ANNUAL REPORT OF COOPERATIVE REGIONAL PROJECTS
Supported by Allotments of the Regional Research Fund,
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January 1 to December 31, 1978

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 Coordinator — 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	*M. L. Swearingen	North Dakota	*J. S. Quick
Iowa	*I. T. Carlson, Chmn	Ohio	*M. H. Niehaus
Kansas	*C. E. Wassom	South Dakota	*R. M. Peterson, Sec'y
Michigan	*R. L. Andersen	Wisconsin	*W. H. Gabelman
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U.S. Department of Agriculture

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*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 Pathologist	R. L. Clark
Research Entomologist	J. L. Jarvis

3. PROGRESS OF WORK AND PRINCIPAL ACCOMPLISHMENTS:

a. Introductions Having Special Value

Described below are plant introductions reported by cooperators in 1978, that are considered to have made important contributions to plant breeding programs and to U.S. Agriculture. Additional reports on these and other plant introductions are provided in Appendix C of this report, titled "Promising Plant Introductions for 1978", which will be issued later.

(1) Alfalfa

(a) PI 251205, a Medicago sativa introduction from Yugoslavia, was used in the parentage of the variety Pioneer 524 released by Pioneer Hi-Bred International, Inc.

(b) Two alfalfa introductions were used in the stem nematode resistance germplasm release, Washington SNI, released by the USDA-SEA and the Nevada and Washington, AES in 1978. PI 279958 with stem nematode resistance from Turkey was used via the WN-S-1 parental line and the stem nematode resistant PI 141462 from Iran was used via the WH-S-3 parental line.

(c) In 1978, a Western series publication was published which lists all alfalfa breeding lines or germplasm releases available to individual scientists and to organizations interested in the improvement of alfalfa. This list represents releases made between 1965

and 1978. In this list, 16 breeding lines contain germplasm from 1 or more PI accessions (as high as 44) for a total of 175 accessions used (though some are duplicated). This publication is listed in item 6d.

(d) A new alfalfa weevil resistance mechanism was discovered in PI 247790 from Peru by scientists at Purdue. "A portion of the weevil larvae reared on this introduction convulsed, dehydrated and died before pupation. One clone produced up to 20% convulsing larvae and 40% mortality. Due to the large degree of variability for this trait in PI 247790, it should be possible to increase this type of antibiosis through selection." (Crop Sci 18(2):208)

(2) Beans

(a) PI 181954 found to have high tolerance (hypersensitive leaf reaction and no systemic chlorosis in leaves) to a new virulent (Nebraska isolate) strain of halo blight (Pseudomonas phaseolicola). GN Nebraska #1 selection 27, resistant to race 1 and 2 was susceptible to this new strain. D. P. Coyne, M. L. Schuster and Carol Erwin, Nebraska, 1978 Apr.

(b) PI 255960 report based on F_3 data. The high ovule number (9-10/pod) of this PI line is controlled primarily by a single major gene with additive effects. The high ovule was found to be associated with purple flowers, colored seeds and late maturity in the F_2. Linkages were detected between flower color and maturity, flower color and pod tip shape. D. P. Coyne, Nebraska, 1978 Apr.

(c) PI 207262 found that the delayed flowering (lateness) of this line is due to a response of long days x high temperature, and was controlled by a single recessive gene. D. P. Coyne, Nebraska, 1978 Apr.

(d) PI 165421 leaves resistant to all strains (6) tested of Xanthomonas phaseoli (common blight bacterial disease of bean) but pods were susceptible. Indicates that different genes control reaction in different plant parts. D. P. Coyne and M. L. Schuster, Nebraska, 1978 Apr.

(e) PI 176675 found to have high genetic resistance to white mold (Sclerotinia sclerotiorum) reaction found to be simply inherited. Further genetic studies are in progress. D. P. Coyne, Steadman and Weihing, Nebraska, 1978 Apr.

