seed requests in 1989, up nearly 50% from 1988. Total packets distributed numbered 21,779, a reduction from 1988, but still higher than the average for the past 5 years. Greatest activity came in the following crops:
Helianthus - 5828; corn - 5773; Cucumis spp. - 3861; Brassica - 3166; Melilotus -- 580; and beets - 579.

Distributions by geographic areas were: North Central Region - 8753; North East -551; Southern -1831; Western -2954; and 5089 foreign.

D. Germplasm evaluation

1. Woody ornamental program

Distributions of 13 accessions of woody landscape plants (636 individual plants) were made to 27 trial sites for the regional ornamental testing program. An additional 153 plants of these accessions were sent to arboreta and botanic gardens. Reports were obtained from trial sites on plants distributed for testing in 1979, 1984 and 1988. Trials in Missouri, Kansas, Nebraska and Minnesota were visited. Other requests for ornamental germplasm resulted in the shipment of 86 plants and 58 seed packets. Seed and plant inventories were updated in the GRIN database and all requests for ornamental germplasm, both seeds and plants, are now handled through the GRIN order module.

2. Cooperator Evaluations

a. Vegetables

Four cantaloupe accessions (PI 164797, 207662, 289876, and 436533) showed less than 40% infected plants when mechanically inoculated with Zucchini Yellow Mosaic Virus in Australia. In Israel, cantaloupe accession PI 124111 and 124112 showed resistance to race 2 of powdery mildew inherited as partially dominant genes. Also in Israel, PI 124111 was used as a source of downy mildew resistance in an inheritance study. A gummy stem blight resistant cantaloupe breeding line, AC-70-154, released by Alabama utilized the resistance of PI 140471.

In France, seven cantaloupe accessions (PI 124112, 163208, 164323, 164856, 179894, 255478, and 414723) were used as sources of downy mildew resistance. In New Hampshire, PI 126156 was used as a source of cold germinability.

In Michigan, PI 344103, Lycopersicon pimpinellifolium, showed partial resistance to tomato bacterial canker. In Indiana, three other wild relatives of tomato, PI 126449 (L. hirsutum), 134417 (L. hirsutum F. glabratum), and 341985 (L. esculentum) are being used in a breeding program for insect resistance and low-temperature germination.

In other vegetables, rust resistance was noted in seven bean accessions in Nebraska; nine accessions of Capsicum (pepper) showed tolerance to Leaf Curl Virus, had high capsaicine content, and moderate to high yields in Illinois; four other pepper accessions are being used in tissue culture work in Michigan; and, in Wisconsin preliminary data indicate PI 294081 may be tolerant to carrot blight, but further work is needed.

b. Oilseed and Special Crops

Sunflower accessions are being used in a breeding program in North Dakota for additional genetic variability in a CMS fertility restoration program (PI 371935), as sources of resistance to downy mildew, race 4, and as sources of male sterility (PI 413158 and 5 others). Two (PI 413034 and 413119) were found to have stem weevil resistance and PI 430541 is being used in another breeding program as a good source of resistance to rust, downy mildew, and stalk rot.

b. **Oilseed** and Special Crops (cont.)

A series of 29 germplasm lines was released by **USDA-ARS** and North Dakota, involving interspecific crosses between cultivated sunflowers and 16 wild species accessions of *Helianthus* from the PI collection.

Amaranthus accessions were reported to have **good** productivity and hardiness (PI 482051) and acid tolerance in amine reclamation study (451826, 477914, and 480920). PI 480920 was also tolerant of saline areas.

Seven *Brassica juncea* accessions (PI 181040, **426308**, **426315**, **426333**, **426360**, **426381**, and 458996) yielded more than 1600 lb/A in northeastern Iowa (Nashua) when **Westar**, **B. napus**, yielded 1132 lb/A. In 1988, under severe moisture and heat stress at the same location, 6 *B. juncea* accessions (173873, 175607, 209781, 212970, 426316, and 426363) averaged more than 800 lb/A while **Westar** yield 133 lb/A. *B. juncea* accessions also showed good traits in Edmonton, Canada, including resistance (PI 311726) to what was probably *Alternaria* and *Sclerotinia*.

Two *B. niara* accessions (PI 179851 and 180416) are being used in an attempt to recreate *B. carinata* by crossing with *B. oleracea* in an Ohio program. Also in Ohio, mine reclamation work indicates that PI 194253, *B. carinata*, had good vigor even in acidic or salty soils.

c. Legumes

Out of 149 alfalfa accessions tested for downy mildew resistance in Kansas, 9 (PI 170534, 170543, 171720, 176638, 177013, 178980, 182238, 182242, and 183695) had at least 3.4 times the number of symptomless plants as Saranac when inoculated with isolate I-7. Four accessions (PI 205891, 206102, 206106, and 217419) had at least 1.1 times as many symptomless plants as Saranac when inoculated with isolate I-8.

d. Grasses and Corn

Two *Panicum miliaceum* accessions (PI 170594 and 463347) showed acid and salt tolerance in Ohio; also in Ohio, the bluegrass accession PI 369718 showed good to high seed yield. Sorghum accession PI 266965 has resistance to biotype E of the **greenbug** in Kansas.

