

MAR 2 1983

ANNUAL REPORT OF COOPERATIVE REGIONAL PROJECTS  
Supported by Allotments of the Regional Research Fund,  
Hatch Act, as Amended August 11, 1955  
January 1, to December 31, 1983

1. PROJECT: NORTH CENTRAL REGIONAL PROJECT NC-7  
Introduction, Multiplication, Evaluation, Preservation, Cataloging, and  
Utilization of Plant Germplasm

2. COOPERATION AGENCIES AND PRINCIPAL LEADER:

<u>Administrative Adviser</u>		R. L. Mitchell, Missouri	
<u>Regional Coordinator, Acting</u>		R. L. Clark, Iowa	
<u>State Experiment Stations and Representatives</u>			
Alaska	*R. L. Taylor	Missouri	*L. E. Cavanah
Illinois	*T. Hymowitz	Nebraska	*J. H. Williams
Indiana	*J. Janick	North Dakota	*J. D. Franckowiak, S
Iowa	*I. T. Carlson	Ohio	*S. Z. Berry
Kansas	*C. E. Wassom	South Dakota	*R. M. Peterson
Michigan	*A. Iezzoni	Wisconsin	*W. H. Gabelman
Minnesota	*H. Pellett, Chmn		

U. S. Department of Agriculture

ARS Germplasm Resources Laboratory	*G. A. White
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ARS Area Director, Mid-Great Plains Area	C. W. Alexander
Cooperative State Research Service	C. O. Grogan
Soil Conservation Service	*K. Bl an
Northern Regional Research Center	*R. Kleiman

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North Central Regional Plant Introduction Station, Ames, Iowa

Acting Regional Coordinator	R. L. Clark
Horticulturist	M. P. Widrlechner
Research Plant Pathologist	R. L. Clark
Research Entomologist.	R. L. Wilson

3. PROGRESS OF WORK AND PRINCIPAL ACCOMPLISHMENTS:

New introductions of agronomic and **horticultural** crops received **totalled** 850 including 586 grasses and field crops, 148 legumes, and 116 fruits and vegetables. Packets distributed in 1983 **totalled** 11,471, including 1,748 grasses and field crops, 1,417 legumes, 8,306 fruits and vegetables. 1,988 PI lines of sunflowers and 171 oil seed lines of Brassica and 112 packets of Amaranthus.

Dr. Mark P. Widrlechner (Ph.D. at Univ. of Minnesota) joined as Horticulturist in November.

In corn, 36 accessions were reported as having useful characters such as: kernel depth, viable pollen shed in extreme heat and drought, resistance to Goss's wilt, southern leaf blight, rust, earliness, cold tolerance, and resistance to Aspergillus flavus and Maize Dwarf Mosaic Virus.

In cucumber, 46 accessions were reported as having such useful *characters* as: resistance to scab, angular leafspot, powdery mildew, and Cucumber Mosaic Virus. Twenty four tomato accessions had at least one of the following

useful traits: resistance to anthracnose, bacterial speck, bacterial wilt; early seedling emergence, early yield, fruit firmness, and high vitamin C content.

Sixteen carrot PI lines were reported on as having Alternaria resistance or good root color and crown attachment.

Three pumpkin lines showed resistance to the herbicide trifluralin and one celery-line was resistant (PI 169001) to Cucumber Mosaic Virus. In alfalfa, 21 annual and 11 perennial PI lines were resistant to both races 1 and 2 of antracnose.

The orchard grass variety Pancho has PI 234688 as one parent. A Bromus sericeus (PI 317422) had an exceptionally high number of spikelets per culm. Four smooth bromes had good forage yields and high IVDMD.

a. Tomatoes

The TGSC accessioned 113 new items in 1983, bringing the total holdings to ca. 2,400, of which some 750 are wild species, 875 monogenic stocks, the remainder, multigenic, chromosomal, and misc. lines. During 1983 we grew 1,396 different cultures, most of which were TGSC stocks; pending current harvests of wild species, ca. 720 TGSC accessions were increased. TGSC stocks continue to be in high demand: the total no. samples requested was 2,596, distributed in response to 180 requests from 128 investigators.