(3) Canarygrass

(a) PI 170622, Phalaris canariensis from Turkey was used along with caryopses of 5 other cultivars in an evaluation of the potential of P. canariensis for food purposes. PI 170622 did not differ markedly from the others in chemical composition. However, as a species, P. canariensis caryopses has a total amino acid concentration of 19.25% and a N to protein conversion factor of 6.71. Its N-to-protien conversion factor was the highest reported for any crop. Canarygrass caryopses had higher concentrations of all eight essential amino acids than did those reported for wheat or corn caryopses. Annual canarygrass is a potential food grain crop.

(4) Corn

(a) PI 251934, the cultivar 'Chernovitskaya-21' from the USSR, was used in a corn hybrid released in Minnesota for its earliness and multiple eared tendency. Other favorable reports on its performance were received from Minnesota and Canada. However, it did not perform well at Lincoln, Nebraska in 1977, which was an unusually hot dry year. The report from Lincoln stated that the accession grew quite well and flowered very early, as expected. Pollen production was excellent and silks emerged satisfactorily but the seed set was very poor. The accession evidently lacks heat and drouth tolerance, particularly heat tolerance because the nursery was irrigated. Therefore, one might expect it to perform better under cool summer conditions than under warm conditions.

(b) Previous studies on PI 217413, Zapalote Chico corn at the University of Missouri showed that it had resistance to corn earworm (Heliothis zea). The resistance was due to a chemical factor used in the silks. Recently, in cooperation with Dr. Tony Waiss and his staff at the USDA, Western Regional Center, located the resistance

factor and named it Maysin. Maysin is a flavone glucoside. When incorporated in diets, it severely retards earworm larvae growth and increases mortality. Studies are in progress at the University of Missouri to study the inheritance of Maysin synthesis.

(c) Visual cob inspection of the following corn plant introductions indicated that these four had desirable cob characteristics, particularly the "wood" content for the Missouri pipe corn program:

172335 'Silvermine'
221895 'Dill White Dent'
314844 'Mammoth White Pearl'
363067 White Dent

(d) Additional sources of monogenic chlorotic - lesion resistance to Helminthosporium turcicum were found in corn PI's at the University of Illinois. They are 190081, Guatemala 218167 New Mexico, 186221 and 186224 Argentina, 186231 Uruguay, 217415 'Drought Proof' W. Virginia, 217461 'King Philip' New York, 166700 Argentina, 213713 'Mortgage Lifter' and 221866 'Boone Co. White' Missouri. (Hooker Crop Sci.)

(5) Tomatoes

(a) Two tomato introductions, 213189 from Greece and 298633 from the USSR, were among the parents used in the "Oregon Cherry' tomato variety released in 1978.

(b) A selection from a small fruited tomato species, PI 365899 had the highest level of resistance to leaf spot caused by Septoria lycopersici of the 34 red-fruited PI entries screened. This selection has been designated PI 422397. Three other introductions, 111406, 111407, and 205014 showed resistance.

(c) The tomato PI 272636, is a recognized source of resistance to anthracnose. It was used as a resistant check for evaluating breeding lines for anthracnose resistance. It was also used by Del Monte plant breeders, resulting in an anthracnose tolerant tomato variety. (PDR 62(11).

(d) In 1973-1976, 4050 accessions of the world collection of tomatoes were screened for heat tolerance based on fruit setting at high temperatures at the Asian Vegetable Research and Development Center, Taiwan. A high percentage of the 4050 accessions were derived from the world collection at Ames. The following showed high levels of heat tolerance during the evaluation period: 365914 Ecuador, 273445 'Nagcarlan' Phillipines, 365916 and 365917 Ecuador, 136452 Canada, 203232 South Africa, and 290856 Texas. PI 365917 was used as a heat tolerant check. This work is described by Villareal, Lai, and Wong in publication No. 1d(4) in Appendix A.

(e) The tomato, PI 134417 (Lycopersicon hirsutum f. glabratum) from Ecuador is highly resistant to the tobacco hornworm, Manduca sexta, as manifested by reduction in larvae survival and weight gained by survivors over a 72 hour period. (Kennedy, J. Am. Soc. Hort. Sci. 103(334).

