

ANNUAL PROGRESS REPORT

For Calendar Year 1990

USDA-ARS NATIONAL CLONAL
GERMPLASM REPOSITORY
33447 Peoria Road
Corvallis, OR 97333

Presented June 18 and 19, 1991

Dr. Kim Hummer, Research Leader/Curator
Dr. Barbara Reed, Cryopreservation, Plant Physiologist
Dr. Henrietta Chambers, Research Horticulturist
Jim Chandler, Biological Technician - Plants(Temp.)
Bill Doerner, Agricultural Technician - Integrated Pest
Management
Judith Flynn, Secretary
Ray Gekosky, Biological Aid - Field Assistant
Donna Gerten, Computer Programmer - Information Systems
Manager
Jay Goodwin, Biological Technician - Seed Management
Vonda Peters, Agricultural Technician - Plant Propagator
Carolyn Paynter, Tissue Culture Technician
Joseph Postman, Plant Pathologist
Joe Snead, Agricultural Technician - Field Manager
Dr. Maxine Thompson, Research Horticulturist

Dr. Patricia Buckley, Biological Technician (Temporary)
Brian Courtney, Biological Aid (Temporary)
Traci DeWilde, Biological Aid (Temporary)
Aaron Henderson, Biological Aid (Temporary)
Nancy Higgins, Biological Aid (Temporary)
Lisa Hunt, Biological Aid (Temporary)
Erin McConnell, Biological Aid (Temporary)
Wes Messinger, Biological Aid(Temporary)
Theresa Reynolds, Biological Aid (Temporary)
Xiao-Ling Yu, Graduate Student
Dr. Francis Lawrence, Collaborator
Dr. Mel Westwood, Collaborator

Personnel Changes

In August our Biological Technician-Plant Propagator, John Orlowsky, left us to get married, take a bike trip through Europe and live happily ever after in Canada. We wish him the best of luck in his endeavors. Because of the federal hiring freeze after John left, we were unable to refill his position until mid-December. Vonda Peters was selected and has taken on the tasks of propagation, distribution, and maintenance of plants in the greenhouse and screenhouse. We were thankful she was on board for the scionwood distribution season.

We were without a secretary from last Spring until the end of September when personnel finally gave us permission to recruit a replacement. Judy Flynn came on board and has been getting our front office back in order. We welcome her assistance.

After 23 years of service as a Research Assistant for Oregon State University, Jim Chandler retired as of May 31, 1991. Jim was the first technician assigned to the NCGR and worked the last 12 years in the repository greenhouses, screenhouses and field. He also assisted with the physical plant maintenance. Now that he retired from state service he will continue as a USDA-ARS Part-time Biological Technician working in the greenhouses and screenhouses.

We have had several promotions and position developments during the last year for our highly-deserving staff member. Deanna Gerton was promoted and her position was reclassified from a Biological Technician to Computer Programmer, which more aptly describes her duties. Joe Snead, Joseph Postman and Ray Gekosky received well deserved promotions in their positions of Agricultural Technician, Plant Pathologist and Biological Aid.

We have just recently added Mr. Jay Goodwin to our staff. He started on June 3, 1991, as a Biological Technician. He will be defining germination rules and determining viability of our seed collections. We welcome him on board. This important seed collection management task is critical to our clonal germplasm maintenance.

Dr. Margaret Stahler, Research Geneticist, has taken the post-doctoral position working under Dr. Bob Linderman on the breeding of small fruits. Margaret is stationed at our unit and is assisting us in the evaluation of our *Fragaria* field collection this summer.

Dr. Maxine Thompson, famed plant explorer who has roamed Pakistan, Russia, Ecuador and other corners of the world, is a Visiting Scientist with NCGR. She is studying our *Rubus* collection including counting chromosomes and examining morphologic and physiological differences. She will give a critical eye to our taxonomic designations and assist in obtaining new *Rubus* for our collection.

Dr. Henrietta Chambers' title has changed to Visiting Scientist although her present duties will continue as Assistant Curator of the *Mentha* collections. We are glad to have her excellent taxonomic expertise.

Both Dr. Whitey Lawrence, Retired USDA Fruit Breeder, and Dr. Mel Westwood, Emeritus Professor at Oregon State University, continue as active collaborators for our facility. We are grateful to have access to their vast knowledge and experience.

