'94

MINUTES OF THE MEETING OF

THE S-9 TECHNICAL ADVISORY COMMITTEE

ON THE INTRODUCTION, MULTIPLICATION, AND EVALUATION

OF NEW PLANTS FOR AGRICULTURAL AND INDUSTRIAL USES

AND THE PRESERVATION OF VALUABLE GERMPLASM

DEPARTMENT OF CROP SCIENCE
NORTH CAROLINA STATE UNIVERSITY
RALEIGH, NORTH CAROLINA

JUNE 15-16, 1994

SUBMITTED BY

DAVID L. COFFEY, SECRETARY
S-9 TECHNICAL ADVISORY COMMITTEE 1994

AGENDA

S-9 Regional Technical Advisory Committee Meeting

June 15-16, 1994

HOST: North Carolina State University, Agricultural Research Service

LOCATION: Williams Hall, NCSU Campus

June 15, 1994

8:00 a.m.	1.	Call to Order
8:10 a.m.	2.	Introduction of Attendees
8:20 a.m.	3.	Official Welcome
8:30 a.m.	4.	Approval of Minutes -- 1993 Meeting
8:40 a.m.	5.	Approval/Additions to Agenda for 1994 Meeting
8:50 a.m.	6.	Appointment of Committees A. Nominations B. Time & Location of Next Meeting C. Resolutions
9:00 a.m.	7.	"Germplasm -- What's It all About", Dr. J. R. Ballington, Plant explorer and breeder: Vaccinium, Rubus, Ribes, Fragaria, etc.
9:30 a.m.	8.	Activities of the U.S. National Genetic Resource Program
10:00 a.m.		**COFFEE BREAK**
10:30 a.m.	9.	Activities of the National Germplasm Resources Laboratory
11:00 a.m.	10.	Activities of the National Seed Storage Laboratory
11:30 a.m.	11.	CSRS Activities on Genetic Resources
12:00 Noon		**LUNCH**

June 15, 1994 (continued)

1:15 p.m.	12.	NCSU Arboretum -- Mr. Tom Foley, Assistant Director, Department of Horticulture
2:55 p.m.	13.	Intensive Grazing Management -- University Farms -- Dr. Joe Burns -- Crop Science, USDA
3:40 p.m.	14.	NCSU Phytotron -- Dr. Judy Thomas, Director, and Dr. R. J. Downs, Director Emeritus
6:30 p.m.		Pig and Chicken Pickin' -- Brickyard -- Williams Hall

June 16, 1994

8:00 a.m. 15. Call to Order

8:10 a.m. 16. Plant Genetic Resources Conservation Unit: Reorganization

- A. Philosophy
- B. Program
  - Service -
    - Curation
    - Detection and Therapy
    - Database
  - Research -
    - Genetics
    - Pathology
- C. Budget
  - Current
  - FY95 request
- D. Personnel
  - Changes
- E. Infrastructure Improvements
  - Westbrook Farm irrigation
  - Local area network
  - -20C storage room
- F. Future Improvements and Contributions

10:00 a.m. **COFFEE BREAK**

June 16, 1994 (continued)

10:30 a.m.	17.	Future Areas for Cooperation and Support

A. S-9 TAC role
B. Opportunities
C. Contributions/Presentations
D. Examples from NE-9 meetings
E. Subcommittees
   Plant exploration

11:30 a.m.	18.	Committee Reports and Acceptance

A. Nominations
B. Time & Location of Next Meeting
C. Resolutions

11:45 a.m.	19.	ADJOURNMENT

1. CALL TO ORDER

The Regional S-9 Technical Advisory Committee (TAC) meeting was called to order at 8:00 a.m. on June 15, 1994 by chairman Bill Branch in McKimmon Room 2223 of Williams Hall of the Crop Science Department of North Carolina State University.

2. INTRODUCTION OF ATTENDEES

Name	Address	Phone & FAX
*William D. Branch	University of Georgia Coastal Plain Experiment Station Tifton, GA 31793-0748	912/386-1728 FAX: 912/386-7293
*David L. Coffey	The University of Tennessee Dept. of Plant & Soil Science P.O. Box 1071 Knoxville, TN 37901-1071	615/974-8829 FAX: 615/974-7997 E-MAIL: PA40098@ UTKVM1.UTK.EDU
Wanda Collins	North Carolina State University Dept. Hort. Science Box 7609 Raleigh, NC 27695-7609	919/515-1205 FAX: 919/515-7747 E-MAIL: Wanda_Collins @NCSU.edu
*Ruben Velez Colon	University of Puerto Rico Fortuna Agric. Exp. Substation HC 02 Box 7115 Juana Diaz, PR 00795	809/837-3905
*Bill Fike	North Carolina State University Crop Science Department Raleigh, NC 27695-7620	919/515-4063
*Jim Kirby	Oklahoma State University Department of Agronomy Stillwater, OK 74078	405/744-9600

Stephen Kresovich	USDA-ARS University of Georgia 1109 Experiment Street Griffin, GA 30223	404/228-7207 E-MAIL: skresov@gaes.griffin.peachnet.edu
*Don R. LaBonte	Louisiana State University Department of Horticulture 131 J.C. Miller Hall Baton Rouge, LA 70803	504/388-1024 FAX: 504/388-1068
*Teddy Morelock	University of Arkansas Department of Horticulture Fayetteville, AR 72701	501/575-2603
*Carlos E. Ortiz	University of Puerto Rico Dept. of Agronomy & Soils Agricultural Exp. Station P.O. Box 21360 Rio Piedras, PR	809/767-9705 FAX: 809/758-5158
*Gordon M. Prine	University of Florida Agronomy Department P.O. Box 110500 Gainesville, FL 32611	904/392-1811 FAX: 904/392-1840
Eric E. Roos	USDA-ARS National Seed Storage Lab Fort Collins, CO	303/495-3205 FAX: 303/221-1427 E-MAIL: eroos@lamar.colostate.edu
Antonio Sotomayor	USDA-ARS Trop. Agr. Res. Sta. Box 70 Mayaquez, PR 00681	809/831-3435 FAX: 809/832-1025
*Francisco Vazquez	USDA-ARS Box 70 Mayaqeuz, PR 00681	809/831-3435 FAX: 809/832-1025

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*Members of the S-9 TAC

3. OFFICIAL WELCOME

Dr. George J. Kriz, Associate Director of the North Carolina Agricultural Research Service along with Dr. David Knauft, Head of the Department of Crop Science of North Carolina State University, welcomed the committee. Dr. Kriz gave a synopsis of the agricultural research program at North Carolina State University and of the agricultural industry in the state, emphasizing that 31% of the labor force in North Carolina is associated with agriculture.

4. APPROVAL OF MINUTES

Minutes of the 1993 S-9 TAC meeting, held in conjunction with the joint Regional (NC-7, NE-9, W-6, and S-9) TAC meeting at the USDA National Seed Storage Laboratory, Colorado State University, Ft. Collins, were approved as previously submitted by the secretary.

5. APPROVAL OF AGENDA

The agenda for the 1994 meeting was circulated and approved after amendment to accommodate plant exploration proposal, discussion, and recommendations.

6. APPOINTMENT OF COMMITTEES

A.) Nominations: Francisco Vazquez (Chairman) and Teddy Morelock

B.) Next Meeting (Time and Place): Jim Kirby (Chairman) and Bill Fike

C.) Resolutions: Don LaBonte (Chairman) and Rueben Velez Colon

D.) Plant Exploration: Gordon Prine (Chairman), Jim Kirby and Steve Kresovich (Ex-Offico)

7. "GERMPLASM -- WHAT'S IT ALL ABOUT", DR. J. R. BALLINGTON, PLANT EXPLORER AND BREEDER: VACCINIUM, RUBUS, RIBES, FRAGARIA, ETC.

The above listed title was very appropriate for the presentation made by Dr. J. R. Ballington of the North Carolina State University Department of Horticulture. Dr. Ballington shared with the committee highlights of several of his domestic and international germplasm explorations. Dr Ballington is a small fruits breeder involved with Vaccinium, Rubus, Ribes and Fragaria. Through a slide presentation he showed photographs of many species of these specific genera and others that he has collected on various plant explorations. He explained excellently how he and other plant breeders are making practical use of this collected germplasm in small fruit breeding programs in the United States and elsewhere. Of special interest were what he referred to as "serendipitous blueberry species" that he had collected in the tropics which may have potential as ornamental and/or floricultural plants. His presentation was very interesting and informative and further illustrates the importance of germplasm collection,

evaluation and preservation. Results of his explorations certainly substantiate the fact that funds expended for plant exploration are good investments. The committee expresses thanks to Bill Fike for getting his university colleague, germplasm user and state cooperator to speak to us.

8. ACTIVITIES OF THE U.S. NATIONAL GENETIC RESOURCE PROGRAM

A national program staff report *(attachment #1)* prepared by Henry L. Shands was presented by Steve Kresovich. One high point of the report is that the budget has been flat for about seven years with no increase for genetic resources.

9. ACTIVITIES OF THE NATIONAL GERMPLASM RESOURCES LABORATORY

A copy of a report of the National Germplasm Resources Laboratory to the Regional Technical Committees on Plant Germplasm prepared by Allan Stoner, George White and others is attached *(attachment #2)*. One note of interest in this report is the announcement that APHIS now charges $19.00 for each Federal Phytosanitary Certificate (FPC) that they issue. The PIO staff regret having to institute these charges and hope that they will not lesson exchanges with foreign colleagues.

10. ACTIVITIES OF THE NATIONAL SEED STORAGE LABORATORY

Eric Roos reported that the new NSSL facility is basically complete and functioning well. He complimented the hard work of Loren Wiesner and his group for physically moving all the NSSL accessions to the new facility. He reported that Steve Eberhart, Director of the NSSL, was consulting with the Indian government in the construction of a gene bank facility for India. He highlighted research problem areas and activities of the seed storage laboratory i.e. seed viability and longevity of storage, strategies to rescue deteriorated seed, digital imaging analysis, apple bud cryopreservation, cryopreservation of shoot tips using vitrification methods. The attached report *(attachment #3)* which he distributed goes into more detail on some if the above listed topics. He also indicated that reprints of publications listed at the end of the report are available upon request.

11. CSRS ACTIVITIES ON GENETIC RESOURCES

An update report of the ESCOP Plant Germplasm Subcommittee from R. L. Lower, Chairman was distributed by Steve Kresovich. Activities of the Plant Germplasm Subcommittee are highlighted in the attached report *(attachment #4)*. Steve Kresovich also reported briefly on some of the activity concerning the review involving Plant Variety Protection Act Amendments.

12. - 14. TOURS

On the afternoon of June 15, the committee visited three points of interest on the NCSU campus. A guided tour of the NCSU Arboretum was conducted by Assistant Director, Mr Tom Foley who pointed out the large number of plant species that are being evaluated in this eight acre facility. Later in the afternoon the committee visited the intensive grazing study plots on the university farm. USDA Crop Science researcher, Dr. Joe Burns, explained the research being conducted. Finally, the committee was guided on a very informative tour of the NCSU Phytotron by Drs. Judy Thomas and R. J. Downs, director and director emeritus, respectively.

15. CALL TO ORDER

The meeting was called to order at 8:10 a.m. on Thursday, June 16, by Chairman Branch.

16. PLANT GENETIC RESOURCES CONSERVATION UNIT: REORGANIZATION

Steve Kresovich spent a large portion of the morning meeting detailing the reorganizational activities that are taking place at the Griffin Unit. He covered in some degree of detail activities, "nuts and bolts" as he referred to it, in the following categories: Philosophy, Program, Budget, Personnel, Infrastructure Improvements, Future Areas for Cooperation and Support. One of the main points emphasized by Steve is that he desires the S-9 TAC to function as an advisory committee for the operations at Griffin. He is very serious that the committee feels comfortable with the operations there and that the representative states are getting their "money's worth" from the activities of the regional project. He desires that our committee assist in establishing priorities for the operation of the program of the station at Griffin. He asked questions such as: How do we fit into the global genetic resources program? How do we establish short term and long term priorities, especially under static funding support? How do we measure quality of selections?

Steve stated that the personnel at Griffin consisted of about 40 individuals. He outlined a breakdown of the professional staff according the responsibilities in curation, research, and support services. Senior personnel and respective responsibilities in some of the major areas are as follows:

Personnel	Accession Areas	Responsibility Areas
Pittman	Peanut	Curation
Jarret	Vegetables	Research/Curation
Lovell	Grasses, Misc.	Curation
Gillaspie	Vigna	Research/Curation
Morris	Other Legumes	Curation
Scott		Field Services
Hopkins		Detection/Therapy
Spinks		Database
Chalkley		Storage
Kresovich	Unit Director	Adm./Research

Steve stressed that priories within each crop are being established in the following categories: acquisition, characterization, evaluation, regeneration, documentation and distribution. Personnel in each of the responsibility areas are being asked to annually evaluate their areas very closely in order to establish appropriate priorities in the various categories. To further implement the operations, he stated that an Operations Manual has been prepared. He also reported that computer networking capabilities are being installed and that all curators are becoming computer literate, especially in GRIN.

In science research, Steve emphasized that identification, relatedness, structure (how variation is partitioned among accessions in a genetic group), location (molecular marker development & technology) are some important areas where activities are in progress or are being planned. He mentioned sweet potato, watermelon, pepper, peanut and sorghum as crops that are being utilized in this type of research.