(6) Ornamentals

(a) PI's 420323 to 420327, Betula maximowicziana, from Hokkaido, Japan, is highly resistant to bronze birch borer and will be an excellent replacement for susceptible species, such as B. papyrifera, B. pendula, and white barked birches.

(b) Crabapple cultivars 'Silver Moon' and 'Tschonoski' have been reported to be highly resistant to scab and rust under Kansas growing conditions.

b. Accomplishments at the Regional Station

(1) New agronomic, horticultural, and industrial plant introductions received in 1978 totalled 920 accessions. About 2500 were grown for seed increase plus 2000 for insect and disease evaluations. More than 10,350 packets of seed and plants were distributed.

(2) Construction was begun on a metal frame shop and equipment storage building. Work was started in November just before the advent of winter weather. Because of the severe winter, only a limited amount of work could be done before spring.

(3) A cooperative agreement with the University of Nevada at Reno for increasing seed of alfalfa introductions under cages was initiated. This will provide controlled pollinated seed for distribution and will replace the open pollinated seed from original seed in 1979-1980.

(4) A cooperative agreement with South Dakota State University is being negotiated for the production and harvest of a collection of native grasses from Eastern South Dakota.

(5) Three plant explorations were conducted in 1978 as follows:

(a) H. T. Erickson, Purdue University collected vegetables, especially lima beans in Northern Brazil.

(b) D. Ugent and R. Ruhde, University of Southern Illinois and USDA, SEA, AR, Interregional Potato Station, Sturgeon Bay, Wisconsin, respectively, collected wild species of tuber bearing potatoes in Southwest United States.

(c) D. Stuthman, University of Minnesota collected wild oats in Mexico.

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

(a) Insect Resistance Screening

1/ 2nd-Generation European Corn Borer. A total of 41 corn introductions, recently received by the Regional Station, were evaluated in the field for resistance to 2nd-generation European corn borer. All were very susceptible to sheath and collar feeding. A total of 10 corn introductions had been previously rated as being resistant to both sheath and collar feeding and stalk tunneling. In 1978 these introductions were given an unusually heavy corn borer infestation; all were again resistant. The introductions in which resistance was confirmed were 162927, 186209, 209135, 218191, 226685, 317328, 317329, 317330, 349256, and 406133.

2/ Black cutworm in corn. A total of 2,386 corn introductions were evaluated in the greenhouse for resistance to black cutworm. None were resistant; pop corns appear to be extremely susceptible. Future plans include infesting plants with eggs in an attempt to identify plants that may have a low level of resistance.

3/ Sunflower moth resistance in sunflowers. Sunflowers were evaluated for resistance to sunflower moth. A total of 13 have been identified as resistant, the most resistant being 172906, 204578, and 380569. A study will be made to determine the mechanism of resistance and the inheritance of resistance in these PI's to sunflower moth.

4/ Cooperative work. A study is planned to determine the effect of resistance in corn to 2nd-Generation European corn borer on the incidence of stalk rot (in cooperation with the Regional Station's plant Pathologist).

(b) Disease resistance screening

1/ Fruit rot evaluations were made on another 267 PI lines for resistance to Rhizoctonia solani induced soil rot. More than two dozen lines looked promising enough to retry in 1979. PI 345559, from Russia, looked very good in this year's test. It is a paste type tomato with good firmness and flavor. It held its foliage longer into the season than most esculentums this year - a year of heavy leafspot attacks. It also seemed to be tolerant to TMV in the field.

The chemical(s) responsible for the resistance of PI 193407 to R. solani fruit rot has been shown to be in the chloroform extracts from the fruits. Further attempts to positively identify this compound are being made in cooperation with chemists at the NRRC in Peoria, Illinois.

2/ Belly rot resistance is being looked for in the cucumber collection using the same technique as in the tomato fruit rot tests. This year 40 PI lines were tested but the test was not severe enough, as 21 lines showed no infection. Further evaluation and modification of the screening technique will be carried out in 1979.