All things considered we continue to have an excellent staff on board, and are looking forward to our second decade of challenge in temperate fruit and nut germplasm preservation.

Physical Plant

Our newly purchased 42 acres of land is under development. We have bids out for fencing, drilling of a new well, and installation of an irrigation system.

We are in the process of demolishing existing unsafe structures. This is no small task! We plan to construct a 35 X 50' work space with office, phone, lavatory and tool storage area.

We have laid down gravel for roads and made divisions for the first field plots. We calculate that we will have about 30 acres of useable field space after roads, fence and borders are in place.

We plan to plant our next *Fragaria* field collection on the new land this summer. Seedling species material of other genera will be initially planted also.

We plan to roof over the walkway between the headhouse and main office. This will provide a storage space for our growth chambers, freezers, refrigerators and other large laboratory equipment items. This will free up more useable laboratory, headhouse and office space and will be a much more efficient use of the building. This construction will require two years at least.

We have improved our pesticide storage area and plan to install a much needed exterior door to one pesticide mixing area. We are replacing 10 year old coolers in the greenhouses with new fiberglass models having fewer moving parts.

We have rearranged plants in our screenhouses to make additional room for the small fruit genera. We now have one house each for *Rubus*, *Ribes*, *Vaccinium* and *Fragaria*. We have one house for virus infected material, and one for miscellaneous genera. Within several years two houses will be needed for *Rubus* which will expand into the present miscellaneous house.

Budget

Our base funding in FY90 was \$636,000 and FY91 was \$640,878. In FY91 the USDA-ARS PWA graciously provided us with an additional \$55,000 for fencing and irrigation development of the new property. In addition we coordinated \$47,500 from Program Staff for two specific Cooperative Agreements evaluating strawberries and pear germplasm.

With federal pay adjustments , staff promotions and utility increases our discretionary funds were significantly cut this past year. Projections for the next two years look very bleak provided additional funding is not available.

If our budget remains at the present cap we would lose 5 temporary assistants by FY93 and additionally 2 visiting scientist positions by FY94. Maintenance of present collections would be difficult and germplasm increases for genera that are quite deficient, such as *Rubus*, *Vaccinium*, *Fragaria* and *Ribes* would place a large strain on operations.

Our present ray of hope would involve new germplasm dollars congressionally appropriated on the Farm Bill presently before Congress.

To maintain the genera assigned to Corvallis in the best possible condition in the coming decade, I have requested three additional full-time permanent curator positions, two for the small fruit genera and one for *Pyrus* and *Corylus*. While we have excellent technical support we have many more genera than can be cared for in detail by one research leader/curator.

This request for additional staff members is worked into the 5- and 10-year plan for the repository, provided additional funding becomes available.

<u>YEAR</u>	<u>AMOUNT REQUESTED</u>	<u>PERMANENT SY REQUESTED</u>
	\$ 850,000	3
	\$1,000,000	5

New Accessions

In 1990 we have added 1008 new accessions to our collection. These include native American, Russian, South American and European germplasm.

We received mutant *F. vesca* clones generated from Scott Williamson's graduate program at University of New Hampshire. In the fall I collected native *Fragaria* in New England. Joseph Postman provided us with 28 virus-negative pear clones from infected clones in our collection. Drs. Maxine Thompson and Calvin Sperling brought back *Ribes* species seed from their collecting trip in the Soviet Union. We also received *Ribes* and *Rubus* from Drs. Jim Ballington, Jim Leutyn, and Maxine Thompson's collection expedition to Ecuador. When Dr. Nick Vorsa had the opportunity to visit Skhalin Island, USSR, he collected many *Vaccinium* species and some *Rubus* for our collection. One of the species, *V. praetans*, has a potent pungent aroma that is very penetrating. With help from Drs. Smagula, Pollard, Pellett and others I collected *V. macrocarpon* wild large fruited cranberries from native bogs in Maine, New Hampshire and Vermont. While in Maine Dr. Smagula provided us with Lowbush blueberries of both *V. angustifolium* and *V. myrtilloides*. Dr. Don Mairs sent more Maine cranberry selections after my return.