He stated that 14 acres of the Griffin facility are now under irrigation and this is a major improvement to assist in the regeneration activities. He indicated now that regeneration sites are being investigated near Fresno, CA and the expansion of plant regeneration at Griffin is contingent on what happens in the West. A copy of S-9 Funding Request for FY95 presented by Steve Kresovich in February 1994 to the Southern Association of State Agricultural Experimental Station Directors is also attached *(attachment #5)*.

17. FUTURE AREAS FOR COOPERATION AND SUPPORT

Steve again stressed that he desired the S-9 Committee to serve in an advisory role and solicited committee members' input. To better acquaint the committee with the current operations of the Griffin unit, he suggested that the 1995 meeting be held again there with considerable time being devoted to on-site visitation of the various laboratory and field operations.

Considerable discussion followed concerning the publication and presentation of individual state reports at the annual S-9 Committee meetings. A motion was made by Don LaBonte that representatives from 3-4 states report on work in their respective states at the 1996 meeting and that in subsequent years the same procedure be considered. Motion was seconded by Rueben Velez Colon. Considerable discussion followed with the consensus being (1) that the 1995 meeting be held at Griffin during the week of July 17, and (2) that further consideration of the state report issue be an agenda item for further discussion at the 1995 meeting when a better representation of the S-9 committee members is anticipated. Motion passed with one dissenting vote.

18. COMMITTEE REPORTS AND ACCEPTANCE

A.) Nominating committee nominated Don LaBonte of Louisiana State University as secretary for 1995. David Coffey of the University of Tennessee will become chairman of the 1995 TAC.

B.) By invitation and request from Steve Kresovich, the Time and Place of Next Meeting Committee recommended the 1995 TAC meeting be held at Griffin, GA during the week of July 17.

C.) The following expressions of thanks and resolutions were submitted by the Resolutions Committee:

1. We express our thanks to Dr. Bill Fike and NCSU for hosting our annual meeting. The hospitality extended us made for a most memorable and productive meeting. Bill's efforts were indicative of the his leadership, guidance and involvement over the 35 years he has served on this committee. We all sincerely wish you in the best in retirement, Bill. (Bill, the Pig and Chicken Pickin' Wednesday evening was great - comments from the secretary and chairman).

2. We express our thanks to the USDA-ARS speakers for their presentations and participation in the meeting.

3. We express thanks to NCSU personnel for providing us the insight into the excellent research conducted at NCSU.

4. Let it be resolved to thank Dr. Bill Branch and Dr. David Coffey for their service to the S-9 Technical Advisory Committee as president and secretary, respectively, for the year.

5. Let it be resolved to welcome our new representative from Puerto Rico, Carlos Ortia, to the S-9 Committee.

6. Let it be resolved to congratulate Dr. David Coffey and Dr. Don LaBonte for their selection as new chairman and secretary, respective, for 1995.

D.) The Plant Exploration Sub-committee reviewed two proposals "Plant Exploration to Western Brazil to Collect Arachis Germplasm by Roy Pittman and Charles E. Simpson and "Plant Exploration to Indonesia to Collect Sweet Potato (Ipomea batatas) Germplasm" by Don R. LaBonte and R. L. Jarret. The committee recognized both proposals as having great merit and recommended both for funding, one proposal representing an important agronomic crop and the second proposal representing an important horticultural crop for the Southeastern Region. (These proposals comprise *attachments #6 and #7.*)

19. ADJOURNMENT

The meeting was adjourned at 11:15 a. m.

Attachment #1

National Program Staff Report

June 13, 1994

Henry L. Shands

Budget. The FY 1994 budget had no increase for plant germplasm. The FY 95 budget also calls for no increase. The House Appropriations Committee action appears to have extended the life of two sites maintaining germplasm (Miami, FL and Brownwood, TX) for a year. The Oxford, NC location's closure will also result in the loss of funds for the tobacco genetic resources. Additional costs for germplasm will be incurred in establishing the Mayaguez, PR backup collection and the maintenance of the tobacco collection at Griffin, GA. Senate mark up is scheduled for June/July. The FY 1995 budget process is moving along at a slower than normal rate while the economic package is being debated in Congress. Germplasm funding:

Activity (STP Codes)	FY 1992	FY 1993	FY 1994
Acquisition *2111,2112*	$ 4,510,900	$4,519,400	$4,453,551
Preservation *2113*	12,157,100	11,941,200	12,266,925
SUB-TOTALS:1/	16,668,000	16,460,600	16,720,476
Characterization *2114*	3,740,000	3,698,000	3,782,630
New Crops 2115	134,300	218,700	309,391
Evaluation	--	--	--
Enhancement	5,602,700	--	--
TOTALS:	20,542,300	20,377,300	20,812,497

1/ Funding level most consistent with activities relating to National Genetic Resources Program.

National Genetic Resources Program. The National Genetic Resources Advisory Council for the National Genetic Resources Program (NGRP) met December 15-16, 1993, in Washington under the leadership of Chair Neal Jorgensen and Vice-Chair Don Duvick. The Charter expired 10 March 1994 and it and the appointments of the nominated members and the charter must be reinstated. As of now there is no scheduled second meeting during the current fiscal year due to lack of adequate funding.

At the meeting, the Council passed two resolutions. The first recommended to the Department that a storage category for protected germplasm be established at the National Seed Storage Laboratory in cooperation with the Crop Science Society of America for protected germplasm. This germplasm would not be part of the NPGS until the expiration of the protection at a maximum of 20 years. The second resolution expressed concerns of the Council that the Department was not adequately paying attention to the development of the genetic resources program and recommended moving it from the Department to another Department, if the USDA did not provide more interest and support. There was no effort taken to create coordinating committees for the different life forms. There is still no plant group bringing together Federal, State, and industry leaders to share their knowledge and concerns.

Agricultural Research Institute Conference and Workshop on Plant Genetic Resources. The Agricultural Research Institute (ARI) is planning a Conference and Workshop on Genetic Resources during the week of October 17, 1994, in Washington, DC. Dr. Peter Day has agreed to chair the meeting. It will examine issues tying food

security to genebank security. Issues of access to collections and potential impact on food supply will be addressed. Workgroups will examine the ramifications for the National Genetic Resources Program relative to its priorities. The meeting is "open" and NPGS participation is welcomed and encouraged. A reasonable registration fee will be charged.

Convention on Biological Diversity. A ratification package was sent to the Senate and a hearing held. The Senate's ratification vote has not been taken. An affirmative vote must be taken at least 90 days before the first scheduled meeting of the Conference of Parties in November 1994 for the U.S. to participate as an active member. The U.S. continues to support a narrow renegotiation of the FAO Undertaking to be presented to Convention as a possible protocol on agro-biodiversity associated with food and agriculture. At present it does not look like the renegotiation will be an easy matter. The process will start with an extraordinary meeting of the FAO Commission on Plant Genetic Resources in November, 1994.

FAO Commission on Plant Genetic Resources and the International Technical Conference on PGR. The FAO will sponsor the 4th International Technical Conference on Plant Genetic Resources which Germany will host. Dr. Cary Fowler is the Organizer at FAO. The meetings objective is to present a Global Action Plan for Plant Genetic Resources to a ministerial level conference.

The revised Code of Conduct for Plant Collecting and Transfer was approved by the FAO Conference. It is currently voluntary but in the renegotiation of the FAO Undertaking may make it legally binding. Even now some countries are requesting that collecting trips conform to the Code In that way it will have considerable impact on how plant exploration are conducted. Signatory authority to sign documents is being clarified in ARS. You will not be able to obligate the USDA in any way in respect to conditions established by the country; however, copies of all correspondence relative to the matter must be filed with the Germplasm Resources Laboratory.

National Academy of Science/ Board on Agriculture Reports on Managing Global Genetic Resources. The final report in the series was released in January, 1994. The American Association for the Advancement of Science will not publish the companion report on aquaculture later due to a management decision to terminate the AAAS Press.

Personnel. ARS continues to look for opportunities to fill the position of National Program Leader for Plant Germplasm at Beltsville, Maryland. Contact Henry Shands (301-504-5059) for information. In addition, ARS will be looking for selected personnel in the germplasm system in keeping with needs and available personnel slots.

Attachment #2

REPORT OF THE NATIONAL GERMPLASM RESOURCES LABORATORY TO THE REGIONAL TECHNICAL COMMITTEES ON PLANT GERMPLASM

JUNE 1994

The fate of all forms of life --- depends on the continuity of variation. At the entrance to CERES Laboratory in Canberra (Australia) there is the following inscription: "Cherish the earth, for man will live by it forever." We might have said with equal justification: Cherish variation, for without it, life will perish. - Sir Otto Frankel

Cauliflower is nothing but cabbage with a college education - Mark Twain

LABORATORY LEADER OFFICE **Allan K. Stoner**

The primary role of the National Germplasm Resources Laboratory (NGRL) is to support the mission of the National Plant Germplasm System (NPGS): "To effectively collect, document, preserve, evaluate, enhance, and distribute plant genetic resources for continued improvement in the quality and production of economic crops."
The specifics of our past year's activities are detailed in the individual reports that follow. Like the other NPGS programs, our Laboratory faced many challenges during the year. They included understanding and determining how to cope with global issues relating to germplasm ownership and exchange; adopting the rapidly developing new technologies for indexing quarantined germplasm, electronic databases, etc.; working with germplasm curators and crop advisory committees to rethink policies and practices relative to composition and management of germplasm collections; and coping with fiscal and personnel constraints. Although, we know that these and other challenges will continue to confront us, it is my hope that our programs will lead to the development of improved germplasm collections, the better management of these collections and better responses to requests from the user community for germplasm or information about available germplasm.

PLANT INTRODUCTION OFFICE (PIO) **George A. White and Staff**

Personnel - George White has compiled the Laboratory's reports for the Regional Technical Committees for 22 years (1973-1994). Because of restructuring of laboratory activities and other changes, he will either retire at the end of the fiscal year or be involved in different work. He has enjoyed the association

with the various State and Federal representatives of the four RTCs over the years and wishes you well in continuing activities and in your research and teaching responsibilities. Thank you for your good cooperation with PIO. A profile of George White is to appear in the summer edition of DIVERSITY.

Exchanges - During 1993, the PIO distributed 37,305 items in 1,141 shipments to 93 countries. Of these items, 38% were cereals, 21% vegetables, 16% oilseeds, and 11% forages. Fifteen countries received more than 1,000 accessions each. The PIO coordinated the introduction of 115 white clover (Trifolium repens) cultivars from 24 countries for testing in acid soils of West Virginia. Of the 13,341 foreign introductions in 1993, 5,876 were sorghums. Some of these were "pass throughs" to individual scientists. Recipients of such materials are urged to interact with germplasm collection curators in case some of these materials should be preserved in the NPGS.

The five-year foreign distributions through the PIO flow channel is summarized in Table 1. For the period of January 1 - May 31, 1994, 17,229 items have been sent abroad to 71 countries in 408 shipments.

TABLE 1. PLANT GERMPLASM DISTRIBUTIONS-FOREIGN

Year	Exchange programs	Items	Number of shipments	Countries
1993	Regular	40,548	1148	92
	AID	1,921	91	36
		42,469		
1992	Regular	58,560	1211	88
	AID	2,355	60	26
		60,915		
1991	Regular	26,256	1392	92
	AID	2,397	156	36
		48,653		
1990	Regular	43,350	1358	101
	AID	734	95	35
		44,084		
1989	Regular	27,564	1078	92
	AID	2,978	270	54
		30,542		
Annual average	Regular	43,256	1,237	93
	AID	2,077	134	37
		45,333		

[1]Distributed overseas through the Plant Introduction Office, USDA-ARS, Beltsville.

The following manuscripts are under preparation:

1. Feature article for HortScience entitled International Exchange of Horticultural Crop Germplasm by George A. White.
2. Invited chapter entitled Inventory of Agro-Mass for the book Paper and Composites from Agro-based Resources by George A. White and C. G. Cook (ARS, Weslaco, TX).

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NOTICE

1. APHIS now charges $19.00 for each Federal Phytosanitary Certificate (FPC) that they issue. Non-NPGS sites are welcome to continue to use the Beltsville flow channel; but you will need to enclose a check or money order for $19.00 with the shipment of plant materials. Payment should be made out to APHIS; the For portion should indicate FPC - (country name).
2. PIO will bear the mailing costs of shipments through the Quarantine Center to foreign countries for a maximum of four pounds. You will need to make special arrangements for shipments sent through Beltsville that exceed four pounds.

PIO staff hope that these changes, which we regret having to make, will not lessen your exchanges with foreign colleagues. Please do not bypass the quarantine aspects of plant germplasm exchanges (FPCs for foreign shipments; official quarantine inspection for imported materials).

o o o o o o o o **NOTICE** o o o o o o o o

We estimate that by October 1, 1994 or earlier the USDA Plant Germplasm Quarantine Center at Building 320 will be relocated into new quarters in the Building 580 complex. The address for receiving or sending plant materials overseas will be:

USDA Plant Germplasm Inspection Station
Bldg. 580, BARC-East
Beltsville, MD 20705

NOTICE

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The Prosser WA Station staff have completed the virus-indexing of 'Usuzumi', the 1,400 year-old flowering cherry tree. The people of Neo Village, Japan donated cuttings to the United States as a good will gesture. Plans call for about 50 trees of 'Usuzumi' to be planted in Potomac Park, Washington, D.C. The presence of little cherry virus after the first heat therapy treatment prolonged the quarantine period. Arrangements must now be made to graft 'Usuzumi' on rootstocks and grow trees to an adequate caliper size [reference: George A. White. 1992. Neo Villagers of Japan donate ancient flowering cherry to the United States. DIVERSITY 8(1): 26-27.]