3/ Rust evaluations of 140 corn lines showed 9 that scored less than 2 on a 0-5 scale when 5 is most severe rust, 0 is no rust. These rust resistant lines all scored equal to or better than the resistant check, AES704. The susceptible check, PI 228167, rated 4. PI 196127 rated less than 1 and 194389 rated 1. Both of these lines are dent corns from Ethiopia.

4/ Diplodia stalk rot evaluations were carried out on the same 140 lines as in the rust trial. Of these, 24 showed some resistance to Diplodia in a replicated, inoculated test. The most resistant line was PI 186189, which is the Wisconsin Inbred 621, received back in this country from Uruguay.

Data on stalk strength characteristics of these 140 lines will be obtained this year on samples from the 1978 plots. Correlations will be run between stalk rot reaction and stalk strength. The best lines will then be used as parents in crosses to determine the inheritance of these characters.

(c) Disease control:

1/ The 3-year downy mildew control program continues with our sunflower seed increase plots. Lack of systemically infected individuals in this year's plots indicated two things: (1) our original seed stocks are quite free of downy mildews, and (2) that our rotation of the sunflower plots has been sufficient to reduce the chances of soil-borne inoculum carrying over from one sunflower crop to the next year.

2/ The tomato scorch disease found in the 1977 seed increase plots did not reoccur in 1978. The pathogens involved were determined to be Tobacco Mosiac and Potato Y. Viruses. Tomato plants infected by both viruses and subjected to moisture stress in the growth chambers exhibited symptoms similar to those observed in the field in the drought year of 1977. Such conditions are not expected to reoccur for many years.

3/ Cucurbita and Cucumis seedlings from original seed were again observed in the greenhouse for the presence of seed borne viruses, mainly Squash Mosiac Virus, before being transplanted into the field. Diseased plants were rouged and destroyed.

(7) Ornamental Program

(a) In cooperation with the NC-7 Ornamental Subcommittee, 1247 plants of 11 introductions were distributed to the NC-7 Regional Ornamental Trial Cooperators and Botanic Gardens and Arboreta in the North Central Region. Ornamental plant introductions sent on NC-7 Regional Trial included Acer Ginnala 'Compacta', A. grandidentatum, Betula glandulosa (PI 232552), B. maximowicziana, B. platyphylla japonica, Euonymus europaea 'Redcap', Ilex verticillata 'Winter Red', Pyrus calleryana fauriei and Rhus aromatica 'Grow-Low'. Also, 2 additional plant introductions, Impatiens schlechteri 'Naispela' (PI 354259) and I. sultanii (PI 406747), were distributed to the Botanic Gardens and Arboreta.

1/ A total of 726 plants were sent on request to the NC-7 Regional Ornamental Trial Cooperators for planting at 28 trial sites. In addition, 12 plants were sent to Colorado State University in the Western Region and 10 plants to the University of Kentucky in the Southern Region.

2/ 499 plants were distributed to the 19 Botanic Gardens and Arboreta in the North Central Region.

(b) About 2000 ornamental plants were raised for distribution during 1979 and 1980. Ornamental plant introductions to be sent in 1979 include Betula nana (PI 414758), Betula maximowicziana (PI's 420324 to 420327) Fraxinus excelsior (PI 385251), Genista multibacteata, Picea omorika (PI 399396), Pyrus communis (418783), Rhus lancea (PI 419221), Syringa pekinensis, Taxus baccata (PI's 399411 and 399412) and Thuja occidntalis 'Wardii'.

(c) An 'NC-7 Regional Ornamental Plant Distribution List: 1954-78' was compiled and distributed to the NC-7 Ornamental Cooperators. This publication lists more than 300 ornamental plants distributed for testing and evaluation in the North Central Region since the start of the NC-7 Regional Ornamental Trial Program.

(d) Regional Plant Introduction Station has been requested by the Ornamental Working Groups, American Society for Horticultural Science, to prepare an annual publication entitled 'List of New Ornamental Plants.. This list of new ornamental plants will be published annually in HortScience.

c. Regional Cooperative Program

The Nebraska Station has intensified the evaluation program on alfalfa introductions. This work now includes yield trials, replicated tests for insect resistance, in addition to the single row field evaluation trials made in the past.

