ANNUAL REPORT OF COOPERATIVE REGIONAL PROJECTS
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1. PROJECT: NORTH CENTRAL REGIONAL PROJECT NC-7
NC-7 "New Plants" - The introduction, Multiplication, Preservation and Evaluation of New Plants for Industrial and Agricultural Utilization.

2. COOPERATING AGENCIES AND PRINCIPAL LEADERS:

Administrative Adviser — R. W. Hougas, Wisconsin
Regional Coodinator — W. H. Skrdla, Iowa
State Experiment Stations and Representatives

Alaska	*R. L. Taylor	Missouri	*L. E. Cavanah
Illinois	*T. Hymowitz	Nebraska	*J. H. Williams
Indiana		North Dakota	*J. S. Quick
Iowa	*I. T. Carlson, Sec'y	Ohio	*M. H. Niehaus
Kansas	*C. E. Wassom	South Dakota	*R. M. Peterson
Michigan	*R. L. Andersen, Chm.	Wisconsin	*W. H. Gabelman
Minnesota	*C. Stushnoff		

U.S. Department of Agriculture

SEA Germplasm Resources Laboratory	*G. A. White
SEA National Program Staff	Q. Jones
SEA Area Director, Mid-Great Plains Area	C. W. Alexander
Cooperative State Research Service	C. O. Grogan
Soil Conservation Service	*A. A. Thornburg
Northern Regional Research Center	*L. H. Princen

*Voting members of NC-7 Technical Committee

North Central Regional Plant Introduction Station, Ames, Iowa

Regional Coordinator	W. H. Skrdla
Horticulturist	H. S. Bhella
Research Plant Pathologist	R. L. Clark
Research Entomologist	J. L. Jarvis

3. PROGRESS OF WORK AND PRINCIPAL ACCOMPLISHMENT:

a. Introductions Having Special Value

Described below are plant introductions, reported by cooperators in 1977, that are considered to have made important contributions to plant breeding programs and to U.S. agriculture. Additonal reports on these and other plant introductions are provided in Appendix C of this report, titled "Promising Plant Introductions for 1975," which will be issued later.

(1) Alfalfa

(a) Three alfalfa introductions 107298 (Turkey), 206278 (Turkey), and 234205 (Iran) var. 'Bam' contributed germplasm to the variety 'Baker' released jointly by ARS and the Nebraska AES.

(b) Six alfalfa introductions, 234815 (M. falcata, Switzerland), 325396 (M.romanica, USSR), 325402 (M. romanica, USSR), 325408 (M. romanica, USSR), 325412 (M. romanica, USSR), and 346921 (M. sativa, USSR) showed little or no damage in evaluations for potato leafhopper resistance.

(2) Bean

(a). In the cross of the late maturing Phaseolus vulgaris L. parents, PI 165426 from Mexico (a small white seeded selection tolerant to Fusarium) x colored large-seeded pinto breeding line P-73-121-7, violet flower color and reddish

stems were controlled by two complementary dominant genes; variegated foliage by two duplicate recessive genes, and determinate plant habit by a single recessive gene. Transgressive segregation occurred in the F_2 for early maturity. Violet flower color was associated with reddish stem color and high seed weight was associated with pigmented seed coat color in the F_2 generation. Linkage was detected between flower color and foliage color pattern.

(b) Phaseolus vulgaris, 195401 from Guatemala and 142899 from Iran were evaluated at Michigan and are considered to have the potential for improving the nutritional status and food quality of the bean.

(3) Corn

(a) Four corn introductions, PI's 172323, 172324, 172327, and 195239 appear to have some 2nd broad European Corn Borer resistance.

(b) Five corn introductions, PI's 186233, 210402, 221888, 222637, and 233001 showed good resistance to spider mites in evaluations in New Mexico.

(4) Cucumber

(a) PI 234517, Cucumis sativus from South Carolina showed resistance to Angular leaf spot in repeated tests in Wisconsin. This accession is designated as SC-50 and is derived from PI 197087 from India, also resistant to ALS.

(b) Two cucumber introductions, 137847 from Iran and 390244 from Japan are being used in a breeding program at Michigan for their resistance to Triazine. They are being used for studies of mechanism of resistance and inheritance.