Plant and Seed Materials Project - Through this long-term project funded by AID, larger quantities of selected cultivars and improved lines are provided to lesser developed countries with AID missions. A sharply reduced budget will result in fewer and smaller samples being supplied in Calendar Year 1994. During 1993, PIO staff provided 1,921 accessions in 91 orders to 36 countries. Composition of orders included 37% forages, 16% oilseeds, and 12% vegetables. Highlights of the year included assemblage and shipment of 138 forage crop cultivars for evaluation trials in Latvia, Lithuania, and Estonia; donation of large numbers of garden vegetables and ornamentals to Russia; and Dr. White's travel to Albania. Opportunities for exchanging plant germplasm with Albania now exist and have become a project priority for Calendar Year 1994. A Memorandum of Understanding (MOU) between the Genetics Department, Agricultural University - Tirana, Albania and ARS to store maize germplasm under good storage conditions at NSSL is pending. PIO supplied vegetable seed to Senegal in response to a request from the Peace Corps.

Documentations of PIs - During 1993, 11,752 PI numbers including 3,781 sorghums (2,851 from Sudan) were assigned. The 316 Crop Science registrations represented 31 of the 54 crop groups and break down into categories as follows:

CV - 102	GS - 22
GP - 165	PL - 27

There were 317 PI numbers assigned to Plant Variety Protection (PVP) application items. Becky Norris submitted Plant Inventory No. 202 for publication in April, 1994. Documentation included several collections at NSSL and other sites. Some examples follow:

- Barley and chickpea from Spain
- Corn from Colombia, Mexico, and Peru
- Flax from Canada
- Medicago and safflower from China
- Peanuts from India and Mexico
- Potatoes from Colombia and Ecuador
- Rice from China and Italy
- Secale from Turkey
- Soybeans from Australia and China
- Sweet potato varieties from the U.S.
- Wheat from Bulgaria and Russian Federation.

Dan Harmon added 12,733 PI range records to the GRIN database during 1993 and an additional 7,864 through May, 1994.

PLANT EXPLORATION OFFICE **Calvin R. Sperling**

The Plant Exploration Office (PEO) provided support for 16 domestic and foreign explorations for germplasm acquisition in FY1993 and is supporting 10 explorations in FY1994. All foreign explorations are in cooperation with the host countries. Following an exploration for apples in Kazakhstan in 1993, a reciprocal visit by five scientists from Kazakhstan to NPGS sites

in the U.S. was organized by the Plant Exploration Office. Guidelines for plant explorations for 1995 were revised. A new Global Positioning Unit was purchased so that PEO now owns three GPS units. All participants in NPGS-sponsored plant explorations are urged to borrow these units to obtain exact latitudes and longitudes of germplasm collection sites. PEO delivered several presentations on plant genetic resources to national and international organizations in 1993 and early 1994. Complementary to exploration for acquired germplasm for ex situ conservation, PEO continues to be involved in projects to conserve germplasm in situ. The World Bank Global Environmental Facility project on in situ conservation of wild crop relatives in Turkey is proceeding with Dr. Sperling serving as scientific advisor. In July, 1993, Dr. Sperling conducted a course on crop genetic diversity in Turkey for Turkish researchers who will be involved in the project. The United Nations Development Programme proposal for a farmer-based program to assist the Government of Ethiopia with conserving landraces of cultivated plants has been approved for funding by GEF and will soon become operational. Dr. Sperling will work with UNDP as a resource person. A proposal for in situ conservation of cranberry genetic resources has been presented to a federal inter-departmental committee on native plant conservation. During the past year, Dr. Sperling worked with researchers in Minnesota towards the goal of establishing in situ reserves for wild rice genetic resources.

Dr. Sperling served for two months on a special assignment to the U.S. State Department as a resource person for several U.S. Government biodiversity issues including preparation for ratification of the Convention on Biological Diversity. He also prepared a proposal to the State Department for additional financial aid available under the Freedom Assistance Act for the N.I. Vavilov Institute of Plant Industry (VIR) and the Komarov Botanical Institute. This proposal was accepted and funds will be available in FY1994. Funds for several CRADAs have been provided through the U.S. Department of State to support germplasm conservation activities in the Central Asian Republics of the former Soviet Union.

David Williams has nearly completed work on an ecogeographic survey of Arachis. This study will provide substantial direction to future Arachis germplasm acquisition activities. Dr. Williams travelled to Bolivia and Mexico this year on expeditions to collect Arachis germplasm. Dr. Williams is preparing to expand his activities to include research on additional crops.

USDA/ARS Explorations Undertaken in FY1993

Plant Exploration	Country	Principal Contacts
Taxus sumatrana	Philippines	M. Shemluck, R. Nicholson
Trifolium spp.	Bulgaria	G. Pederson, K. Quesenberry
Trifolium spp.	Reps. of Georgia and Armenia	C. Hoveland
Festuca spp.	Morocco, Spain, France	C. West, D. Sleper
Solanum spp.	Bolivia	D. Spooner, A. Cardozo
Glycine spp.	Australia	T. Hymowitz, A. Brown
Forage grasses and legumes	PRC	M. Rumbaugh, D. Johnson
Oilseed crops and ornamentals	Mexico	W. Roath, M. Widrlechner
Malus spp.	Kazakhstan, Kyrgyzstan	P. Forsline, G. Mink, E. Dickson
Solanum spp.	Mexico	A. Rodriguez
Cucumis spp.	India	J. McCreight, J. Staub, N. Koppar,U. Srivastava
Oilseed crops	USA	A. Thompson, D. Dierig, J. Rebman
Arachis spp.	Mexico	D. Williams
Poeae and Aveneae grasses	Turkey	J. Davis, R. Soreng
Gossypium spp.	Australia	J. Stewart, J. Wendel, L. Craven, C. Brubaker
Woody ornamentals	PRC	L. Lee, P. Meyer, P. Bristol, T. Dudley

USDA/ARS Plant Explorations Planned/Undertaken in FY 1994

Plant Exploration	Country	Principal Contacts
Ipomoea spp.	Papua New Guinea	D. La Bonte, J. Martineau, R. Jarret
Grasses and legumes	Mongolia	D. Johnson, D. Sheehy
Forage grasses and legumes	Tunisia, Algeria, Morocco	W. Graves, P. Cunningham
Arachis spp.	Bolivia	D. Williams, C. Simpson, I. Vargas
Oilseed crops	USA	A. Thompson, D. Dierig
Solanum spp.	Bolivia	D. Spooner, G. Aguirre, A. Devaux
Trifolium spp.	USA	N. Taylor, K. Quesenberry
Helianthus spp.	Canada	G. Seiler
Beta spp.	India	L. Panella
Juglans spp.	Kyrgyzstan	M. Thompson

GERMPLASM RESOURCES INFORMATION NETWORK (GRIN) **Jimmie Mowder**

The Database Management Unit continues to progress with the development of the next generation of the GRIN system. A GRIN prototype system was presented to site personnel for review in June 1993 resulting in database structure changes to incorporate site personnel recommendations. The new system will replace the existing GRIN system in August 1994. We continue to provide assistance to site and public users storing and accessing genetic resource data.

DBMU personnel took ten personal computer systems to VIR, St. Petersburg, Russian Federation, in March 1993. After the computers were installed, VIR scientists were provided training in the use of the personal computers and the software. Presentations on GRIN were given at the dedication of the National Plant Genetic Resources Center (NPGRC) in Wu-feng, Taichung, Taiwan, and a jointly organized symposium by IAALD, CTA, and ZADI on New Information Technologies in Agriculture, Bonn, Germany. Demonstrations on GRIN were given to the American Society for Horticultural Science, the Agronomy Society of America, and to several foreign visitors. A microbial germplasm database design was reviewed by one of the curators. Initial programming began on the microbial section of GRIN in October and is nearing completion. We assisted in the selection of a computer specialist for APHIS who is responsible for developing the insect section of the GRIN system. We also participated in the Biological Needs and Resources Workshop sponsored by APHIS and ARS to determine the future direction for the insect database. The animal germplasm database continues with data gathering and system analysis.

MOLECULAR APPROACHES FOR DETECTION AND CONTROL OF VIRUSES AND VIROIDS IN FRUIT CROP GERMPLASM **A. Hadidi**

Rapid, accurate, and sensitive methods, based on polymerase chain reaction technologies have been developed for the detection of peach latent mosaic viroid from infected peach and grapevine viruses A, B, and leafroll III from infected grapevine tissue and viruliferous vector. The complete nucleotide sequences of peach latent mosaic viroid and the closely related dapple apple and pear rusty skin viroids have been determined. A rapid and simple method for preparing plant tissues infected with viruses, viroids, or MLOs using a commercial product now as Gene Releaser™ has been developed in our laboratory. The Gene Releaser™ polymeric matrix method produced plant extracts suitable for polymerase chain reaction amplification without the use of organic solvents, ethanol precipitation or additional nucleic acid purification techniques. Plum pox potyvirus (PPV) and a new potyvirus, named prunus latent virus (PLV) have been detected for the first time in stone fruit germplasm from East Asia. We have developed an accurate method for PPV

identification and its differentiation from PLV. This method is based on polymerase chain reaction technology and utilizes primers specific for the 3' non coding region of PPV RNA. By using this methology, we have identified and confirmed the infection of sour cherry trees from Moldova with PPV. It has been thought among European virologists that cherry trees are immune to infection by this virus. The results of research will be used by plant pathologists and plant quarantine officials responsible for keeping foreign plant diseases from entering the U.S.

PLANT GERMPLASM QUARANTINE OFFICE (PGQO), B 580 & GLENN DALE
Rice, tissue culture, etc. Bruce Parliman

In 1993, 434 rice accessions were quarantined processed, released and shipped to recipients. Of the 360 accessions currently in the active rice quarantine inventory, only 125 remain to be processed and these should be finished by December of 1994. There is no backlog for quarantined rice processing. New accessions are expected for 1994 and 1995. Quarantine Laboratory staff, rice pathologists from a number of states, and APHIS staff are currently involved in reviewing and streamlining the rice quarantine processing protocol. Meristem therapy has been attempted on 57 of 63 virus infected sweetpotato accessions currently secured in tissue culture. Meristem derived subclones have been produced from 42 of the 57 accessions. For the 1994 summer testing season, 61 meristem derived subclones are ready for acclimation to the greenhouse and first year testing. Meristem therapy is being initiated currently on 20 accessions. For this work, meristems will be taken from in vitro grown shoots and will be placed on media modified from that used in 1993.

Eight Manihot accessions arrived in tissue culture in 1993 and have been secured in vitro. The manihot indicator clone and 1 to 3 subclones of each of 3 virus positive control clones have been secured in tissue culture. In the 1994 winter season, indexing was conducted using in vitro propagated plant materials. The Manihot indexing program using in vitro derived accessions, indicators, and positive controls, is efficient and saves greenhouse space.

A total of 212 accessions of Solanum are being preserved in quarantine in tissue culture: 80 are virus negative to date, 9 are virus free and in the process of being sent to recipients, 65 are virus positive and in therapy or have completed therapy, and 58 are virus positive and are waiting for therapy. Thirty eight therapy derived subclones from 30 accessions have been acclimated to the greenhouse for re-indexing. Five additional accessions are being prepared for tissue culture.

Virus indexing - Ipomoea, Malus, Pyrus, Saccharum, Solanum
Suzanne Hurtt

Acquisitions: Request for new introductions of sugarcane and potato accession remained high for the period from June, 1993 to June, 1994. Potatoes were received as true seed (TPS) and clonal propagations, either in tuber or tissue culture form. The number of TPS received was 117; the number of clonal introductions was 104. The sugarcane unit processes germplasm that is exchanged among the states as well as foreign introductions. During this reporting period, 19 foreign introductions and 157 domestic lines were sent to our unit. Sweetpotato acquisitions were down this period, totalling only 5 new imports for the year. Pome imports were also fewer than normal and totalled 14.

Releases and Distributions: Formal release and distribution of germplasm from quarantine were the greatest for sugarcane and potatoes. Sugarcane shipments totalled 246 units. A unit is defined as a quantity of cane pieces sent to an individual in quantities sufficient to establish 2-3 plants. For potatoes, 60 introductions of clonal material and 62 lots of TPS were released and distributed. Seven sweet potatoes were released and distributed. No releases of pome fruits were made this period. However, the heat therapy and retesting process continued to progress well and numerous releases are anticipated this fall.

Therapy and Retesting: The number of heat-treated pome introductions is not over 100 with an average of 4-5 heat treated progeny for each accessions. The heat treated propagations are eligible for provisional release after two years of negative results in the greenhouse testing. Final release is dependent on completion of all field tests which still require 3-5 years to complete.

A number of potato and sweet potatoes began retesting this year after undergoing therapeutic treatments for virus infections. Fifteen treated sweet potatoes were tested and twelve had negative tests for pathogens during July/August, 1993. If tests results are negative this summer, these will be released in September, 1994. An additional 30 treated sweet potatoes have entered retesting during the spring, 1994. Likewise, about 20 potatoes entered the retesting program during the winter 1993/1994. Three continued to harbor one or more viruses. The negative accessions will be retested in the fall of 1994 and released if tests are again negative.

Research: Research was conducted to improving the efficiency and speed needed to detect and diagnose pathogens. A rapid, nonradioactive assay for the detection of apple scar skin viroid was developed. A new protocol that integrates biological and molecular assays for reliable detection of this group of viroids was developed. The process utilizes plants to bioamplify the viroid titer and tissue blot hybridization with a digoxigenin-labeled cRNA probe to detect the viroid. Research was also conducted to evaluate seed transmission of apple scar skin viroid

in oriental pears. No seed transmission was detected. This research is important because the viroid is present in the fruit of apple and pear. However, present quarantine regulations allow pome seed to enter the country without pathogen testing.