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. USEFULLNESS 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 environmnet. 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, 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 (c) coordination of regional cooperative programs.

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

c. Finish construction of shop and equipment storage building and begin work on Seed Processing and Office and Laboratory Building.

d. 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 tentral Region are plant introductions 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) MOCK, J. J., and W. H. SKRDLA. 1978. Evaluation of maize plant introductions for cold tolerance. Euphytica 27:27-32.

(2) GUNN, C. R. W. H. SKRDLA, and H. C. SPENCER. 1978. Classification of Medicago sativa L. with use of legume characters and flower color. USDA Tech. Bul. 1974. 84 pp.

(3) THOMPSON, J. M., T. C. DAVIDSON, J. C. CRADDOCK, W. R. LANGFORD, and W. H. SKRDLA. 1978. A General procedure for the installation of an integrated information-exchange prototype for germplasm resources. Agronomy Abstracts. 1978:113.

(4) CLARK, R. L. and J. H. HILL. 1978. A new tomato virus disease induced by co-infection with tobacco mosaic and potato Y viruses. (Abstract) Phytopath News 12:171.

(5) BHELLA, H. S. 1978. NC-7 Regional ornamental plant distribution list, 1954-1978. (Distributed by NC-7 Plant Introduction Station, Ames, Iowa).

b. State Station Publications

(1) Kansas

(a) Pair, J. C. and W. G. Willis. 1978. Flowering crabapple evaluations, 1972-77. Kansas Agr. Exp. Sta. AES Keeping up with Research 36. Leaflet.

(2) Nebraska

(a) Salac, S. S., P. N. Jenson, J. A. Dickerson, and R. W. Gray, Jr. 1978. Wildflowers for Nebraska landscapes. Nebraska Agricultural Experiment Station, April 1978.

(3) Wisconsin

(a) Hasselkus, E. R. 1977. A guide to selecting landscape plants for Wisconsin. Wisconsin Agricultural Experiment Station, July 1977.

c. Journal articles

(1) Illinois

(a) Hooker, A. L. 1978. Additional sources of monogenic resistance in corn to Helminthosporium turcicum. Crop Sci. 18(5):787-788.

(2) Indiana

(a) Stevenson, W. R., G. E. Evans, and T. H. Barksdale. 1978. Evaluation of tomato breeding lines for resistance to fruit anthracnose. Plant Dis. Reptr. 62:937-940.

(b) Thompson, T. E., R. E. Shade, and J. D. Axtell. 1978. Alfalfa weevil resistance mechanism characterized by larval convulsions. Crop Sci. 18(2):208-209.

(3) Michigan

(a) Dayanandan, P., Frederick V. Hebard, Van D. Baldwin, and Peter B. Kaufman. 1978. Structure of gravity-sensitive sheath and internodal pulvini in grass shoots. Amer. J. Bot. 64(10):1189-1199.

(4) Minnesota

(a) Robinson, R. G. 1978. Chemical composition and potential uses of annual canarygrass. Agron. J. 70(5):797-800.

(5) Missouri

(a) Purivirojkul, P. Sittiyos, C. H. Hsu, J. M. Poehlman, and O. P. Sehgal. 1978. Natural infection of mungbean (Vigna radiata) with cucumber mosaic virus. Plant Dis. Reptr. 62(6):530-534.

(6) Nebraska

(a) Coyne, D. P. 1978. Genetics of flowering in dry beans (Phaseolus vulgaris L.). J. Amer. Soc. Hort. Sci. 103(5):606-608.

(b) Ibrahim, A. M., and D. P. Coyne. 1975. Genetics of stigma shape, cotyledon position, and flower color in reciprocal crosses between Phaseolus vulgaris L. and Phaseolus coccineus (Lam.) and implications in breeding. J. American Soc. Hort. Sci. 100(6):622-626.

(c) Kehr, W. R., G. R. Maglitz, and R. L. Ogden. 1978. Registration of Baker alfalfa. Crop Sci. 18(4)692-693.