(5) Field Mustard

(a) Brassica compestris, 175054 and 175079 from India produce a high percentage of plants that flower early, in 16 to 18 days. They are being used in the development of stocks to be used in an introductory plant genetics course.

(6) Meadowfoam

(a) PI 278170, Limnanthes douglasii from Europe, has been reported to have outstanding ornamental characteristics under Alaska conditions.

(7) Mungbean

(a) The quantity of carbohydrates in the texture layer from dull seeds of mungbean, Vigna radiata, was 3 to 4 times that in the texture layer from shiny seeds. PI's 180311 and 368299 were used for their shiny seed coats and PI's 271401, 368288, and 368307 were used for their dull seed coats.

(8) Muskmelon

(a) Cucumis melo, 140471 from Texas is being used as a resistant check for seedling screening procedures in Wisconsin for gummy stem blight resistance.

(9) Ornamentals

(a) Abeliophyllum distichum, Caragana frutex 'Globosa', Ilex verticillata, Lonicera tatarica 'Valencia', Lonicera xylosteum 'Emerald mound', Potentilla fruticosa, and Viburnum opulus 'Compactum' plants have performed exceptionally well under the severe climatic conditions of the Northern Great Plains Region.

(10) Sunflower

(a) PI 204578 from Turkey, a ray-flower, or dahlia-like flower, is resistant to the sunflower moth.

(b) A few inbred lines were selected out of the sunflower introduction, PI 307946 from Spain. These lines, being further evaluated in hybrid combinations are rust susceptible but appear to be vigorous and adaptable to growing conditions of Glyndon, Minnesota.

(11) Tomatoes

(a) PI 197159, Lycopersicon esculentum x L. pimpinellifolium from Guatemala contributed germplasm to the variety 'Petitebec' released in Canada.

(b) PI 263726, L. esculentum from Puerto Rico 'McDaniels 414' contributed

germplasm to the tomato variety ' Superbec' released in Canada.

(c) A collection of 1,030 accessions of tomato (Lycopersicon esculentum Mill.) mostly cultivars and assumed varities, was evaluated for resistance to the tomato fruitworm. Although no immunity was found, there were significant differences in the degree of susceptibility. The most resistant cultivar, 'Tiny Tim' PI 128230 from Bolivia, was 83.1 and 57.6% less damaged than the susceptible and resistant controls, respectively. Even though the data were possibly confounded by vine size effects, indications are that much of the variability can be used to develop less susceptible cultivars. 126431, L. pimpinellifolium from Peru

(d) Tomato PI's 79532, L. pimpinellifolium from Peru and 126434, L. glandulosum from Peru were grown in cell culture on defined medium for prolonged periods. PI 79532 died out after 6 months but 126431 and 126434 have been maintained since March 1977. PI 126434 has been particularly vigorous and is being screened for glyphosate resistant cell lines. At present, this line is still capable of shoot regeneration and should produce a line with resistance. The work is being done by Dr. R. D. Lovy at Mighigan State and he would be glad to correspond and share information with anyone interested in this work.

(12) Vegetables

(a) Fifty-three vegetable cultivars, representing 18 plant species, recently introduced from the People's Republic of China, were evaluated for resistance to viruses affecting similar crops in the Northeast United States. Twenty-four of these cultivars were resistant or tolerant to one or more viruses. New sources of resistance are reported for four viruses in three plant species.

(13) Watermelon

(a) Citrullus lanatus, 189225 from Belgian Congo and 271778 from South Africa are practically immune to Collectotrichum lagenarium (anthracnose) isolates from cucumbers used in the USDA cucumber disease screening program in Wisconsin.

(13) Wheatgrass

(a) Six wheatgrass introductions out-yielded and out-performed the check variety, 'Slate' in several ways at Nebraska. They are PI's 345586, 273733, 273732, 315355, 315067, and 315353. It is highly recommended, by the evaluator, that these accessions be evaluated by other wheatgrass breeders.

b. Accomplishments at the Regional Station

(1) New agronomic, horticultural and industrial plant introductions received in 1977 totalled 450. About 2750 were grown for seed increse plus 2250 for insect and disease evaluations. More than 17,550 packets of seed and plants were distributed. Over 200 tomato introductions were grown for reidentification. Field observations on reidentification were made by Harold Winters and the Regional Station Staff members.