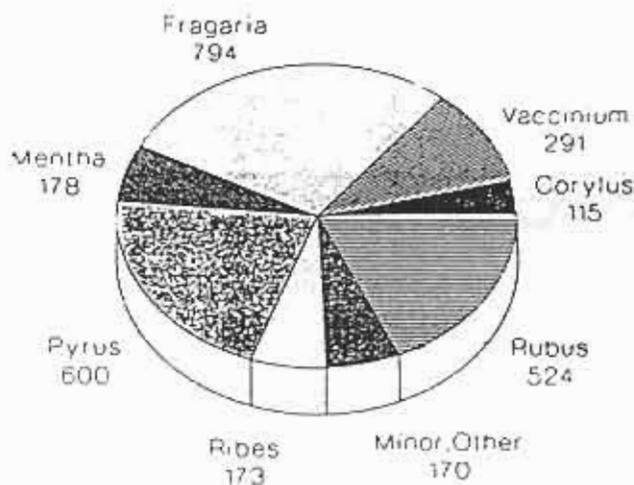
After some discussion among curators within the germplasm system it was decided that our facility will take on four additional genera: *Arbutus*, *Ceanothus*, *Escallonia*, and *Holodiscus*. We have begun to obtain germplasm of these new genera.

Plant Germplasm Distribution

The total number of foreign countries receiving germplasm from our facility (26) increased by one from 1989, and the number of states receiving germplasm decreased by one (36 states not including the District of Columbia) from last year's totals. The volume of requests has dropped since last year. As of late December 1990, 324 orders had been received totaling 3051 items. Of these 2200 have been shipped to requestors, while 328 items remain in pending status. Items unavailable numbered 437.

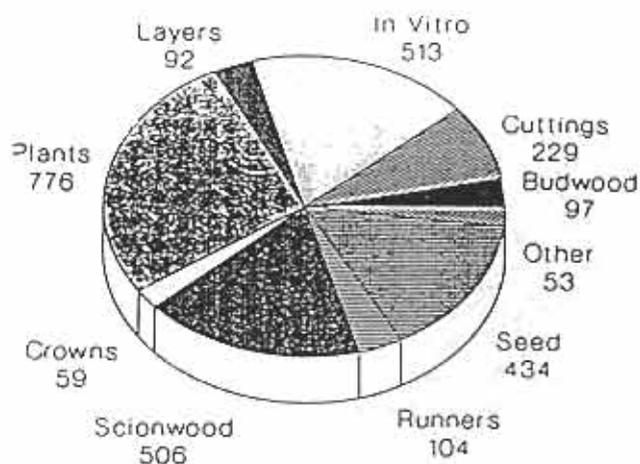
Most items shipped last year went to requestors in the Foreign Public Organization Sector (Universities, Institutes, Botanical Gardens), followed by: State Agricultural Experiment Stations, Universities, State Agricultural Departments; Commercial seed/biotech/chemical companies within the United States; U.S. Individual, no organizational affiliation; Foreign National Gene banks, research organizations and USDA-ARS. Less than 100 items were shipped in descending order to: Foreign Commercial (Seed/biotech/chemical companies); CGIAR International Agricultural Research Centers, FAO; Foreign Individual, no organizational affiliation; U.S. Public (non-profit) Organizations (botanical gardens, CPS, Seed Saves, Rodale); and Other U.S. Federal Agencies.

Germplasm Distributions 1990 Breakdown by Genus



Germplasm Distributions 1990

Breakdown by Material



In Vitro Culture and Cryopreservation

In 1990 the cold storage experiments were evaluated and we found that *Fragaria* in heat sealed, gas-permeable polyethylene bags store longer and remain in better health than those in boxes or tubes. Contamination was cut to near zero. Virus thermotherapy of in vitro *Fragaria* is now being performed in bags as well since they exclude contamination usually caused by fluctuating temperatures.

Most cold stored *Mentha* accessions in tubes were contaminated after four years of storage so the entire collection was reinitiated with fresh cuttings from the greenhouse. Many contain internal bacterial contaminants and methods of escaping or eliminating the problem are being pursued.

Cold storage experiments were set up with *Rubus* to test containers, temperatures and light cycles which might improve the length of storage. Additional studies of growth room temperature storage are also underway. *Ribes* are being stored in the dark at both 4 and -1°C to determine if the colder temperature will provide longer storage times. Nearly all *Humulus* cultivars were placed in cold storage as a backup of greenhouse plants. Large numbers of *Ribes*, *Fragaria*, *Mentha* and *Vaccinium* were added to the collection.

In vitro plant requests sent out have increased to over 300 in vitro plants for each of 1989 and 1990. This is up from less than 100 in previous years.