A molecular probe was developed in cooperation with Dr. Robert Owens, USDA, Beltsville, MD for detection of pear blister canker viroid. Use of this nonradioactive probe to rapidly detect the viroid via tissue blots is in progress.

Three new indicator hosts for improved detection of apple stem grooving virus were evaluated as part of a cooperative project with IR-2/NRSP5. All three indicators gave improved detection as compared to Virginia crab apple, the currently used greenhouse assay host. ASGV is the most difficult of the common pome viruses to detect and the most difficult to eliminate by heat therapy.

Research on sweetpotato viruses showed that a graft transmissible pathogen causes leaf cupping symptoms in the indicator Ipomoea setosa. The pathogen also reacted with a cDNA probe for geminiviruses. This research will continue in cooperation with Dr. Ernest Hiebert, University of Florida, Gainesville, FL.

Virus Indexing - Prunus, grasses, small fruits, others
Howard Waterworth

A fairly large number of accessions of these prohibited-category genera continued to come into the quarantine program for virus testing. For the period May 93 through April 94, 102 items of Prunus, 101 of grasses and 30 accessions of other genera were received. During the same period we shipped 805 (accessions x recipients) items of stone fruit germplasm to some 24 U.S. breeders/collectors, 135 items of grass germplasm, 16 Ribes, 4 mangoes, and 7 woody ornamentals. Viruses were detected in 12 accessions of Prunus including the plum pox virus in one accession; and in 3 grass accessions, 3 currants, and 2 raspberries.

Inventories include approx. 500 accessions of Prunus (including 150 items released from quarantine, but which will be offered again this summer), 134 grasses, 135 currants, 21 Rubus and Morus, 4 elms, and 8 miscellaneous items.

Research objectives continued to focus on better ways (faster, more reliable, cheaper) to detect some of the more insidious viruses, viroids, MLOs and other infectious agents for which APHIS requires testing. To this end the PCR method was evaluated as a more sensitive means to detect the prune dwarf virus. A faster and more reliable method to detect plum line pattern virus was developed in cooperation with Agdia Corp. by ELISA testing. Twenty more Prunus species were evaluated for sensitivity to

hard-to-detect stone fruit pathogens among them peach latent mosaic viroid, peach wart agent, little cherry virus, and green ring mottle agent. Current tests for these, and many other pathogens, require long testing periods or give unreliable results. Attempts were also made to isolate several viruses in herbaceous plants, specifically exotic genera of Nicotiana, from which the viruses can be manipulated and rapid tests developed. Tests are also underway to develop a faster test for the currant reversion pathogen which now requires a 3-year test.

Another objective was to determine whether the peach latent mosaic virus is present in imported stone fruit germplasm. In a cooperative project some 60 accessions were tested via the PCR method and, indeed, a positive result was obtained with 30% of the accessions. We are now looking for a biological test to confirm these results.

There are dozens of named virus-like diseases of stone fruits not known to occur in the U. S. for which APHIS requires our conducting tests. The question is whether the pathogens, or only the names of the diseases, are different from domestic diseases. In a cooperative project we obtained cultures of 11 foreign diseases and are now comparing their pathogens with 11 domestic viruses on some 9 standard stone fruit virus woody indicators. Although many have incited symptoms in some of the indicators it will be a year or more before any conclusions can be drawn.

A year ago we reported on a 'new' poty-like virus that was discovered in Canada in stone fruit germplasm. One of the many questions was whether this virus would cause any significant disease in commercially-grown varieties of plums, peaches, or apricots. To this end we inoculated a year ago 3 widely grown varieties of each fruit type. So far no disease has been observed.

TROPICAL BIODIVERSITY **James A. Duke**
Stephen M. Beckstrom-Sternberg and Judith L. duCellier

We are developing a cooperative agreement with the Missouri Botanical Garden, whereby our post-doc Dr. Beckstrom-Sternberg can continue working with us, moving our databases to a CD-ROM.

We were pleased that two of our books on Alternative Crops finally come out. Both relate to our program for selecting alternative crops for the Latin American crop coca, source of cocaine. Duke and duCellier's Book, several years in the making, has been presented to the Ambassador from Peru to the US, Mr. Luna. A special Indonesian edition of the Duke and DuCellier Book has been requested following Duke's trip to Indonesia. The Duke and Vasquez Amazonian Ethnobotanical Dictionary resulted from collaborative work with the Peruvian Botanist, Rodolfo Vasquez. It enumerates most of the endemic lowland Peruvian

plants with economic potential. This culminates several unofficial trips to Amazonian Peru, begun in 1991. Some of these species will be appraised for their potential as alternative crops. At the request of the Vice President's office, this Dictionary, and three other of Duke's books on medicinal plants, were provided to Mr. Gore. The Alternative Crop Program may be expanded to Hawaii, where sugarcane is now in decline as an economic venture. Cooperating with Dan Kugler's Office (CSRS), Duke and Beckstrom-Sternberg are obtaining climatic data from various areas in Hawaii. With the publication of the Amazonian book, Duke and Vasquez (Mo. Bot. Garden) have been encouraged to move on to an Andean Ethnobotanical Dictionary.

Duke and Beckstrom-Sternberg continue updating the published natural product databases (Duke 1992a, b) which are now fully interactive. Duke added several thousand new entries for aromatic mints being considered as alternative crops. Beckstrom-Sternberg updated the coca bibliography, and expanded our climatic and ecological files, making them interactive with other databases even the Sigma Chemical Price Catalog. The databases can now be queried to ask which of some three thousand species have the greatest number of bactericidal, fungicidal, candicidal, molluscicdal, nematicidal, piscicidal, tumoricidal, and/or viricidal activities. Further, when two or more compounds are proved to be synergistic in these activities, the database can be queried to find out which species are best endowed with both chemicals.

Preliminary results on genistein screening indicated that groundnut (Apios) and Peruvian lupines (Lupinus) may be as good as or better than soybean as a source of the antiangiogenic compound genistein. A second round of samples have been sent to Dr. Peter Kaufman at Michigan for further analyses, comparing seeds and sprouted seed.

CROP ADVISORY COMMITTEE **Mark Bohning**

The NPGS is supported by 40 Crop Advisory Committees which provide crop specific advice on plant genetic resources. The CACs are involved in numerous activities including:

1. compiling lists of germplasm sources, both within the U.S. and worldwide (cultivated and wild material);
2. identifying gaps in U.S. collections and developing proposals to fill these gaps either through exchange or exploration;
3. assisting crop curators in identifying duplication within collections;
4. prioritizing traits for evaluation and developing proposals to carry out the evaluations;
5. assisting the GRIN Database Management Unit (DBMU) and crop curators to ensure that standardized and useful information is entered into the GRIN database; and
6. preparing reports on the status of their respective crops for

the ARS National Program Staff, state university administrators and other key individuals involved with the National Plant Germplasm System (NPGS).

One activity which has received a great deal of attention from the CACs over the last few years is the development of core collections which is hoped will assist curators in their management activities and provide a focal point for future evaluations. The committees have worked with the crop curators and other NPGS personnel to identify accessions which should be included in the core. Allan Stoner and Mark Bohning of the NGRL continue to serve as a link between the CACs and other components of the NPGS along with facilitating their activities. A fifth biannual meeting of the CAC Chairs is scheduled for June 28 and 29, 1994. During the meeting several issues pertaining to plant genetic resources will be discussed including international activities, intellectual property rights, core collections, quarantine issues and molecular characterization.

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Attachment #3

June 7, 1994

SUBJECT: NSSL 1993 Progress Report

TO: Regional Technical Advisory Committees on Plant Germplasm

FROM: National Seed Storage Laboratory
Steve A. Eberhart, Director
Eric E. Roos, Research Leader
Loren E. Wiesner, Research Leader

With the fourfold increase in vault space of the expanded facility, curators of all crops were encouraged to send duplicate samples to NSSL of all accessions not yet duplicated even if only small quantities were available. The systems and equipment in the new facility are operating as designed after only a minimum of modification and adjustment.

More than 150 participants attended the Joint Meetings of the Regional Technical Advisory Committees, a Research Workshop on Plant Germplasm, and the PGOC at NSSL, June 28 to July 1, 1993. These meetings provided a good exchange of information and technologies.

NSSL continued to participate in the USAID funded training and orientation of genetic resource scientists from India.

SEED VIABILITY AND STORAGE UNIT

LOREN E. WIESNER

The Seed Quality and Evaluation group conducted 17,432 quality evaluation tests. A total of 10,963 samples were placed into storage; 2,571 into cryostorage and 8,392 into conventional storage. During the last 11 months we received 15,980 new samples including 323 from the Plant Variety Protection office, 11 endangered species from Botanical gardens, 3,402 from plant quarantine, 6,228 from Regional Plant Introduction Stations, 236 from Crop Science registration and the remaining 763 from Plant Breeders, and other individuals and organizations.

A total of 5,467 accessions were distributed to 81 Scientists in 18 different countries. A total of 2,978 sorghum accessions were packaged, washed and sent to St. Croix for increase under quarantine.

Germination tests were completed by the Colorado Seed testing Laboratory under the terms of a Specific Cooperative Agreement (SCA). Most of the samples tested were NSSL retests and initial germination tests on maize accessions received from the maize regeneration project. The viability test results were entered in GRIN. These test results will be used to determine when samples of accessions should be regenerated.

New smaller, light-weight plastic trays were procured, and all samples were transferred and consolidated. New location codes were then assigned and

entered in GRIN. The bar codes and special computer programs written by NSSL staff accelerated this project and insured accurate assignment of the new location codes.

The second year of routine cryopreservation of apple buds has been completed. This is a cooperative project with the Plant Germplasm Preservation Research Unit of NSSL and the Geneva Plant Genetics Resources Unit. An additional 150 accessions were placed in storage in 1993. This cooperative effort will be continued with the Plant Genetics Resources Unit taking the lead in the preparation of samples and drying and the NSSL placing the samples in cryostorage.

A cooperative research project on the development of germination procedures for *Penstemon pendlandii* was initiated. Seed of this endangered species was collected and seed viability studies were conducted using various dormancy breaking treatments such as seed coat clipping, GA3, prechill and hydrogen peroxide. The seed coat clipping treatment gave germination percentages equal to seed viability as determined by tetrazolium.

Morphological characteristics of duplicate pea accessions are being compared with laboratory tests evaluating total seed proteins using SDS-PAGE and peroxidase isozyme analysis using PAGE. The greenhouse study identified 15 cultivars with different morphological traits. None of the laboratory tests conducted were able to separate these accessions according to the morphological traits. We are now using RAPDs to evaluate these pea accessions.

Survival of cryopreserved buds from cold tender dormant apple cultivars increased when buds were exposed to molar concentrations of sucrose. Preliminary studies on cryopreserving two cultivars of cold tender *vinifera* grapes were successful when using techniques employed from previous work on cryoprotectants and from the strawberry leaf disk model system. This research was conducted through a SCA by Dr. C. Stushnoff.

A SCA project with CIMMYT was continued to regenerate, characterize and preserve maize and other germplasm which is stored in national genebanks throughout Latin America, but is in danger of being lost because there is no backup in long-term storage. Present effort is in regenerating the various maize race collections which are stored in the national genebanks in the Latin American countries. Shipments of regenerated collections have been received from Mexico (890), Colombia (162), and Peru (100) and are stored at the National Seed Storage Laboratory and at CIMMYT. An inventory of maize landrace accessions includes 20,019 in Latin America in addition to 10,634 in CIMMYT for a total of 30,653. This inventory and passport information has been put on a CD ROM and is available to scientists. We have received our final shipment of rye accessions from Poland which included 39 accessions for storage at NSSL and the National Small Grains Collection.

PLANT GERMPLASM PRESERVATION RESEARCH UNIT

SEED LONGEVITY STUDIES

ERIC E. ROOS: (Supvry Plant Physiol); Don Davidson (Biolcl Sci Tech); James Young (ARS collaborator, Reno, NV); Jian Fang (Grad Student, China); Edward Towers (Student)

PROBLEM: Long-term preservation of plant genetic diversity using the most cost-effective means will usually involve storage of seeds under optimum conditions. Although we generally know that this is best accomplished by cold, dry storage, we are unable to predict, reliably, how long seeds will remain viable under these conditions. Nor do we know how different species will store, or how seed lots within a species will behave. At present, predictions of seed longevity rely on extrapolation of data, using the "seed viability equation" developed by researchers in the United Kingdom. This equation predicts how long seeds will store at a given temperature and seed moisture content. In general, the equation functions best under conditions of limited temperatures (0 to 40C) and moisture contents (5 to 20%). Unfortunately, determination of the various constants in the equation has been done using extreme conditions of high temperature and/or high seed moisture content and extrapolation to very low temperatures has not been warranted. We have recently developed an alternative approach (see report by C.W. Vertucci). The problem then is to acquire longevity data on seeds stored at known temperatures and seed moisture contents for a wide variety of species and seed lot accessions in order to validate these theoretical approaches.

APPROACH: Seed longevity data are acquired from several sources including experiments initiated by previous scientists at NSSL or elsewhere. Materials available to us for study include a large collection of forage seeds from the Rincker study on forage legume and grass seed, various vegetable seed lots from earlier work by James and Bass, and seeds of several desert species from the Went longevity study. Also, seed lots which have been in storage at NSSL since the early 1960's are available for viability assessment. Seed moisture contents are determined along with the germination level. Seedling vigor may also be assessed. Seed lots having very low viability levels are targeted for seed rescue attempts (see report by S.A. Blackman).