(2) Plant introductions were evaluated in the field and greenhouse for disease and insect resistance:

(a) Disease resistance screening

1/ Corn

a/ Stalk rot

Inoculations were made on 140 PI lines of corn in a six-replicated field trial, using a conidial suspension of Diplodia zeae. Stalk rot readings were taken on the vertical and horizontal spread of rotted tissue as a percentage of the inoculated internode affected. Standard ANOVA was carried out on the ISU computer using SAS. Highly significant differences between lines were observed for both horizontal and vertical spread of rotted tissue.

High negative correlations existed between rot and days to silk (maturity). Horizontal spread of rot was more strongly correlated with maturity ($r=-.76$) than was vertical spread ($r=-.66$). The best looking lines in this year's test were: 357093, 357098, 357101, 357102, 357103, 357128, and 414178.

b/ Rust

A two-replicated field nursery of 140 PI lines was established to evaluate their rust (P. sorghi) reaction. Fifteen lines (357094, 357100, 357104, 357114, 357116, 357119, 357122, 357123, 357124, 357126, 393753, 393755, 393770, 401758, and 401761) rated less than 1.5 on a 0 - 5 scale, 0 being no rust, 5 most severe rust. The susceptible check, PI 228167, rated 4.5; the resistant check, AES704, rated 1.5.

The resistance involved is the polygenic, mature plant type in which fewer lesions are formed on resistant plants. No new sources of the non-sporulating lesion type resistance were found.

2/ Tomatoes

a/ Rhizoctonia fruit rot

An inoculated test involving 207 tomato lines was carried out in sand benches using fruits from the field. Up to 20 fruits from each line were included in each test. Whenever possible, a second test was run on lines showing good resistance in the first test.

In addition to the resistant lines from previous years' tests, the following showed promise in 1977: 325136, 325143, 326172, 330338, 330427, 339326, 339916, 340907, 341130, 341142, 341147, 341148, 341150, 346761, 346762, 346769, 355100, 355119, 355889, 357252, 358818, 358819, 365914, and 365916.

Seven F_2 populations, representing single plant selections from PI 193407 crossed with 205001 and 306137 were also evaluated for Rhizoctonia fruit rot reaction. The data from this test indicate that resistance to Rhizoctonia fruit rot in PI 193407 is due to a single dominant gene, and that individual plants within line 193407 are either heterozygous, resistant or homozygous resistant. Results from previous years and from cooperating scientists indicate that there are also susceptible individuals in PI 193407.

(b) Disease control

Vine crops (cucumber and pumpkin) were again observed for seed-borne virus in the seedling stage before being transplanted to the field. Diseased plants were destroyed.

Sunflowers were again examined for presence of seed-borne downy mildew and the few infected seedlings were burned.

(c) Disease incidence

From April through July of 1977 our rainfall was very far below normal. High temperatures occurred in July along with the drought. These conditions delayed the development of fungal and bacterial leaf diseases on most of our plantings.

Rainfall in August, however, was almost 12 inches, coming close to the all-time record for that month. Early blight and fruit rots became very heavy on our tomatoes and cercospora nearly defoliated the beet planting.

Before the hot, dry weather ended in July, a disease appeared in the seed increase tomatoes that at first looked like double virus streak. Necrotic areas appeared on leaves, petioles, and stems, leading eventually to tip blighting. In severely affected plants, the entire plant eventually died.

Initial examination of the diseased material revealed no fungal mycelium or masses of bacteria. Leaf dips viewed under the transmission microscope in the Botany Department's microscope facility revealed the presence of two rod-shaped virus particles - one relatively short and stiff (Tobacco Mosiac Virus) the other long and flexuous. The identity of this Potato Virus Y type virus has not been completed. It is transmitted by the green peach aphid as well as mechanically. Physical properties and host range are currently under investigation. There is no evidence at this time of seed transmission.