The 800 odd accessions received from E. A. Kerr have been reviewed; 87 were selected for immediate increase, including new monogenic stocks; new linkage testers marking as many as JO chromosomes apiece, and highly useful amplification of chromosome JO testers. Other useful items from this collection will be accessioned as resources permit. We also reviewed the genetic stock collection of the late Dr. J. W. Lesley and selected items of special interest.

The entire species collection is being tested by C. L. Foy of V.P.I. for resistance to broom-rape and by F. M. Ashton of UC-Davis for reaction to dodder. Any resistance to these pernicious parasites that might be encountered would well justify the effort in providing such large numbers of samples.

Several accessions of the Galapagos Island tomato (L. cheesmanii) showed unusually thick fruit epidermis in 1983 research. This trait might have value in respect to resistance to fruit rots and fruit worms. Since this wild species readily hybridizes with the common tomato, such a character should be easy to transfer genetically.

b. Alfalfa

Two hundred sixty eight perennial Medicago PI lines were increased under cages using alfalfa leafcutter bees as pollinators. Seed production ranged from 0 to 507 gm. Of the 268 lines, 171 were in their first year of production, 54 in second year, 32 in third, and 11 in fourth. Only 24 lines had fewer than 50 plants per line. Two lines (206286 and 440509) had only 7 plants each.

Average seed yields were 54.4 gm in 1983 versus 38 in 1982. Summarized by year of production, the 171 first year PI's averaged 51.2 gm per

line, 2nd year lines averaged 95.7 gm, 3rd year only 15, and 4th year 14.7 gm per line.

Because some lines showed very poor seed set under cages, some open pollinations were carried out to test the basic fertility of the poorer caged lines. There appeared to be no **correlator** between seed set in cages and seed set under open pollination. From 1981 through 1983, yields of less than 10 gm per line have varied from 20% of the lines in 1981 to 44% in 1983. Weather conditions were thought to be the main limiting factor in the lower yields in 1983.

Of the 268 lines reported on from Reno, 90 produced a total of less than 10 gm of seed. The other 178 lines range from just over 10 gm to over 500 gm.

c. Forage Grasses

Nursery plantings of material collected in 1964 (Big Bluestem), and 1969-1971 (Big Bluestem and Switchgrass) are being maintained at Brookings, S.D. Collection site descriptions, family identification numbers, family means for several characters measured on individual plants over the years, weights of seed fractions that were sent to NSSL this year, and weights of seed fractions that are currently being stored in cold storage at SDSU are available on all collections.

There are 69 families of Big Bluestem from the 1964 collection; 187 Big Bluestem and 50 switch grass from the 1969 collection; 223 Big Bluestem and 45 switchgrass from the 1970 collection; 643 Big Bluestem and 99 switchgrass from the 1971 collection. Total families now in the nursery: 1,122 Big Bluestem and 194 switchgrass.

d. Sunflower

Preliminary data from Wisconsin on sunflowers indicates possible high yield and oil potential from the variety 'Voshod', PI 371936, and early maturity from 'Tchernyanka', PI 265104, both from USSR. 'Voshod' had 45.8% oil compared with 43.9% and 43.8% for each of two check varieties. Yield of 'Voshod' was 1370 lb/A compared with 1579 and 1470 lb/A for the two checks. (LSD at .05 = 375 lb/A)

'Voshod' (PI 371936), along with PI 340788, is being considered in a breeding program in Wisconsin for yield and oil content. This same line (371936), plus 8 other PI lines, were used in developing the germplasm composite DM-1, having resistance to race 3 of downy mildew. Other downy mildew resistant composites were produced in North Dakota with PI lines in them as follows: DM-2 with PI 430538 and DM-3 with PI 430541. Also in North Dakota, the following two lines: PI 431529 and 431543, showed resistance to Sclerotinia stalk rot. In South Dakota, 23 lines have been used to make selections from for high oil content and good seed set.