RESULTS: True seed of potato, received in the 1960's, were tested for germination and seed moisture content. These lots had been replaced with fresh seed in the long-term storage inventory of NSSL and thus were available for research studies on longevity. Initial viability for the 162 lots (tested in 1968) averaged 84% and declined to 80% and 59%, respectively in 1978 and 1983 (148 lots tested); and 55% in 1993 (162 lots tested). Seed moisture content for these lots ranged from 4.1 to 8.1% with an average of 5.6%. Overall, these data would appear to represent a typical deterioration curve, with seed lots gradually losing viability over time. However, the real concern comes from a closer examination of individual seed lots. Of the 162 lots, germination (measured as percent normal seedlings) in 1993 was zero for 15 lots. This means that these lots would be lost as a source of germplasm for plant breeders, if they had not

been regenerated and fresh seed produced. Other seed lots germinated above 90%, indicating that in the 25 years of storage, essentially no deterioration had occurred. Furthermore, examining those lots which had zero germination in 1993, we found that the germination in 1968 for these lots ranged from 47 to 91%.

INTERPRETATION: The above results with potato are typical examples of storage samples deteriorating over time and this trend has been seen with other crops, as well. Although we can usually predict that seeds having low germination initially will not retain viability during prolonged storage, we cannot predict that other seed lots having high initial germination will survive prolonged storage. Previous studies have indicated that different species might be classified as having "good" and "poor" storage characteristics and our previous results have confirmed this characteristic at the species level. However, the present studies reinforce the maxim that it is very difficult to predict the storability of an **individual** seed lot, based only on initial germination value. Additional research incorporating vigor tests may lead to better predictions of storability. We have proposed setting up a routine vigor test for samples received from the Regional Stations as they are regrown. Such tests may give an "early warning" of eminent deterioration.

STRATEGIES FOR RESCUE OF DETERIORATED CORN SEEDS

SHEILA A. BLACKMAN: (Res Assoc, Plant Physiol); E.E. Roos; Margaret Rittner (Student)

PROBLEM: Seed storage banks such as the National Seed Storage Laboratory frequently receive seed of very low quality. This may represent valuable germplasm that is in danger of being lost. The general objective of the present work is to design strategies for retrieving germplasm from such low viability seed.

APPROACH: Our overall objective can be divided into two "sub-objectives": 1) To obtain plants by culture of embryos isolated from deteriorated seed; 2) To understand the underlying physiological and biochemical reasons for the failure of deteriorated seed to germinate. We are focussing our initial efforts on corn.

1) Obtaining plants by tissue culture of isolated embryos. The following factors are being investigated for their effects on corn embryo growth during culture: a) seed pretreatment; b) surface sterilization and antibiotics; c) nutrient supplementation; d) hormonal supplementation. Deteriorated and non-deteriorated seeds are given the prescribed treatment, then growth of the axis is measured.

2) Understanding the physiological and biochemical reasons for deterioration. This objective is aimed at identifying important early physiological and biochemical processes in germination, to determine the effects of suboptimal storage on those processes and to determine means of artificially promoting those processes in deteriorated seed. We are focussing efforts on respiratory pathways because they are critical for producing the energy, reducing equivalents, and carbon skeletons necessary

for biosynthesis and germination. Carbon dioxide and ethanol evolution and oxygen uptake during early germination are monitored by infrared gas analysis, gas chromatography and oxygen electrode.

RESULTS: 1) Embryo culture. Corn seeds are partially imbibed to 60% embryo water (dry wt. basis) prior to embryo dissection. The dissected embryos are disinfected in 10% bleach and cultured on media containing a fungicide (thiram) and antibiotic (kanamycin). Embryo growth is stimulated by sucrose, normally provided by the endosperm in the intact seed. The whole embryos apparently contain adequate quantities of other nutrients because the addition of these nutrients does not stimulate embryo growth as sucrose does. Of the hormones, only gibberellic acid (GA) enhances radicle growth of isolated aged embryos. Our evidence suggests that the effect of GA reflects a deterioration-related deficiency, possibly in the capacity of embryonic axes to take up nutrients. After visible germination is achieved, embryos are transferred to a complete medium for seedling establishment. Then, they are planted in vermiculite, watered with a nutrient solution, and transferred to soil in the greenhouse. The National Seed Storage Laboratory is currently using these methods to save 60 lines of Argentinean corn that have very low field germination and seed numbers. The germination protocols have proven largely successful although seed lots differ in their response to these techniques. Between 2 and 15-fold higher germination rates are achieved when compared with germination rates of whole seeds in rolled paper towels.

2) Physiology and biochemistry of germination in deteriorated seed. Our results indicated that-non-deteriorated embryos rely on both oxygen-dependent and oxygen-independent pathways for their biosynthetic and energetic requirements and are capable of responding quickly to anaerobiosis by increasing activity of alcoholic fermentation. Deteriorated embryos have lower rates of both-oxygen-dependent and oxygen-independent carbon oxidation and they cannot respond to anaerobiosis by increasing fermentation rates as do non-deteriorated embryos. Our data thus suggest that glycolytic capacity, which is critical to embryo germination, is low in aged seeds.

IMPLICATIONS: Although we strive to maintain our seed genetic resources in long-term storage, it is very apparent that much germplasm is in danger of being lost through neglect of one form or another. It may be simply that the financial resources are not available to regenerate stocks when needed. Rescue of this material at the whole seed, embryo, cell or DNA level will allow the potential to save valuable genes before they are lost forever. To date, we have shown that at least some material can be rescued if the proper precautions are taken during the seed germination stage.

EVALUATION OF SEED GERMPLASM USING DIGITAL IMAGE ANALYSIS AND CRYOPRESERVATION OF PLANT GENETIC RESOURCES

PHILLIP C. STANWOOD: (Res Agron); M. Scott Howarth (Res Assoc, Agric Eng); Lana Wheeler (Biolcl Sci Tech); Rich Hannan and Walter Kaiser (Collaborators, Pullman, Wash); Chad Lewis, Doug Weber (Students)

PROBLEM: The conservation of plant germplasm requires an understanding of physiological deterioration, methods to measure viability, and techniques to counter deterioration. Application of this information results in improved maintenance of genetic materials by: 1) reducing the frequency at which a sample has to be tested and/or regenerated; 2) reducing maintenance costs both for equipment operation and support personnel; 3) providing greater physical protection of the specimen; and 4) providing a method of preservation for materials that are not or cannot now be routinely stored.

APPROACH: Current research is directed at: 1) development and understanding of cryopreservation of seeds and pollen using liquid nitrogen as a storage medium; and 2) the use of computer digital analysis to measure vigor of seed germplasm and to develop the concept of an "electronic seed (plant) herbarium".

RESULTS: A robotic system based on computer image analysis was built to simultaneously conduct 50 seedling root growth vigor tests. Several species have been successfully grown on the slant board including lettuce, onion and sorghum seed. The SGRobot is housed in a controlled environmental chamber with the slant boards slewing continuously, providing on the average, the same micro-environment to each slant board. This has reduced experimental error and allowed us to use fewer seeds per test, reducing labor and material costs and seed germplasm loss. We are in the final stages of algorithm development that provides evaluation of root growth.

A seed image database project was started in conjunction with the Plant Germplasm Regional Station in Pullman, Washington and the ARS-GRIN project in Beltsville, Maryland. The core subset of chickpea (505 accessions) is being used as the first test species. A system has been developed to obtain appropriate seed images with color and measure standards and convert these images into CD-Rom digital format. These images along with passport data, accession evaluation data, literature references, disease reaction images and images of field grown material are being collated into an object oriented database that will eventually be published on CD-Rom.

Table 1 illustrates the response of seeds stored for extended periods (10y) at various temperatures. At 5C, reduction of seed germination and root growth (vigor) is observed, while at -18C only root growth (vigor) reduction is observed. Germination and root growth for samples held at -196C remain vigorous. These results are an early indication of seed deterioration at the warmer temperatures. More time, possibly another 10-15 years of storage is needed to more clearly identify these trends on a species by species basis.

Table 1. Lettuce Seed Germination and Root Growth After 10y Storage at +5, -18 and -196C.

	+5C Storage		-18C Storage		-196C Storage	
Cultivar	Germ %	Root mm	Germ %	Room mm	Germ %	Root mm
All Year Round	87	12.0	95	13.1	97	15.9
Bib	91	9.4	96	14.4	97	15.3
Avg. (14 lines)	67	2.8	86	5.7	86	6.6

INTERPRETATION: Cryopreservation of seed germplasm using liquid nitrogen offers the opportunity to enhance the longevity and quality of stored seed materials. This technique can also improve the reliability of the storage system and reduce overall expenditures, depending on the application and seed material. Cryopreservation also offers the opportunity to preserve those materials that cannot now be routinely preserved, namely recalcitrant (desiccation-sensitive) seeds and pollen.

Computer digital analysis of biological materials is an emerging field that has significant potential for the characterization and evaluation of plant genetic resources. The primary project objective is to characterize seed deterioration using computer digital analysis of seedling growth. Resulting information is then related to seed longevity and physiological process leading to deterioration. A second imaging objective is to develop a digital image system to collect and evaluate morphological characteristics of seed germplasm diversity within a species.

CRYOPRESERVATION OF APPLE GENETIC RESOURCES

LEIGH E. TOWILL: (Plant Physiol); John Waddell, Genevieve Valdez (Biolcl Sci Tech); Phillip Forsline (Collaborator, Geneva, NY); Carla Zanella (Grad Student); Tammi Cooper, Dave Huber, Nina Pokriots, Tara Towers (Students)

PROBLEM: Long-term preservation of clonal stocks is needed to avoid potential loss of germplasm. Because of success with the apple bud cryopreservation pilot project, apple (Malus spp.) is now the first clonal species to be routinely placed into cryogenic storage. But the method used needs to be improved. Specific problems are: 1) How does the cryogenic protocol apply to diversity within the collection? (Previously we emphasized cold hardy lines.); 2) How can the procedure be modified to be more efficient and effective?; and 3) What alternatives can be used with particularly cold-tender lines?

APPROACH: 1) Ninety-nine lines were examined in winter-spring of 1993 using a procedure previously shown as generally effective. The oxidative browning test and the grafting (budding) test (Geneva NY) were used to assess survival. 2) The general procedure as used is time-consuming and contains some steps for which optima were not determined. As an initial test, twig moisture content, holding time at -30C, cooling rate between -30C and -196C, and warming rates were examined for tender and hardy lines. 3) Two procedures are viable alternatives to the dormant bud technique: a. use of in vitro plants with vitrification or two step cooling techniques and b. use of dormant buds but retrieve plants after freezing with 'tissue culture' techniques.

RESULTS: 1) Seventy-seven of the 99 lines had survivals greater or equal to 20% using the standard method. The 99 lines (fire-blight sensitive lines were selected because of their susceptibility to loss) represent a range of cold-hardiness potential; results are encouraging but reaffirm that modifications are needed. 2) Drying of twig sections to about 30% moisture is laborious and inexact in the sense that the bud and bark moisture levels varied considerably in twigs with similar moisture content. The question is now if we can better control the bud/bark moisture contents. Cooling rate between -30C and -196C did not greatly influence survival, although there was considerable variability. Faster warming rates gave slightly higher viability. Moisture content and survival is being retested in 1994. 3) We investigated the use of in vitro plants and cryopreservation using vitrification techniques. Two cold-tender lines survived in high percentages after low temperature exposure using a modification of the usual vitrification technique. Survival using the dormant bud technique with field trees of these two lines was low in tests in previous years. 4) Preliminary tests with sour and sweet cherry showed some survival (browning test) using the standard dormant bud method. Survival was greater with sour cherry.

IMPLICATIONS AND IMPACT: Results obtained in this and previous years demonstrate that dormant bud cryopreservation can be applied to a wide range of genotypes. It is also obvious that no single method will give high levels of viability for all genotypes. Supplemental methods have been developed that probably can allow cryopreservation of all apple germplasm. The cryopreservation of apple germplasm allows for safe, long term storage which then gives the clonal repository options for minimizing costs with field or greenhouse maintenance.

CRYOPRESERVATION OF SHOOT TIPS USING VITRIFICATION METHODS

L.E. TOWILL; J. Waddell, G. Valdez

PROBLEM: Vitrification, a method to cryopreserve diverse cells, tissues and organs, has been shown to be effective for a range of species. As it is a process containing a series of steps, a number of these steps must be optimized. We investigated aspects of these steps for several species.

APPROACH AND RESULTS: 1) In sweet potato, kinetics of application of the vitrification solution are crucial. Variability in survival is observed. Two factors have emerged. Faster cooling rates gave higher percentages of

survival, suggesting the cellular milieu is not a good glass former, and shoot tips were shown to be chill sensitive. Extending exposure times to the solution did not enhance survival. An alternative vitrification solution was examined, but found to be highly toxic. Several additional lines from the clonal repository for sweet potato were obtained for tests on applicability to diversity.

2) In a continuation of a previous study, about 50 species of Mentha were examined for response to determine if diversity of the collection could be cryopreserved. High levels of viability were found for most lines. Interestingly, small shoot tips (<0.5mm) do not survive as well as larger ones (ca. >0.5mm). We feel the procedure for mint is now satisfactory for practical use at the NSSL.

3) A short-term storage study at -160°C with vitrified shoot tips from Mentha sp. showed no loss of viability over a 12 month period. This is as expected for cryogenic storage and shows that glasses are, at least in the short term, stable and do not crack under usual manipulations. Further studies are planned on glass stability.