(d) Insect resistance screening

1/ A total of 800 corn introductions were evaluated in the field for resistance to 2nd generation European corn borer larvae. Introductions that showed resistance to sheath and collar feeding were further examined to determine the amount of stalk tunneling. Introductions resistant to both sheath and collar feeding and stalk tunneling were 209135 and 218191.

2/ A total of 586 corn introductions were evaluated in the greenhouse for resistance to the black cutworm. Evaluations were based on leaf feeding by 3rd instar larvae on seedling corn plants. None were resistant to leaf feeding; however, some differences among introductions were noted. Pop corns appear to be extremely susceptible.

3/ Sunflowers were evaluated in the field for resistance to sunflower moth. Early flowering introductions were more heavily infested; 172906, 204578, and 380569 had little or no infestation. 204578 is a "chrysanthemum" type of sunflower. The unusually long petals may give some protection against the sunflower moth.

(3) Ornamental evaluation and distribution

(a) In cooperation with the NC-7 Ornamental Subcommittee, ornamental plants were distributed to the NC-7 Regional Ornamental Trial cooperators and botanic gardens and arboreta in the North Central Region as follows:

1/ A total of 1702 plants of 23 introductions were sent on request to regional ornamental trial cooperators in the North Central Region for planting at 32 trial sites. In additon, 46 plants were sent on request to the University of Kentucky in the Southern Region.

2/ 907 plants consisting of 40 species were distributed on request to the ten botanic gardens and arboreta in the North Central Region.

(b) In order to maintain ornamental evaluation records, planting report cards and 1-, 5-, and 10-year performance report cards were sent to the Regional Ornamental cooperators. These reports will be compiled and 5- and 10-year summaries will be prepared and distributed.

(c) Five accessions of Betula maximowicziana, monarch birch, were received from Hokkaido, Japan. Monarch birch is a rarity in culivation, and only a few trees are found in the U.S., Canada, and Europe. It is highly resistant to bronze birch borer and will be an excellent replacement for bronze birch borer susceptible species, such as Betula papyrifera, Betula pendula, and white barked birches.

c. Plant exploration

(1) Domestic exploration for Pecans

The exploration for superior pecans in Missouri, Kansas, and Illinois continues, although activity during the past year was limited to propagation of 12 trees out of 40 that are under consideration.

(2) Dr. W. H. Gabelman, University of Wisconsin, was a member of the National Academy of Science Committee on Scholarly Communications study tour of vegetable production in the People's Republic of China. Exchanges of germplasm was initiated by the committee.

(3) Dr. Cecil Stushnoff, University of Minnesota, collected several ornamental species in Norway.

(4) Dr. J. O. Young, University of Nebraska, collected several ornamental and other species in Afghanistan.

(5) Dr. H. T. Erickson, Purdue University, collected species of many genera in Spain.

(6) The Alaska legislature is providing plant exploration funds for collecting in northern latitudes of the world.

(7) A proposal for the collection of Avena fatua (wild oats) in Mexico was approved.

(8) A proposal for exploration for vegetables in Brazil by H. T. Erickson was approved. Dr. Erickson is at Purdue University.

(9) A proposal was approved for the exploration for primative tomato cultivars in Mexico and Guatamala by R. L. Clark and H. F. Winters.

d. Regional Cooperative program

The Nebraska and Indiana stations continue to systematically evaluate new alfalfa introductions for insect resistance, and the data is given to the Regional Station. Other stations in the region continue to evaluate plant introductions, as needed, in search of desired plant traits for inclusion in their breeding programs.

4. USEFULNESS OF FINDINGS:

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 a cleaner environment. The evaluation of plant introductions and the exchange and 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, preliminary evaluation; (ii) pathology and entomology screening and evaluation work; (iii) check new plant introductions for abnormalities; (iv) local and regional testing of new crops and ornamentals and (v) coordination of regional cooperative programs.

b. Implement computer assited programs in cooperation with the Germplasm Resources Information Project.

c. Assist with planning and executing foreign and domestic plant exploration.