Two episodes of malfunctioning cold room controls allowed the 4°C storage to be heated to about 35°C for several hours each. These heat shocks killed some plants outright (especially those in glass tubes) and severely injured many others. The controls have now

been modified to turn off the defrost elements in case of a malfunction.

During the winter and early spring *Pyrus* accessions repropagated from tubes in cold storage were restored in bags and have also been multiplied for use in rooting trials and cryopreservation. Fifty accessions were tested for rooting and if rooted, planted in soil, placed in the mist bed for 2 weeks, grown in the greenhouse for 2 weeks and evaluated for successful establishment. By summer we will have data on the response of 50 accessions to three or four different rooting procedures. Inventories of stored collections will now be done for 2 genera each month. This will provide three complete inventories each year and allow for a better flow of work in the laboratory and growth room.

Priorities for 1991 include: Addition of all remaining *Fragaria* accessions (as they run out) from the screenhouse to the T.C. collection; determination of the identity of the contaminating bacteria in *Mentha*; completion of the *Mentha* and *Humulus* collections; collection of requested plants that are not currently in vitro; improvement of *Vaccinium* culture; improved initiation of *Corylus* cultures.

COLD STORAGE COLLECTION
IN VITRO

GENUS	DEC. 1988	DEC. 1989	DEC. 1990	MAY 1991
CORYLUS	14	14	20	23
FRAGARIA	149	188	300	300
HUMULUS	0	0	43	78
MENTHA	75	321	400	400
PYRUS	70	140	165	170
RIBES	1	80	129	131
RUBUS	255	265	253	247
VACCINIUM	30	51	53	54
TOTALS	594	1059	1363	1403
INCREASE		465	304	40

In cryopreservation, screening of *Rubus* and *Pyrus* accessions continues. A paper on cryopreservation of *Pyrus* was published in HortScience.

Studies were begun on the effects of ABA, cold hardening and cytokinin levels on survival of *Rubus* meristems frozen in liquid nitrogen. ABA at 5 μ M does not appear to be as effective as cold hardening but produces higher survival rates than control conditions (no ABA, no cold hardening). Additional replicates have been run with *Rubus* meristems on ABA, with and without cold hardening and cytokinin. Cytokinin levels do not appear to affect the results.

Several new vitrification (classification) techniques have been tried with *Rubus* and *Pyrus* meristems, unsuccessfully. Recovery media were tested for their effect on survival of *Rubus* meristems. The histology of the recovery process is also being studied. Some *Pyrus* and *Rubus* accessions have been placed in LN for long term storage during 1991.

GRIN and Our Local Area Network by D.M. Gerten, Information Manager

The Novell ELS System II local area network we installed at NCGR-Corvallis last year has proven to be extremely useful in both our day-to-day operations and in local database management activities. Eight computers located around the facility are connected to the file server and the plant germplasm database is available to all personnel. A number of programs have been prepared in FoxPro, our database management system, to enable NCGR staff members to perform various types of queries and generate reports (and other output) and our annual Catalog from the database easily and quickly. Direct access to the various types of files in the database is provided with certain restrictions to maintain data integrity. This system has worked very well for us in the past year and no doubt has had a positive impact on overall productivity.

We also have other types of programs available on the network including a word processing package, graphics and statistical analysis programs for use by staff members.

GRIN records for accession, inventory, cooperators and distribution are now being updated every two months instead of quarterly, providing for more timely updates and additions from our local database.

Observation records have been prepared and loaded to GRIN for 1990 field evaluations of Corylus, Vaccinium, Mentha, Pyrus and Ribes. In addition, observation records have been prepared and loaded from data provided from several cooperators as well. For Ribes, we loaded 19 records from a Vermont study on White Pine Blister Rust resistance. In Vaccinium, we loaded 211 crop and fruit character records from Dr. D.M. Boone's field study in his Cranberry research plots at the University of Wisconsin (1988), and 16 records from Dr. J. Meyer and Dr. J.R. Ballington's study of leafhopper resistance (1990). For Corylus, we loaded 753 records on phenology data provided by Dr. S. Mehlenbacher at OSU (1988-1990). For Fragaria and Rubus, we loaded a total of 403 records on fruit data

provided by Dr. L. Daley, B. Wood and R. Boone at OSU 1988).