In Ohio, the following 6 lines, out of 524 tested, showed the lowest Diaporthe stem canker: 170417, 172907, 253775, 307935, 307941, and 311743. Also in Ohio, the following 9 showed the lowest Alternaria (out of 66 tested): 162675, 170390, 175731, 228345, 250855, 250856, 323279, 377530, and 406647.

e. **Landscaping Plants.**

Regional trial cooperators were contacted to update performance reports and data on site characteristics. Agreement was made with the Chicago Botanic Garden to provide plants from the 1982 plant exploration trip to Hokkaido and northern Honshu, for distribution to cooperators during the spring of 1984. Seventy-one Jots of ornamental seed were stratified for germination in the coming year. Work was initiated to broaden the network of nursery workers, botanists, horticulturists, plant breeders, and others interested in locating and testing new trees and shrubs of potential merit in the North Central Region.

f. **Entomology Research**

Nine plant introduction crown vetch were screened in the greenhouse for vetch aphid resistance. PI 325265 produced the fewest aphids/plant. It was determined that the Buckfast strain of honeybee was the best pollinator for our tests involving a wild sunflower in cages. Hand pollination was five times the cost of bee pollination when total costs were figured. Seventy-four PI corns were tested in the laboratory for silk feeding resistance to, the corn earworm. PI's 213772, 201844, 221822, 218166, 163144, 203329, 213705, and 213732 produced the smallest 6-day larval weights. It was determined that four grams of Jyophilized plant material added to a pinto bean diet and weighing larvae at seven days, was the best combination to evaluate corn silk feeding resistance in the laboratory. In laboratory testing, three lines of amaranth (A-2252, A-2259, and A-2262) showed leaf feeding resistance to fall armyworms while three different lines (A-2242, A-2254 and A-2261) showed a resistant response to cabbage loopers. One hundred fifty-two PI proso millets were evaluated in the laboratory for leaf feeding resistance to fall armyworm. From ten to twenty will be selected for retesting.

g. **Pathology Research**

Preliminary evaluation of data on an F2 population of tomato involving a fruit rot (Rhizoctonia solani) resistant parent (PI 406756) and the susceptible cultivar Rutgers indicate that resistance is recessive and due to a single gene. PI 406756 is segregating for resistance. Similar results occurred using PI 406776 as the resistant parent. Resistance seems to be due to some characteristic of the fruit skin since artificially wounding them breaks the resistance.

In cucumber F2 populations resulting from crosses between the belly rot resistant PI 165509 and susceptible cultivars Black Diamond and National Fickle, resistance is dominant and probably due to a single gene.

In a stalk rot (Fusarium moniliforme) test of 400 PI corns the following five lines had the lowest average number of rotted internodes: 175334, 177111, 185664, 186187, and 186188, all rating less than 2 rotted internodes. Seven other lines had less than 2.2 internodes rotted in this inoculated test with four 10 plant reps, Readings, and inoculations, were staggered by weekly intervals depending upon silking dates for each plot. Of these 12 lines, 7 came from Turkey, 2 from Uruguay, and one each from Australia, Haiti, and Nepal.

Fusarium moniliforme was, for the second year in a row, the most frequently isolated fungus from stalk rot plots, inoculated and uninoculated, at Ankeny, Iowa.

#### 4. USEFULNESS OF FINDINGS

- a. Plant Introductions continue to provide valuable germplasm for plant traits, disease and insect resistance, and other traits that are useful to plant breeders for developing and improving crop varieties, which benefits the general public by increased food production, improved food quality, energy conservation, and cleaner environment. The evaluation of plant introductions and the exchange for dissemination of information and seed through the NC-7 project, helps to better serve crops workers. The permanent maintenance and preservation of plant introductions assures a valuable germplasm pool for present and future use.