6. PUBLICATIONS ISSUED OR MANUSCRIPTS PREPARED DURING THE YEAR:

Publications that concern information from the North Central Region on plant introductions are listed below. Publications from other regions on NC-7 primary maintenance crops are listed in Appendix A.

a. Regional Station Publications [author(s) is a member of the Regional Station Staff]:

(1) Shafton, A., R. Clark, W. H. Skrdla, and K. Rawal. 1977. A computer-processable nomenclature for gene symbols. Agron. Abstracts 1977; 71.

(2) Clark, R. L., J. L. Jarvis, S. W. Braverman, S. M. Dietz, and G. Sowell, Jr. 1977. A summary of reports on the resistance of plant introductions to diseases, nematodes, insects and chemicals. Medicago spp. Printed and distributed by NC-7 to alfalfa researchers. 66 p.

(3) Barnes, D. K., E. T. Bingham, R. P. Murphy, O. J. Hunt, D. F. Beard, W. H. Skrdla, and L. R. Tueber. 1977. Alfalfa germplasm in the United States: genetic vulnerability, use, improvement, and maintenance. USDA Tech. Bul. 1571, Nov. 1977, 21 p.

(4) Jarvis, J. L. 1977. Evaluation of sunflower introductions for resistance to sunflower moth in 1976. Special Report A-2. Printed and distributed by NC-7 to sunflower researchers.

(5) Bhella, H. S. 1977. Propagation of Pinus Strobus, by stem cuttings, Proc. Int. Plant Prop. Soc. 27: "In press."

(6) Bhella, H. S. 1977. River birch (Betula nigra L.) propagation by stem cuttings. Proc. Int. Plant Prop. Soc. 27: "In press."

(7) Bhella, H. S. 1977. Propagation of river birch (Betula nigra L.) by stem cuttings. Plant Prop. 23(2): 5-7.

(8) Bhella, H. S. 1977. Weed control in hybrid lilies. Florists' Review 159(4131): 32, 72, 73.

b. State Station Publications

(1) Kansas

(a) Painter, R. H. 1968. Crops that resist insects provide a way to increase World Food Supply. Kansas Agr. Exp. Sta. Bul. 520: 22.

c. Journal articles

(1) Illinois

(a) Hooker, A. L. 1977. A plant pathologist's view of germplasm evaluation and utilization. Crop Sci. 17(5): 689-694.

(2) Indiana

(a) Dudley, J. W., R. L. Davis. 1966. Preliminary groupings of plant introductions of alfalfa (Medicago sativa L.) for heterosis studies. Crop Sci. 6(6): 597-600.

(b) Lessman, K. J., V. D. Meier. 1972. Agronomic evaluation of crambe as a source of oil. Crop Sci. 12(2): 224-227.

(3) Iowa

(a) Conje, A. M., I. T. Carlson. 1973. Performance of crosses within and between two diverse sources of birdsfoot trefoil, Lotus corniculatus L. Crop Sci. 13(3): 357-360.

(b) Conje, A. M., I. T. Carlson. 1973. Seedling vigor of open pollination progenies of intra-and inter-source crosses of birdsfoot trefoil Lotus corniculatus L. Crop Sci. 13(3): 361-362.

(c) Frey, K. J. 1976. Plant breeding in the seventies: Useful genes from wild plant species. Egypt. J. Genet. Cytol. 5(2): 460-482.

(4) Minnesota

(a) Barnes, D. K., E. L. Sorensen, R. N. Peaden, W. R. Kehr, J. H. Elgin, Jr., O. J. Hunt, T. E. Devine, I.I. Kawaguchi, F. I. Frosheiser, and C. A. Hanson. 1977. Registration of seventeen populations from the Beltsville International Composite alflafa germplasm pool. Crop Sci. 17(4): 675-676.

(5) Missouri

(a) Courtney, W. H. III, V. N. Lambeth. 1977. Glycoalkaloid content of mature green fruit of Lycopersicon species. Hort Sci. 12(6): 550-551.

(b) Courtney, W. H. III, V. N. Lambeth. 1977. Glycoalkaloid levels in tomato fruit. Tomato Gen. Coop. Rep. 27: 12.

(c) Watt, E. E., J. M. Poehlman, Billy G. Cumbie. 1977. Origin and composition of a texture layer on seeds of mungbean. Crop Sci. 17(1): 121-125.