In April we loaded 18,396 Pyrus records on fruit evaluations made at NCGR in 1987 and 1988 to GRIN. These records took a long time to prepare, however, we hope the data was worth the wait.

This year we look forward to loading more observation data on Rubus, Ribes, Corylus, Pyrus, Vaccinium, Fragaria and Mentha.

Virus Elimination Efforts - 1990
by Joseph Postman, Plant Pathologist

NATIONAL CLONAL GERMPLASM REPOSITORY - CORVALLIS

Virus Status Report

GENUS	CLONES	PERCENT VIRUS NEGATIVE	PERCENT VIRUS POSITIVE	PERCENT UNTESTED OR INCONCLUSIVE
CORYLUS	358	71.79	6.15	22.07
FRAGARIA	678	47.79	10.77	41.00
PYRUS	1459	76.42	13.16	10.42
RIBES	375	38.67	13.60	46.40
RUBUS	559	62.61	13.06	23.08
VACCINIUM	446	52.24	1.57	43.72
TOTAL	3875			
MEAN		58.25	9.71	31.11

Visitors to NCGR

Approximately 310 people were guests for a tour of the NCGR in 1990. Of the 310 individuals 50 traveled from such distances as: Thailand, South Vietnam, India, Tunisia, Kenya, China, New Zealand, Norway, South Africa, Russia, Canada, Argentina, Spain and Bulgaria. We had visits from classes held at Willamette University, Oregon State University, Linn-Benton Community College and a local middle school. The Oregon State University Alumni Class of 1940 were our guests for a tour in the summer. Certainly among our most distinguished visitors were Representatives Michael Kopetski, D-OR, and George Brown, D-CA. Mr. Brown, now chairman of the House Science, Space and Technology Committee, was instrumental in the approval of dollars for establishment of clonal germplasm repositories. He was quite aware of the emerging discipline of genetic resources and the value of the germplasm mission. The congressmen were given the complete tour of facilities and an opportunity to sample Oregon hazelnuts, lingonberry jam, cranberry juice, Bosc pears, red current jelly and other Oregon economically important small fruits.

Specific Cooperative Agreements for which I am the Authorized Departmental Officer Designated Representative:

<u>Collaborator/ Institution</u>	<u>Project Title</u>	<u>Term</u>
Herb Aldwinkle, Cornell Univ., Geneva, NY	Evaluation of <i>Malus</i> Germplasm for Resistance to Fungal Foliar Diseases	05/89-04/92
Pat Breen, Oregon State University Corvallis, OR	Evaluation of Strawberry Germplasm for Resistance to Botrytis Cinerea	05/91-04/92
Susan Brown, Cornell Univ., NYSAES, Geneva, NY	Evaluation of Sweet and Sour Cherry Germplasm for Sources of Resistance to Brown Rot	05/89-04/92
Scott Cameron, Washington St. Univ., Vancouver, WA	Evaluation of Chilean Strawberries for Pest Resistance and Horticultural Traits	06/91-05/93
Amy Iezzoni, Michigan State Univ., East Lansing, MI	Evaluation of Cold Hardiness in a Sour Cherry Germplasm Collection	05/91-04/92

Specific Cooperative Agreements for which I am the Authorized Departmental Officer Designated Representative (Con't.):

<u>Collaborator/ Institution</u>	<u>Project Title</u>	<u>Term</u>
James Luby, Univ. of Minnesota, St. Paul, MI	Evaluation of Asian <i>Vitis</i> Species for Cold Hardiness	05/89-04/92
Paul Lyrene, Univ. of Florida, Gainesville, FL	Evaluation of Native Rabbiteye and Tetraploid High Bush Blueberry Selections from Florida and Georgia	06/91-12/93
Shawn Mehlenbacher Oregon State Univ.	<i>Corylus</i> Germplasm for Climatic Adaptation	06/90-05/93
Harold Pellett, Univ. of Minnesota, St. Paul	Evaluation of <i>Pyrus</i> Species for Tolerance to Environmental Stresses and Aesthetic Qualities	06/91-05/93
Robert Pool, Cornell University, NYSAES, Geneva, NY	Evaluation of Grape Germplasm for Mid-winter Cold Hardiness and Ability to Acclimated Under Northern Growing Conditions	05/89-04/92