#### 5. WORK PLANNED FOR NEXT YEAR

- a. Continue (i) program of seed increase, storage, and preliminary evaluation.
- b. Continue to evaluate PI corn germplasm for corn earworm resistance by developing and utilizing a lab technique for silk feeding.
- c. Screen crown vetch for resistance to vetch aphid first by looking for antibiosis.
- d. Compare pollination efficiency of the Buckfast strain of honey bee with the sunflower leafcutter bee on wild type Helianthus annuus by using 8 ft x 8 ft x 20 ft field cages.
- e. Determine the gene(s) responsible for resistance to turnip aphid in Brassica napus and whether the gene(s) is the same one conferring resistance to powdery mildew.
- f. Develop and utilize a field screening technique for evaluating Amaranthus spp. for resistance to lygus bugs.
- g. Evaluate selected amaranthus for resistance to European corn borer.
- h. Determine if our current bee management program of alternately confining bees within and without our pollinating enclosures is an effective practice for maintenance of purity of wild sunflowers.
- i. Screen tomato PI lines for resistance to tomato fruitworm.
- j. Continue to evaluate the PI corn collection for additional sources of stalk rot resistance.
- k. Finish evaluating the cucumber collection for belly rot resistance.
- l. Make crosses between Septoria leafspot resistant PI tomatoes to determine how many genes are involved in the resistance.
- m. Determine the effect of various stresses (European corn borer, four stalk rot fungi, and tillage systems) on yield of corn.
- n. Reactivate regional testing of woody plants to evaluate adaptability and landscape qualities.
- o. Acquire germplasm of woody plants native to the Northeastern and North central and Rocky Mountain states from the northern and western extremes of their native range.

#### 6. PUBLICATIONS ISSUED OR MANUSCRIPTS PREPARED DURING THE YEAR:

- a. Publications of Regional Plant Introduction Station staff.  
WILSON, R. L., JARVIS, J. L., and GUTHRIE, W. D. Evaluation of maize genotypes for resistance to black cutworm larvae. *Maydica* (accepted for publication 2/28/83)

WILSON, R. L. and COURTEAU, J. B. A search of plant introduction proso millets for fall army worm resistance. *J. Econ. Entomol.* (Accepted for publication 8/11/83).

GEORGE, B. W., WILSON, F. D., and WILSON, R. L. Methods of evaluating cotton for resistance to pink bollworm, cotton leaf perforator, and lygus bugs. P. 41-45. In Host Plant Resistance Methods for **Insects, Diseases, Nematodes & Spider Mites** in Cotton. Southern Coop. Series. Bul. April

b. Journal Articles by cooperating scientists

ELGIN, J. H., JR. and OSTAZESKI, J. A. 1982. Evaluation of Selected Alfalfa Cultivars and Related **Medicago** Species for Resistance to Race 1 and Race 2 Anthracnose. Crop Sci. **22:39-42**

ARNY, D. C., GRAU, C. R., and SULEMAN, P. E. 1980. **Occurrence** of Maize Dwarf Mosaic in Wisconsin and Reaction of Sweet Corn Plant Introduction Accessions and Commercial Hybrids. Plant Disease **64:85-87**.

MILLER, ANITA N., NG, T. J., and BARKSDALE, T. H. 1983. Inheritance and Heritability of Resistance to Tomato Anthracnose caused by **Colletotrichum dematium**. J.A.S.H.S. **108:1020-1023**.

FALLIK, E., BASHAN, Y., OKON, Y., CAHANER, A., and KEDAR, N. 1983. Inheritance and Sources of Resistance to Bacterial Speck of Tomato caused by **Pseudomonas syringae pv. tomato**. Ann. Appl. Biol. **102:365-371**.

Rick, C. M., 1983 Species stocks -- revised list. TGC Report **33:18-33**.

7. APPROVED:

March 7, 1984

Date

Harold Pellett  
Chairman, NC-7 Technical Committee  
Harold Pellett

March 12, 1982

Date

Roger Mitchell  
NC-7 Administrative Advisor  
Roger Mitchell