(c) Purivirojkul, W., J. M. Poehlman. 1977. Injury in mungbean from natural infection with cucumber mosaic virus. Crop Sci. 17(4): 654-656.

(6) Nebraska

(a) Coyne, D. P., J. R. Steadman, 1977. Inheritance and association of some traits in a Phaseolus vulgaris L. cross. J. Hered. 68: 60-62.

(7) South Dakota

(a) Klett, J. E. 1977. Deciduous shrubs for the Great Plains. Amer. Hort. 56: 34-36.

(8) Wisconsin

(a) Hall, T. C., B. H. McCown, Sharon Desborough, R. C. McLeester, G. E. Beck. 1969. A comparative investigation of iso yme fractions separated from plant tissues. Phytochemistry, 8: 385-391.

(b) Huber, S. C., G. E. Edwards 1975. Regulation of oxaloacetate, aspartate, and malate formation in mesophyll protoplast extracts of three types of C_4 plants. Plant Physiol. 56: 324-331

(c) McCown, B. H., G. E. Beck, T. C. Hall. 1968. Plant leaf and stem proteins. I. Extraction and electrophoretic separation of the basic water-soluble fraction. Plant Physiol 43 (4): 578-582.

(d) McCown, B. H., T. C. Hall, G. E. Beck. 1969. Plant leaf and stem proteins. II Isozymes and environmental change. Plant Physiol. 44(2) 210-216.

(9) USDA, Beltsville

(a) Norwood, R. S., VAn Denburgh, C. H. Hanson, C. C. Blickenstaff, 1967. Factors affecting resistance of field planted alfalfa clones to the alfalfa weevil. Crop Sci. 7(2): 96-99.

(b) O'Brien, Muriel J., H. F. Winters. 1977. Evaluation of spinach accessions and cultivars for resistance to Fusarium wilt. I Greenhouse-bench method. J. Amer. Soc. Hort. Sci. 102(4): 424-426.

(10) USDA - ARS Series

(a) Gunn, C. R., F. B. Gaffney. 1974. Seed characteristics of 42 economically important species of Solanaceae in the United States. USDA-ARS Tech. Bul. 1471.

7. APPROVED:

Date

Chariman, NC-7 Technical Committee
R. L. Andersen

Date

NC-7 Administrative Adviser
R. W. Hougas

MISCELLANEOUS PUBLICATIONS

1. Publications

The publications listed below are from other regions, and foreign sources, but concern NC-7 primary maintenance crops.

a. Alfalfa

(1) Graham, J. H., R. N. Peaden, D. W. Evans. 1977. Verticillium wilt of alfalfa found in the United States. Plant Disease Reptr. 61(5): 337-340.

(2) Pederson, M. W., G. D. Griffin. 1977. Registration of Desert Alfalfa. Crop Sci. 17(4): 671

b. Clover

(1) Taylor, N. L., P. B. Gibson, W. E. Knight. 1977. Genetic vulnerability and germplasm resources of the true clovers. Crop Sci. 17(4): 632-634.

c. Endive

(1) Zitter, T. A., V. L. Guzman. 1977. Evaluation of COS lettuce crosses, endive cultivars, and Cichorium introductions for resistance to Bidens mottle virus. Plant Disease Rptr. 61(9): 767-770.

d. Tomato

(1) Fery, Richard L., Frank P. Cuthbert, Jr. 1974. Resistance of tomato cultivars to the fruitworm, Heliothis zea (Boddie). Hort. Sci. 9(5): 469-470.

(2) Fery, Richard L., Frank P. Cuthbert, Jr. 1975. Antibiosis in Lycopersicon to the tomato fruitworm (Heliothis zea). J. Amer. Soc. Hort. Sci. 100(3): 276-278.

(3) Schuster, J. D. 1977. Resistance in tomato accessions to the tomato pinworm. J. Econ. Entomol. 70: 434-436.

e. Vegetables

(1) Provvidenti, R. 1977. Evaluation of vegetable introductions from the People's Republic of China for resistance to viral diseases. Plant Disease Reptr. 61(10): 851-855.