COLLABORATIVE RESEARCH BETWEEN USDA-ARS
NATIONAL CLONAL GERMPLASM REPOSITORY
AND OREGON STATE UNIVERSITY

<u>Principle Investigator at NCGR</u>	<u>Principle Investigator at Oregon State University</u>	<u>Title of Project</u>
1. Mr. Bill Doerner	Dr. AliNiازه, Dept. Entomology	Mating Disruption Codling Moth
2. Mr. Bill Doerner	Dr. Glen Fisher, Department Entomology	Integrated Pest Management
3. Dr. Kim Hummer	Dr. Les Fuchigami, Dept. Hort.	Blackberry Cold Hardiness
4. Dr. Kim Hummer	Dr. Aaron Liston, Dept. Botany	Taxonomy of Native Currants and Gooseberries
5. Dr. Kim Hummer	Dr. Lloyd Martin, N. Willamette Expt. Sta.	Strawberry/Raspberry Evaluation
6. Dr. Kim Hummer	Dr. Shawn Mehlenbacher, Dept. Hort.	Cold Hardiness of Filberts
7. Dr. Kim Hummer	Dr. Bob Stebbins, Dept. Hort.	Chilling Requirement of Pears
8. Dr. Kim Hummer	Dr. Bernadine Strik, Dept. Hort.	Cranberry Cold Hardiness
9. Dr. Kim Hummer	Dr. Dave Sugar, S. Ore. Expt. Sta.	Filbert Back-up Collection
10. Mr. Joseph Postman	Dr. Tom Allen, Dept. Botany	Viruses in Mint
11. Mr. Joseph Postman	Dr. Ken Johnson, Dept. Botany/ Dr. Jack Pinkerton, USDA	Diseases in Filberts
12. Mr. Joseph Postman	Dr. Shawn Mehlenbacher, Dept. Hort.	Viruses in Filberts
13. Mr. Joseph Postman	Dr. Shawn Mehlenbacher, Dept. Hort.	Incidence of Apple Mosaic in Imported Filbert Germplasm
14. Dr. Barbara Reed	Dr. Bill Dougherty, Dept. Microbiology	Identification of Bacteria From Mint Cultivars
15. Dr. Barbara Reed	Dr. Machfeld Mok, Dept. Hort.	In vitro (test-tube) culture of Filberts
16. Dr. Barbara Reed	Ms. Gail Nickerson, Dept. Ag. Chemistry	Mint Analysis

Publications

Hummer, K.E. 1989. *Rubus* Germplasm at the National Clonal Germplasm Repository. *Acta Horticulturae* 262:25-27.

Hummer, K.E. 1990. Interstate Restrictions on Movement of *Ribes* Germplasm. *Fruit Varieties J.* 44(4):194-197.

Hummer, K.E. 1990. *Fragaria* at the National Clonal Germplasm Repository at Corvallis. Proceedings of the 3rd Annual North American *Fragaria* Conference. In Press.

Postman, J.D. 1989. Incidence of Viruses in the U.S. National Clonal Germplasm Repository *Ribes* and *Rubus* collections. *Acta Horticulturae* 262:217-222.

Reed, B.M. 1990. Multiplication of *Rubus* Germplasm in vitro: A screen of 256 accessions. *Fruit Varieties Journal* 44(3):141-148.

Reed, B.M. 1990. Survival of in vitro Grown Apical Meristems of *Pyrus* Following Cryopreservation. *HortScience* 25(1):111-113.

Abstracts

Hummer, K.E. 1990. How Curators Obtain Information on Germplasm Held Outside of the National Plant Germplasm System. *HortScience* 25(9):1179.

Hummer, K. 1990. The status of *Pyrus* Germplasm in the U.S. *HortScience* 25:1142.

Hummer, K.E. and D. Gerten. 1990. Bloom and Ripening of *Ribes* in Corvallis, Oregon. *HortScience* 25(9):1109.

Postman, J. and B.M. Reed. 1990. Effect of Elevated CO_2 and Culture Medium on the Survival of in vitro *Rubus* Plants During Thermotherapy. American Phytopathological Society Annual Meeting, August 1990 in Grand Rapids, Michigan.

Reed, B.M. 1990. Cold Storage of in vitro Fruit and Nut Germplasm. VIIth International Congress on Plant Tissue and Cell Culture. Amsterdam. June 24-29.

Reed, B.M. 1990. Cold Hardening vs ABA as a Pretreatment for Meristem cryopreservation. *HortScience* 25(9):1086.