4) Differential scanning calorimetry of vitrification solutions demonstrated their characteristics, but we were unable to determine events within the cells of the shoot tips independent of any extracellular solution remaining.

5) Cold pretreatments of stock plants from potato and Arachis glabrata were assessed to determine if this process affects subsequent cryopreservability. Results showed the treatment gave a slight improvement in survival, but that length of the pretreatment phase may be critical. Sugar and starch analyses are planned to determine how cold promotes cryopreservability.

6) 'Encapsulation and dehydration' methods for cryopreservation also are a form of the vitrification procedure. Preliminarily, we determined the kinetics of drying and survival for mint. The procedure has some technical advantages and will be examined in more detail in 1994.

IMPLICATIONS AND IMPACT: Vitrification is a relatively new method and is, as yet, not used as a routine method for cryopreservation. Encapsulation-dehydration methods appear equally useful but some basic and applied questions still remain. I feel that both developments are such that they can be used for some germplasm collections in the near future. When incorporated, cryopreservation will allow clonal repositories options for cost savings in managing their field, greenhouse or in vitro collections.

ORTHODOX SEED STORAGE: OPTIMUM CONDITIONS AND MECHANISMS OF DETERIORATION

CHRISTINA W. VERTUCCI: Jennifer Crane (Biolcl Sci Tech); Kalyani Srinivasan (Collaborator, New Delhi, India); Robert Cook (Grad Student); Lisa Hill, Tanya Skolonsky, Daren Coonrod, Devon Hawkins (Students)

PROBLEM: The objective of the NSSL is to preserve the genetic integrity of the seeds stored there. This is accomplished by 1) storing the seeds

at low moisture contents and temperatures to limit the rate of aging and 2) monitoring seed viability so that poor quality seeds can be regrown. All of the seeds stored at the NSSL and at other repositories in the NPGS are called 'orthodox' (as opposed to 'recalcitrant' - see problem #2 by CWV) because they survive almost complete desiccation. Since preservation of all biological materials requires drying and/or freezing, the ability of orthodox seeds to survive these treatments allows us to store them efficiently. Unfortunately, all seeds inevitably lose viability during storage, and some seeds lose viability within 10 to 20 years. We believe that the loss of valuable germplasm through attrition can be limited by storing seeds under optimal conditions. In addition, the cost of determining when seeds have aged sufficiently to warrant regrowing can be minimized if we can understand why seeds deteriorate.

APPROACH: Determining the optimum conditions for seed storage and the mechanisms of seed deterioration under cold, dry conditions are intimately related. We have taken a biophysical approach to these questions which have remained enigmatic for years. Over the past few years we have sought to describe the thermodynamic properties of water at room temperature and different water contents. We developed a model to describe how water properties control the nature and kinetics of degradative processes.

This year, we focused mainly on testing some of the hypotheses regarding the interaction of lipids and water (work by K. Srinivasan, R. Cook, and permanent staff) and introducing a temperature component into our model (permanent staff). Our experiments this year were designed to determine if there are 1) interactions between water and lipids in deteriorative reactions, 2) effects of seed priming on seed storage characteristics, and 3) independent effects of water content and temperature on seed longevity (as assumed for the last 30 years). Our experiments were simple but labor-intensive. We studied the effects of moisture content, temperature, and time on seed vigor in fairly generic lines of soybean, pea, yew, and peanut as well as isolines of soybean with and without the enzyme lipoxygenase, in isolines of soybeans and sunflower with different lipid contents and fatty acid compositions, and in pansy seeds that had and had not been primed.

RESULTS: This year, we demonstrated that 1) lipoxygenase plays a minor role, if any role, in deteriorative reactions, even though it is an important enzyme in lipid peroxidation pathways 2) the fatty acid composition plays a role in susceptibility to deterioration depending on the relative humidity of storage, and 3) that the optimum water content for storage decreases with decreasing temperature, but that the optimum water activity is relatively constant. The first two points contribute to our understanding of the mechanisms of seed deterioration at different water levels [lipoxygenase (and enzymes in general?) are not important and lipid composition is sometimes important (depending on water content)].

We believe our last conclusion (changes in optimum water content with temperature) will have a lasting and profound effect on seed storage practices. These conclusions are based on classical physical chemistry and are validated by experimental data. However, our conclusions have come under extreme scrutiny (numerous citations, editorials and organized debates). Presently, an international experiment (administrated by IPGRI) is being designed to test our conclusions.

CRYOPRESERVATION OF RECALCITRANT SEEDS

C.W. VERTUCCI: J. Crane; (Collaborators Ervin Oelke and Raymond Porter, U. Minnesota; Mirian Eira, EMBRAPA, Brazil)

PROBLEM: Many economically important plant species from tropical areas and temperate wetlands produce seeds that do not survive desiccation. We are unable to store these "recalcitrant" seeds in the base collection of the NSSL by standard protocols.

APPROACH: In order to develop protocols to store recalcitrant seeds we need to understand the mechanisms and interaction of desiccation damage and freezing damage. In addition, we need to understand ways of altering the water properties to prevent lethal intracellular ice formation.

We have taken a biophysical approach to this study, by mapping out the behavior of water in tissues as a function of temperature and moisture content and determining how the phase behavior of water affects the viability of tissues. Our model systems have focused on *Zizania* spp and *Citrus* and related genera. This year we also studied *Acer*, *Aesculus*, *Coffea*, and *Aracauria*.

RESULTS: We have determined that there is an optimum water content for storage of recalcitrant seeds, such that the opposing stresses of desiccation damage and freezing damage are minimized.

Using the principle of optimum water levels, we have developed two methods to preserve recalcitrant seeds. In the first method, we use thermodynamic considerations to develop a model which predicts allowable moisture content and temperature combinations. The model shows that the boundaries of this optimum narrow as temperature decreases or as the desiccation sensitivity of the tissue increases. We have tested the model extensively with *Zizania* as well as other seeds and our data is consistent with predictions.

Our model predicts, and is confirmed with empirical evidence, that the first method of preserving recalcitrant seeds is not possible for seeds that are very desiccation sensitive. We have developed another method to handle these tissues. This method is called "vitrification" and involves a slight and extremely rapid dehydration and then plunging embryos into liquid nitrogen at 2000C/sec.

Both methods have given us high levels of survival and we are ready to initiate projects to routinely store these types of seeds.

ACQUISITION OF DESICCATION TOLERANCE IN DEVELOPING SEEDS

C.W. VERTUCCI: (Collaborators Olivier Leprince, Belgium; Jill Farrant, South Africa)

PROBLEM: The ability to withstand almost complete desiccation is an unusual feature in biology but is common in many seeds. This ability is acquired during seed development and lost during germination. We believe

that if we can understand how most tissues are damaged by desiccation and how some seeds acquire tolerance to this stress, then we can learn how to improve seed quality and enhance our success in cryopreserving germplasm.

APPROACH: We have approached the study of the mechanisms of damage by and tolerance of desiccation in developing from a biophysical, ultrastructural and biochemical standpoint since these approaches encompass the major hypotheses to date. Studies of the status and requirement for water in developing embryos of orthodox and recalcitrant seeds tell us the critical moisture contents and water properties associated with these. Analyses of the sugar, protein and lipid composition suggest how chemical constituents alter the properties of water and the susceptibility of macromolecular structure to changes in the properties of water. Associated with these studies are studies of the metabolic status and cellular organization of the tissues.

RESULTS: We have found that the properties of water change as seeds develop into the desiccation tolerant state. A type of water with unusual thermodynamic properties is detected during the latter stages of development and is associated with increasing desiccation tolerance. Although sugars have been suggested as the main protectants against desiccation damage, their presence is not associated with the change in water status. A group of late embryogenic accumulating proteins may be associated with the changes in water structure. Embryos become less metabolically active during development and this may be in response to the changing water status. The change in metabolism is associated with desiccation tolerance. Changes in ultrastructure are associated with the metabolic changes. Recent results suggest that desiccation tolerant tissues also have the ability to switch off metabolism during severe stress.

Our results indicate that the nature of metabolism can be manipulated to enhance the level of desiccation tolerance. This knowledge can be used to make to recalcitrant seeds or even orthodox seeds that were harvested prematurely more amenable to storage.

PLANT GERMPLASM PRESERVATION RESEARCH UNIT
PUBLICATIONS FOR CALENDAR YEAR - 1993

1. Berjak, P., J.M. Farrant, N.W. Pammenter, **C.W. VERTUCCI**, and J. Wesley-Smith. 1993. Current understanding of desiccation-sensitive (recalcitrant) seeds: Development, states of water and responses to dehydration and freezing. Fourth International Workshop on Seeds, Angers, France. 705-714.

2. Berjak, P., **C.W. VERTUCCI** and N.W. Pammenter. 1993. Effects of developmental status and dehydration rate on characteristics of water and desiccation-sensitivity in recalcitrant seeds of Camellia sinensis. Seed Sci. Res. 3:155-166.

3. **BLACKMAN, S.A.** and A.C. Leopold. 1993. Chemical and physical factors in seed deterioration. Fourth International Workshop on Seeds, Angers, France. 731-737.

4. **BLACKMAN, S.A.**, R.L. Obendorf and A.C. Leopold. 1993. The role of LEA proteins in desiccation tolerance in soybeans. Fourth International Workshop on Seeds, Angers, France. 121-126.

5. **CONNOR, K.F.** and **L.E. TOWILL.** 1993. Pollen-handling protocol and hydration/dehydration characteristics of pollen for application to long-term storage. Euphytica 68:77-84.

6. Crossa, J., C. M. Hernandez, P. Bretting, **S.A. EBERHART**, and S. Taba. 1993. Statistical genetic considerations for maintaining germplasm collections. Theor. Appl. Genet. 86:673-678.

7. **EBERHART, S.A.** 1993. Plant genetic resources. Proc. Workshop on Adaptation of Plants to Soil Stresses. INTSORMIL Pub. No. 94-2. p. 51-61.

8. **EBERHART, S.A.** 1993. Concept of worldwide germplasm utilization. 18th Biennial Grain Sorghum Research and Utilization Conference. Lubbock, Texas. p. 12-16.

9. **HOWARTH, M.S. and P.C. STANWOOD.** 1993. Measurement of seedling growth rate by machine vision. Trans. ASAE 36:959-963.

10. **HOWARTH, M.S. and P.C. STANWOOD.** 1993. Tetrazolium staining viability seed test using color image processing. Trans. ASAE 36:1937-1940.

11. Pammenter, N.W., **C.W. VERTUCCI** and P. Berjak. 1993. Responses to dehydration in relation to non-freezable water in desiccation-sensitive and -tolerant seeds. Proc. Fourth International Workshop on Seeds, Angers, France. 867-872.

12. Phillips, R.L. and **S. EBERHART.** 1993. Novel methodology in plant breeding -- discussion. p. 647. *In* Crop Science Society of America (ed.), International Crop Science I. Madison, WI.

13. **ROOS, E.E.** 1992. Research program at the USDA National Seed Storage Laboratory. p. 153-163. In A.A. Khan and J. Fu (eds.) Advances in the science and technology of seeds. Science Press, Beijing.

14. **SOWA, S., E.E. ROOS** and W.S. Caughey. 1993. Effector molecules to probe cytochrome c oxidase activity in germinating Phaseolus vulgaris L. seeds. J. Plant Physiol. 141:647-653.

15. **TOWILL, L.E. and P.C. STANWOOD.** 1993. The National Seed Storage Laboratory. Society for Cryobiology News Notes April p. 1-2.

16. **VERTUCCI, C.W.** 1993. Towards a unified hypothesis on seed aging. Fourth International Workshop on Seeds, Angers, France. 739-746.

17. **VERTUCCI, C.W. and E.E. ROOS.** 1993. Seed storage, temperature and relative humidity: Response. Seed Sci. Res. 3:215-216.

18. **VERTUCCI, C.W. and E.E. ROOS.** 1993. Theoretical basis of protocols for seed storage II. The influence of temperature on optimum moisture levels. Seed Sci. Res. 3:201-213.

19. Yu, X-P., **J. FANG**, S-J. Sheng, C-K. Sun, X-Y. Xu and J-B. Zheng. 1993. Viability of Litchi chinensis seeds stored in Na alginate pellets. Fourth International Workshop on Seeds, Angers, France. 863-865.

Reprints or copies of above publications are available from Eric E. Roos, Plant Germplasm Preservation Research Unit, National Seed Storage Laboratory, 1111 South Mason Street, Fort Collins, Colorado 80521-4500.

Attachment #4

6/3

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Date: May 26, 1994

To: ESCOP Plant Germplasm Subcommittee

From: R. L. Lower
Chair

RECEIVED
JUN 1, 1994
DIRECTOR'S OFFICE
GRIFFIN GA

Re: Update on Germplasm Activities

In April, at the request of Dr. Henry Shands, I participated in a conference at Fort Collins that discussed a number of problems which are developing at the IARC's regarding the access of germplasm housed in the centers. Germplasm at the centers represents contributions from many nations around the world and, with the U.S. signing of the FAO understanding and the Biodiversity Convention, any new contributions to the collections at the centers will be looked upon essentially as natural resources of these countries. The donor country will have rights and responsibilities regarding dissemination and retribution for use of the sample. Needless to say, Henry and his staff are working diligently at trying to develop a satisfactory solution to this dilemma.

While in Fort Collins, I was given the opportunity to participate in the question and answer session between Vice-Chair of the National Genetics Resources Program Advisory Council, Dr. Donald Duvick, and Director of that program, Dr. Henry Shands. You will recall that the question and answer session was to be the second step in the development of a process that examines and portrays the plight of germplasm in the United States. The first step in that process was the development and publication of the advisory council's resolution on germplasm. The first step was completed when the last issue of Diversity published the resolution. While in Washington on May 24, I visited with Debra Strauss, editor of Diversity, and she indicated that the question and answer tapes were being transcribed and would soon be available for comments from Duvick and Shands. Completion of the second step will involve publication of the questions and answers sometime in the near future.