The best four (out of 40 tested) accessions of corn (PI 210405, 221841, 233335, and 260614) in Bamenda, Cameroon, in relation to northern leaf blight common rust, and general adaptation are being used in a breeding program there.

About 5% of 500 accessions tested for gray leaf spot resistance in Iowa looked promising and will be retested in 1990. Nineteen other corn accessions are being used in four different breeding programs in the **midwest** to add genetic variation. One accession, PI 520761, is being used as a source of stalk strength and resistance to **raes** 1 and 2 of northern leaf blight, **eyespot**, rust, and stalk rot in Minnesota. Mexican Dent, PI 451694, showed good blight and drought resistance in Wisconsin. An accession from the Hopi Tribe, PI 213733, is being used in a breeding program in Missouri for its long mesocotyl, when grown in the dark.

3. Evaluations and Research at the PI Station

a. Agronomic and horticultural traits

Cuphea species were caged with three different pollinators, bumble bees, honey bees, and leafcutter bees, and it appears that honey bees are as good as bumble bees, better than leafcutters. Since honey bees are easier to manage, they will be used for future Cuphea caged seed increases. Because of low (less than 20%) oil content in seeds of dill and coriander, work with these two species will be discontinued.

A total of 433 accessions, representing at least 35 species, of Cuphea were collected on two trips to Brazil.

Sunflower, **Brassica**, and corn accessions continue to be evaluated for at least a dozen plant traits each as these accessions are grown for increase. A program has been developed for us by a graduate student at the Seed Science Center to capture on the computer digitized video camera color images of corn ears and kernels to aid in documenting cob-kernel data and allow electronic exchange of such images with other curators around the world.

Ornamental trials at 21 outlying sites in the upper **midwest** continue to be coordinated from this station. Germplasm maintenance procedures were refined and a new descriptor list developed for Pastinaca. Tests continue on evaluation of perennial native Lamiaceae as nectar sources for honey bees. Horticultural plant trait data continue to be taken on all Cucurbitaceae as they are grown in controlled pollination increases.

b. Pest Evaluation Research

Two hundred plant introduction corn lines were evaluated for corn **earworm** resistance to silk feeding. Fifty-six lines produced **6-day** larval weights statistically **equal** to the resistant check. One thousand PI corn lines were evaluated for resistance to European corn borer. Three lines rated resistant, 200 lines rated intermediate, and 800 lines rated susceptible. In another test, two popcorn lines of 35 tested rated resistant to first generation European corn borer. One hundred fourteen PI sunflower lines were evaluated for resistance to sunflower moth. Forty-nine PI amaranth lines were evaluated for resistance to tarnished plant bug. A total of 442 sunflower accessions were evaluated for reaction to Alternaria in field and greenhouse inoculated plots. Correlations between field and greenhouse results are being analyzed. Wild material was quite variable but PI 413169 showed good resistance. Powdery mildew tests are being completed on the 36 most resistant cucumber accessions of the **767** tested. Histologic studies are being carried out on the 60 most fruit rot resistant cucumbers. The etiology of a crown-stalk rot disease of Amaranthus is being studied and seems to be due to one of two fungi. **Verticillium dahliae** was isolated from wilted Agastache rugosa, a potential honey bee forage plant.

PLANS FOR NEXT YEAR

Continue our active acquisition program but we will attempt to avoid unnecessary and duplicate entries. Closer examination of each major collection will be carried out to try to determine what types of acquisition are still needed. Core collections will be closely examined as a more efficient alternative, especially with large collections, to screen for new traits. Cold storage space is now, and will continue to be, serving as an overflow storage for NSSL until they are able to construct new storage space.

Our involvement with the 10 Crop Advisory Committees associated with our collections will remain close, as will our working relationships with the National Program Leader for Germplasm and the National Seed Storage Lab.

We will continue winter nursery grow outs of about 100 accessions of corn in Puerto Rico and a **50-accessions** post-entry quarantine increase of corn on St. Croix. We will also explore the feasibility of establishing an arid-site winter nursery on SCS-controlled land on Molokai, Hawaii.

Evaluations for disease and insect resistance will continue on sunflower, corn, amaranth, and cucumber. Histologic studies will be used to examine the nature of fruit rot resistance in cucumber.

Cuphea will continue to be grown in tests designed to develop efficient cultural techniques in an attempt to provide a domestic crop source of **lauric** acid.

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