(7) North Dakota

(a) Wilton, A. C., C. E. Townsend, R. J. Lorenz, and G. A. Rogler. 1978. Longevity of alfalfa seed. Crop Sci. 18(6)1091-1093.

(8) Wisconsin

(a) Ma, Yu and F. A. Bliss. 1978. Seed proteins of common bean. Crop Sci. 18(3)431-437.

(b) Ma, Yu and F. A. Bliss. 1978. Tannin content and inheritance in common bean. Crop Sci. 18(2):201-204.

(9) USDA, Beltsville

(a) Barksdale, T. H., and A. K. Stoner. 1978. Resistance in tomato to Septoria lycopersici. Plant Dis. Reprt. 62:844-847.

(b) Elgin, J. H. Jr., D. W. Evans, and R. N. Peaden. 1978. Registration of 18 Germplasm Populations of Alfalfa. Crop Sci. 18(3)529-530.

(c) O'Brien, Muriel J. and H. F. Winters. 1978. Evaluation of selected spinach accessions for resistance to Fusarium oxysporum F. sp spinaciae. II. Environmental control tests. Plant Dis. Reptr. 62(5):427-429.

(d) White, George A. and Marie Solt. 1978. Chromosome numbers in Crambe, Crambella, and Hemicrambe. Crop Sci. 18(1):160-161.

d. USDA, SEA Series

(a) Hunt, O. J., Hans Baenziger, B. J. Hartman, D. H. Heinrichs, E. S. Horner, I. I. Kawaguchi, B. A. Melton, M. H. Schonohorst, and B. T. Thyr. 1978. Improved breeding lines of alfalfa. SEA, AR Agri. Rev. and Manuals, W. R. Series No. 5, Sept. 1978: 60 pages.

7. APPROVED:

March 9, 1979
Date

I. T. Carlson
Chairman, NC-7 Technical Committee
I. T. Carlson

March 14, 1979
Date

R. W. Hougas
NC-7 Administrative Adviser
R. W. Hougas

APPENDIX A

MISCELLANEOUS PUBLICATIONS

1. Publications

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

a. Cucumber

(1) Armstrong, G. M., J. K. Armstrong, and D. Netzer. 1978. Pathogenic races of the cucumber-wilt fusarium. Plant Dis. Reptr. 62(9):824-828.

(2) Barham, Warren S. 1953. The inheritance of a bitter principle in cucumbers. Proceedings of the Amer. Soc. for Hort. Sci. 62:441-442.

(3) McCreight, J. D., and R. L. Lower. 1978. Heritability of reducing sugar concentration in pickling cucumber fruit and its implication on methods of selection. J. Amer. Soc. Sci. 103(2):271-274.

(4) McCreight, J. D., R. L. Lower, and D. M. Pharr. 1978. Measurement and variation of sugar concentration of pickling cucumber. J. Amer. Soc. Hort. Sci. 103(2): 145-147.

b. Cucurbita

(1) Provvidenti, R., R. W. Robinson, and H. M. Munger. 1978. Resistance in Feral Species to six viruses infecting Cucurbita. Plant Disease Reptr. 62(4):324-329.

c. Medowfoam

(1) Devine, M. B. and J. W. Johnson. 1978. Mode of Pollination and reproduction of meadowfoam. Crop Sci. 18(1):126-128.

d. Tomato

(1) Baggett, J. R. and W. A. Frazier. 1978. 'Oregon ~~Orange~~ Cherry' tomato. HortScience. 13(5):598.

(2) Kennedy, G. G., and W. R. Henderson. 1978. A laboratory assay for resistance to the tobacco hornworm in Lycopersicon and Solanum spp. J. American Soc. Hort. Sci. 103(3):334-336.

(3) Sonoda, R. M. and J. Augustine. 1978. Reaction of bacterial wilt-resistance tomato lines to pseudomonas solanacearum in Florida. Plant Disease Reprt. 62(5):464-466.

(4) Villareal, R. L., S. H. Lai, and S. H. Wong. 1978. Screening for heat tolerance in the genus Lycopersicon. HortSci. 13:(4):479-481.