At the request of Congress Stenholm's committee, I represented the ESCOP Subcommittee on Plant Germplasm at a hearing in Washington, D.C. on May 24, 1994. The request came on Friday afternoon, thus there was little time to develop a testimony and share it with you before deliverance. Attached is a copy of the testimony that I presented and also a list of the other witnesses. It appears the amendments to the Plant Variety Protection Act will go forth after markup committee deliberations shortly after the Memorial Day recess. At this stage, it appears certain that the PVPA will be amended to be more closely in concert with the 1991 UPOV Convention.

If you have questions concerning either of these matters, kindly contact me at your convenience.

RLL:ma:may
Attachment
cc: N. Clarke R. Heil R. Wyse
K. Feltner H. Shands D. Zinn

Department Operations and Nutrition Subcommittee
Public Hearing
May 24, 1994

Richard L. Lower
University of Wisconsin-Madison
on behalf of the Experiment Station Committee on
Operations Planning, National Association of State Universities and
Land Grant Colleges

My name is Richard L. Lower. My current position is Associate Dean of the College of Agricultural and Life Sciences, UW-Madison and Associate Director of the Wisconsin Agricultural Experiment Station. I also serve as Chair of the Experiment Station Committee on Organization and Policy (ESCOP) Subcommittee on Plant Germplasm. In addition to representing ESCOP, I represent the American Society for Horticultural Science (ASHS) and the Steering Committee of the Workshop on Intellectual Property Rights: Protection of Plant Materials held in Washington, D.C. in 1993. This workshop, and its predecessor held in Anaheim, California in 1989, were developed to answer questions regarding plant germplasm (further defined as seed and vegetatively propagated genetic material, cell and tissue culture lines, DNA fragments and pollen) .

Mr. Chairman, thank you very much for the invitation to take part in this hearing.

My comments address plant germplasm from the perspective of a research administrator at a public institution. Public germplasm research has been conducted for over a century and is a primary responsibility of the State Agricultural Experiment Stations (SAES). The SAESs employ approximately 6,000 faculty throughout the United States[1]. A significant portion of these research scientists are directly involved in plant germplasm activities, including acquisition, collection, evaluation, enhancement and genetic improvement of plants. Approximately 350 SAES scientists are plant breeders and they are directly involved in the development of improved germplasm for food, fiber and ornamental crops. In many crops, the role of variety development has been successfully transferred from the public to private industry. However, contributions from public germplasm programs continue to result in improved pest resistance, product quality, and profitability, as well as new knowledge, enhanced technologies and improved breeding methodologies.

SAESs also respond to other rather common situations. In some states, a lack or paucity of acceptable private varieties, because of a unique production or marketing opportunity, has resulted in development of publicly supported germplasm programs and the release of public cultivars. Small acreage specialty crops of major economic importance to a state, but with little interest or incentive to private firms, also are supported by SAES programs.

The successes of SAESs include cooperation with public agencies as well as private industry in germplasm research. Much of this success can be attributed to: 1) the free exchange of information as well as the free exchange of germplasm; 2) the development of a cooperative infrastructure that allows new germplasm to be acquired, maintained, shared, developed, enhanced and ultimately accepted by science and commerce. Equally important are the contributions of SAES in the instruction, education and training of the next generation of

scientists involved in germplasm related activities. A significant number of SAESs' scientists are also involved in research that contributes to plant genome technology. Part of the SAES/university responsibilities are to contribute directly to the training and education of geneticists, plant breeders, biotechnologists and other plant scientists. Many believe this is our primary mission. This human resource pool is accompanied by an improved germplasm pool, new technology, breeding methodology, and sometimes cultivars as products of their mission.

The ESCOP developed and released plant germplasm guidelines in 1989[2]. They espouse the philosophy that SAESs may protect plant germplasm through any number of mechanisms. Plant Variety Protection certificates, plant patents, utility patents and other forms of protection, including restricted releases and use agreements are presently practiced. It is important to recognize that these are guidelines and not formal policy. Each agricultural experiment station must develop its policy regarding plant germplasm and display it prominently to insure that users understand the state's position. Likewise, each agricultural experiment station should develop a mechanism that allows each new invention to be protected, widely utilized and benefit U.S. agriculture.

The research exemption authorized under Plant Variety Protection which allows use of protected material in research and plant improvement programs has contributed positively to the exchange of information and germplasm. We support the essentially derived provision of HR 2927 that allows recompense to the initial inventor when a new germplasm development is released that utilizes the initial protected germplasm and is competitive with the initial inventor's property. These guidelines allow for individual agricultural experiment stations to respond to situations unique to their states and still participate in germplasm improvement and exchanges and to contribute to state, national and international food and fiber industries. Our success in developing food and fiber germplasm has been based on the sharing of genetic resources.

The public, as well as university governing bodies, expect products of tax-dollar supported research to be protected. After all, compensation for research accomplishments is one way to support future endeavors. Until the 1980s, public universities and agricultural experiment stations usually gave germplasm away. It was available as public domain. Many say this was right, since most germplasm research was funded by state and federal formula dollars. Scientists participated in research and exchanged materials openly [although this is a bit of a myth] and with few, if any, restrictions.

Today the motivation to protect germplasm has increased. Tighter university budgets and escalating research costs have caused administrators and researchers to think more carefully about cost containment and cost recovery. Stronger university-industry relationships and greater dependence on revenues generated via intellectual property rights are being considered as significant sources of support for germplasm research. Germplasm exchanges are still taking place, but are frequently accompanied by memoranda of understanding or material transfer agreements that place limits or restrictions on the usage of the germplasm. Hopefully, germplasm research programs are not directed with the sole intent of making dollars or generating support via royalty from releases. This is a treadmill that should be avoided. Base support for university germplasm programs should not be solely dependent on revenue derived from intellectual property protection. Remember, the biggest contribution and primary mission of universities is the training of students - human resource development.

Impacts on Future Research and Development

In addition to developing policies that assure widespread and rapid use of new technology, public institutions must also assure that protection of intellectual property does not, in any way, impede further research. Scientists in both public and private institutions should be able to use information and research materials, whether protected or not, to further their investigations and to speed the acquisition of new knowledge and to speed new discovery.

The new molecular technologies, such as RAPDs and RFLPs, that are an important part of plant genome projects are also important tools in plant breeding and related plant germplasm programs. These technologies contribute to the mapping, sequencing and identification of new genes that will contribute to biology and agriculture. This information could serve to increase genetic diversity, reduce genetic vulnerability and broaden the genetic base of important cultivated crops. The advancing molecular technologies also will enhance our abilities to "fingerprint", measure genetic distance and take part in international discussions on the concept of "essentially derived varieties". The contributions to both science and education are paramount.

On behalf of ESCOP and the ASHS, thank you for the opportunity. One of the recommendations of the 1993 Workshop on Intellectual Property Rights was that the PVPA be revised to conform to the 1991 revision of UPOV. Additionally, we support the provisions on essentially derived varieties as they provide protection for developers of important basic genetic materials.

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[1] Division of Agriculture, Committee on Biotechnology, Emerging Biotechnologies in Agriculture: Issues and Policies - Progress Report VIII, November, 1989.

[2] Seed Policy Subcommittee, Experiment Station Committee on Organization and Policy, Responsibilities and Guidelines Concerning Development, Release and Multiplication of Publicly Developed Germplasm and Varieties of Seed-Propagated Crops, October, 1989.

5/94:may

U.S. House of Representatives
Committee on Agriculture
Washington, D.C. 20515

Tuesday, May 24, 1994

DEPARTMENT OPERATIONS AND NUTRITION SUBCOMMITTEE, Public Hearing, 1300 Longworth House Office Building, Washington, D.C.

SUBJECT: Review of H.R. 2927, the Plant Variety Protection Act Amendments

W I T N E S S E S

2:00 p.m.

1. Dr. Kenneth C. Clayton, Acting Deputy Assistant Secretary, Marketing and Inspection Services, U.S. Department of Agriculture, Washington, D.C.
   Acc. by: Dr. Kenneth Evans, Commissioner, Plant Variety Protection Office, Marketing and Inspection Services, U.S. Department of Agriculture, Washington, D.C.

   Mr. H. Dieter Hoinkes, Patent and Trademark Office, Department of Commerce, Washington, D.C.

2. Panel:
   Mr. Dietrich Schmidt, President, Petoseed Company, Inc., Saticoy, California, on behalf of the American Seed Trade Association

   Mr. John Keeling, American Farm Bureau Federation, Washington, D.C.

   Mr. Lawrence Strouts, Farmer and Certified Seed Dealer, Strouts Seeds, Inc., Wilsey, Kansas

   Mr. Lester Clemons, President, Washington Seed Council, Othello, Washington

3. Panel:
   Mr. Fred Flieler, Director of Potato Purchasing, Frito Lay, Inc., Plano, Texas

   Dr. David Douches, Research Geneticist and Potato Breeder, Department of Crop and Soil Sciences, Michigan State University, East Lansing, Michigan, on behalf of the National Potato Council, Englewood, Colorado

   Ms. Hope Shand, Director of Research, Rural Advancement Foundation International, Pittsboro, North Carolina

   Dr. Richard Lower, University of Wisconsin, Madison, Wisconsin, on behalf of the Experiment Station Committee on Operations Planning, National Association of State Universities and Land Grant Colleges

Attachment #5

Nashville, TN
February 1994

S-9
PLANT GENETIC RESOURCES CONSERVATION AND UTILIZATION

FUNDING REQUEST FOR FY95
TO THE
SOUTHERN ASSOCIATION OF
STATE AGRICULTURAL EXPERIMENT STATION DIRECTORS

BUDGET

A. S-9:

	FY93	FY94	REQUESTED FY95
Personal Services	$160,874[a]	$175,301[c]	$184,395[d]
Travel	500	500	200
Operating	56,941[b]	33,965	34,765
Equipment	2,000	2,000	36,500[e]
TOTAL	$220,315	$211,766	$255,860

[a] FY 93 salary and fringe benefits increased a total of $6,890.

[b] One-time appropriation of $22,976 included $12,976 for renovation of S-9 greenhouse and an additional $10,000 for the S-9 operating budget.

[c] The increase to personal services totaled $14,427 (representing three employees being reclassified at a cost of $6,082 and University merit increases of $8,345.

[d] This category includes a 5% increase in salaries based on projections from the University of Georgia and the CSRS.

[e] One-time appropriation of $35,000 requested for S-9 computer network and database installation. An equal appropriation has been made by the USDA/ARS.

B. **USDA/ARS:**

	FY93	FY94	PLANNED FY95
Personal Services	$ 915,985	$ 924,985	
Travel	31,000	28,000	
Operating	102,434	135,556	
Equipment	30,000	35,000	
Construction	125,197	317,000[f]	
Extramural Services	309,225	325,300	
TOTAL	$1,513,841	$1,765,841	$?

[f] One-time appropriation totaling $252,000 for a trickle irrigation system for the Westbrook Farm ($87,000), completion of the -20C seed storage facility ($40,000), completion of the Applied Genetic Analysis Laboratory ($90,000), and partial support for the local area network and database ($35,000).

The University of Georgia at Griffin has contributed space for the establishment of the Applied Genetic Analysis Laboratory through vacating an area in the Redding Building. The vacated space was made available by the University of Georgia through additional construction of a metal building at an approximate cost of $82,000.

Attachment #6

1995 Plant Exploration in Western Brazil to Collect *Arachis* Germplasm for Crop Improvement (Wild and Cultivated Peanuts)

PROJECT SUMMARY

The Peanut Crop Advisory Committee has determined a need for additional peanut germplasm from western Brazil. This germplasm is needed for future use in breeding programs for cultivated peanut improvement and must be soon collected due to the rapid development in Brazil. The germplasm will be incorporated into the National Plant Germplasm System where it becomes property of the U.S. government and will be available to all qualified scientists/organization, domestic and foreign, which are eligible to receive it. Germplasm will be collected as seeds, plants, and/or nodules. All wild species collections will be documented with voucher herbarium specimens. All collections will be documented with complete 'passport data' (description, locality of collection, including latitude and longitude, elevation, soil type, vegetation, etc.). All germplasm introduced will be handled according to USDA and APHIS regulations. If shipped, all material will be sent to the Plant Germplasm Quarantine Center, Beltsville, Maryland; or if hand carried, it will be properly inspected at the port of entry and carried to the investigators home base, or shipped to the Quarantine Center in Beltsville, as required by the port inspector. All material will be multiplied at least one generation in a greenhouse prior to increasing in the field.

CERTIFICATION

(The first to be signed by the leader of each exploration; the second to be signed by non-ARS participants.)

1. I certify that I have read the Guidelines for Conduct of Foreign Plant Explorations. I agree to abide by all rules and regulations of host countries concerning collection of germplasm and understand that it is my responsibility to ensure that proper permission is obtained in advance of collection. When the exploration is complete I will promptly comply with reporting requirements explained in the guidelines. I will provide a summary report, a narrative report, information on genetic erosion in the region visited and a catalog of collections, including collector's name and number, plant name, collection locality, including latitude and longitude, and appropriate descriptive information (of plant and environment), etc. All germplasm obtained from ARS-funded plant explorations becomes U.S. Government property so that it may be added to the National Plant Germplasm System (NPGS).

Roy Pittman — 5/6/94
Signature — Date

2. As a non-ARS employee, I agree to the above and certify that I have consulted the appropriate official of my institution who has agreed to waive overhead.

Charles E. Simpson — May 4, 1994
Signature — Date

Signature — Date

1. Submitted by:

Roy N. Pittman
Agronomist/Peanut Curator
USDA, ARS
Southern Regional Plant Introduction Station
1109 Experiment St.
Griffin, Ga.
30223

2. Objectives:

a. To collect new accessions of wild and cultivated Arachis in the western region of the state of Mato Grosso between Porto Esperidao, Old Mato Grosso City, Casalvasco, and the area by the eastern Bolivian border.

b. To collect additional accessions of wild Arachis along the route from Brasilia to Porto Esperidao. This could include short (50 km) side trips near Caceres, Cuiaba, Rondonopolis, and Barra do Garcas.

c. During and/or after increasing, material will be evaluated for useful characters. As material becomes available, it will be distributed to breeders and other scientists for use in their programs to develop resistance in cultivated peanuts and/or as a new forage crop.

3. Dates of Travel:

The expedition will have a 20 to 30 day duration in April/May, 1995. The time frame is near the end of the wet season (growing season), when new crop seed of cultivated and wild species seed are most likely to be available, easily harvested, and when areas with dry weather roads are accessible.

4. Host Country:

The host country will be Brazil. A "collection visa" is required. We have been collaborating with EMBRAPA/CENARGEN and Dr. Jose F.M. Valls in this effort since 1981. Dr. Valls coordinates our collection directly with the CENARGEN program and Dr. Valls and one or more other CENARGEN Scientists always participate in the effort. Approval of application requires a minimum of 120 days and the application cannot be submitted until funding of the project is secured. The project leader has had such a visa several times in the past and our contact, Dr. Jose F. M. Valls, is

confident the visa can be obtained again; although the laws and requirements are always subject to change. The collection will be made in western Brazil (See objective 'a' above).

5. Suggested Participants:

A. Co-leader:
Roy N. Pittman, Peanut Curator
USDA, ARS
Southern Regional Plant Introduction Station
1109 Experiment St.
Griffin, Ga 30223
Phone: (404)228-7207
Fax: (404)229-3323
Born: June 26, 1947
At: Amarillo, Potter County, Tx
Passport: 800510089
Foreign languages: None
Previous foreign experience: Two collection trips to Brazil

B. Co-leader:
Charles E. Simpson, Professor
Texas Agricultural Experiment Station
Route 2, Box 00
Stephenville, Tx 76401
Phone: (817)968-4144
Fax: (817)968-3759
Born: August 19, 1940
At: Winters, Runnels County, Tx 79567
Passport: H-107853
Issued: 2/18/89 Houston, Tx
Expires: 2/17/97

Portuguese: Read--fair
Understand--fair
Speak--poor

Spanish: Read--fair to good
Understand--fair to good
Speak--fair

Previous Collection Experience:
Co-leader and/or participant on 19 previous *Arachis* germplasm collection expeditions in South America (1977 - 1993), ten of these expeditions in Brazil.

6. Host country requirements to obtain collecting permit:

The host country Brazil does require a "collection visa." Approval of application requires a minimum of 120 days and the application cannot be submitted until funding of the project is secured. Our Brazilian collaborator, Dr. Jose F.M. Valls, is confident the visa can be obtained again.

7. Justification:

The justification of this work is to make our best effort to collect and preserve the cultivated landraces and wild relatives of peanut before they are destroyed by modern agriculture. As co-collectors, we are able to gain first hand knowledge of peanut germplasm in Brazil and receive, after the collection trip, a share of 'all' the material collected without having to wait several years before the germplasm might be available for distribution. Also, the Brazilians are interested in 'cooperative efforts' in the collection and evaluation of peanut germplasm as there is very limited interest from the government for peanut research. therefore, the benefits derived are greater for the United States than for Brazil. In this light it benefits the U.S. to participate in the work of collecting the material.

This area has yielded several new general Arachis section wild species on previous expeditions, but we need to fill the gaps between collection sites in the western Mato Grosso. In 1981 and again in 1985, we collected near the proposed area, but we did not have proper clearance from the Brazilian Army in 1985 and we did not have sufficient time to cover the area in 1981. Provided we obtain the proper visa/permit and conduct the expedition under CENARGEN supervision and get approval from the Brazilian Army, no political factors impact our work.

8. Germplasm currently available:

Much new germplasm (wild and cultivated) has been collected since 1976, however, the primary proposed area of collection is not represented in our collection. We feel that key accessions of known species may be missing, and possibly one or more new species may be collected.

9. How does the exploration relate to earlier explorations or subsequent expeditions?

This exploration will be a continuation of effort begin in the area in 1981. We know there are wild *Arachis* in the area from old herbarium specimens, word from other explorers

and native peoples we have had contact with from that area.

10. CAC or other concurrence:

See other previous submission for Brazil also.

"Collection Trip to Brazil

As recommended by the
Peanut CAC July 7, 1992

A germplasm collection expedition to western Brazil is proposed for 1993 or 1994. The area to be explored is the southern part of the state of Mato Grosso, from Cuiaba to Caceres to Pto. Espiridiao to old Mato Grosso City (Vila Bela), then south along the border with Bolivia to Casal Vasco and back to Pto. Espiridiao. Also to include side trips north of Caceres to Barra do Bugres, and east of Cuiaba to Rondonopolis and Barra do Garcas (see map).

The expedition would be to collect both wild and cultivated *Arachis*. The wild peanut material of primary interest would be of the section *Arachis*, but sections *Procumbensae*, *Extranervosea*, and *Rhizomatosae* would also be collected.

The trip would be expected to last twenty-one (21) days and would begin and end in Brazilia. Expected start date would be approximately May 10, 1994."

11. Maps:

We have complete and good maps of the region. We also have a satellite location instrument for determining site locations of collections.

12. Vehicle and fuel:

It is our understanding that CENARGEN would be willing to provide a 4-wheel drive vehicle as in the past. We may need to pay some vehicle expenses.

Fuel is usually available. Occasionally we must carry an extra tank of diesel when we wish to explore one of the more remote areas.

Cost of fuel is about four times the U.S. price; about $4.00 per gallon.

13. Currency / exchange rates:

Cruzeiro Regal is the monetary instrument at last check. Currently the exchange is about 956.93 K$ per $1 U.S. Because the inflation rate is so high, costs will be in U.S. dollars and dollars converted as needed.

14. Holidays:

We generally work through weekends and holidays but we are aware that assistance may be limited around Easter, 5th of May, May 1 in some areas, and of course any election day. Fuel sales are often restricted on Sunday.

15. Supplies and equipment:

We carry or purchase upon arrival any supplies we need. We (the peanut germplasm project) has purchased a 'Magellan' location instrument which we use on collection trips. Minor supplies such as film, batteries, bags, tags, vials, rubber bands, and etc. are purchased in the U.S.

16. Field plan:

On day two we arrive in Brasilia. We will study the maps, herbarium specimens, field plots and greenhouse plants for two days. We will formulate our final field plan, purchase supplies and load the vehicle and depart day three or four for the Mato Grosso area. We will drive toward Barra do Garcas collecting along the way. Then we go to Rondonopolis and Cuiaba. Most of the collection will be along the border with Bolivia. Dr. Valls will make any local arrangements with the Brazilian Army that are needed ahead of time. The trip proper will be limited to 20 to 22 days. To conserve time we may fly back from Cuiba to Brasilia.

17. APHIS requirements:

The APHIS requirements for introduction of peanut samples from South America are basic. Materials must be free of insects, diseases, and soil. The samples must be inspected at the port of entry for compliance. Plans will be made to arrive in the U.S. on a Monday through Saturday day, NOT Sunday. Any wild plants for introduction may have to pass through quarantine at Beltsville.

18. Introduction into USA:

An import permit will be obtained from PPQ to import peanut seeds, herbarium specimens, and nodule vials. We will only ship materials to Beltsville if it is required by our visa/permit in Brazil or the inspector(s) at the port of entry (Miami). Our introduction permit allows us to hand carry seed to our home base.

19. Disposition of germplasm after arrival in U.S.:

The peanut germplasm curator is a proposed participant in this exploration. Materials will be multiplied under greenhouse conditions for one or more generations of seed. Live plants brought into the USA must meet quarantine requirments at Beltsville. Plants will be maintained or increases made at the curator's headquarters (Southern Regional Plant Introduction Station, Griffin, Ga.) or the co-project leaders location (Texas A&M University Agricultural Experiment Station, Stephenville, Tx.).

20. Contacts and cooperators:

Dr. J.F.M. Valls
Brasilia, Brazil
CENARGEN/EMBRAPA
Germplasm Curator & Collector

Dr. Valls will participate directly in the mission, and in fact, will be the Brazilian co-leader of the team. Information gathered by Dr. Valls from his EMBRAPA colleagues or his knowledge of the area will directly influence which towns we will use for base operation, which hotels we will stay in, and even to which restaurant is chosen for a meal.

21. References consulted:

Dr. D.E. Williams, Dr. Walton C. Gregory, Ing. A. Krapovickas, and Dr. J.F.M. Valls, cited above.

22. Itinerary:

See Maps on next page.

Day	Location
1&2	Enroute to Brasilia
3&4	Brasilia
5&6	to Barra do Garcas

7	to Rondonopolis
8	Rondonoplis area
9	to Cuiaba
10	Cuiaba area
11	to Caceres
12	Caceres area
13	to Porto Espindiao
14&15	along border to Casal Vasco
16	to Santissima Trandade
17	to Porto Espindiao (north route)
18	to Caceres
19	to Barra do Bugres
20	Barra do Bugres area
21	to Cuiaba
22	to Rondonopolis
23	to Barra do Garcas
24	to Brasilia
25&26	Brasilia
27&28	to USA and Griffin, Ga. or Stephenville, Tx.

23. Budget:

Funding is requested for two (2) people (Two U.S. scientists--one ARS and one AES) at per diem rates for all.

Transportation Costs	U.S.
Airfare (4/25/94 rates)	
from Stephenville	$1800
from Griffin	1800
Taxi, rent car, ferry, etc.	250
Fuel for collection vehicle and repairs	2000
Per diem (estimated) (4/25/94)	
Lodging- In Brazil (28 days)	3800
Meals- In Brazil (28 days)	2320
Supplies	800
Contingencies (Inoculations, communications, photo copies, and other non-specified	800
	$13,570

24. Vitaes:

CURRICULUM VITAE
CHARLES E. SIMPSON

Professor
Texas Agricultural Experiment Station
Texas A&M University
Stephenville, TX 76401
(817) 968-4144

HIGHER EDUCATION

Texas A&M University	B.S. in Agricultural Education, 1963
Texas A&M University	M.S. in Plant Breeding & Cytogenetics, 1966
Texas A&M University	Ph.D. in Plant Breeding & Cytogenetics, 1967

EMPLOYMENT HISTORY

1979-Present: Graduate Faculty, Texas A&M University
1984-Present: Professor, Texas Agricultural Experiment Station
1975-1984: Associate Professor, Texas Agricultural Experiment Station
1967-1975: Assistant Professor, Texas Agricultural Experiment Station

CURRENT RESEARCH ACTIVITIES

Peanut variety development and release; peanut germplasm collection and preservation; peanut germplasm evaluation, enhancement, and utilization. Co-leader on international efforts to collect, preserve and utilize wild peanut species.

AWARDS

1993 Meyer Medal Winner -- CSSA.

PROFESSIONAL ACTIVITIES

American Society of Agronomy (ASA)
Crop Science Society of America (CSSA)
    Crop Registration Committee-Peanut Subcom., 1980-92 - CSSA
American Peanut Research & Education Society (APRES)
    Board of Directors for APRES - 1988-93
    President of APRES - 1991-92
    Past-President of APRES - 1992-93
American Genetics Association (AGA)

American Phytopathological Society (APS)
Council for Agricultural Sciences & Technology (CAST)
Diversity
Sigma Xi
Alpha Zeta
Phi Kappa Phi
USDA Crop Advisory Committee - Peanut - Chairman 1985-88

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Nelson, S. C., Simpson, C. E., and Starr, J. L. 1989. Resistance to *Meloidogyne arenaria* in *Arachis* spp. germplasm. Ann. Appl. Nematol. 21:654-660.

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Smith, O. D. and Simpson, C. E. 1989. Registration of `Tamrun 88' peanut. Crop. Sci. 29:238.

Simpson, C. E., Smith, O. D., and Smith, D. H. 1987. Registration of `Langley' peanut. Crop. Sci. 28:816-817.

PLANT MATERIAL RELEASES

Cultivars - 5 peanut cultivars released.
Germplasm Lines - 6 peanut germplasm lines released.

CURRICULUM VITAE
Roy N. Pittman

Peanut Curator
USDA, ARS
Regional Plant Introduction Station
1109 Experiment St.
Griffin, Georgia 30223 USA
(404)228-7207

HIGHER EDUCATION:

Oklahoma State University, Stillwater, Oklahoma.
Department of Agronomy - **Ph. D. 1981.**
Major: Plant Breeding.
Dissertation: In Vitro Culture of Peanut (Arachis Spp.) Anthers, Cotyledons, and Leaflets.

West Texas State University, Canyon, Texas.
Department of Plant Sciences - **M. A. 1976.**
Major: Plant Science.
Thesis Title: Cytological Methods for Kalanchoe Miscrosporcytes.

Texas A&M University, College Station, Texas.
Department of Plant Science - **B. S. 1971.**
Major: Floriculture.

CURRENT RESEARCH ACTIVITIES:

Co-leader on international efforts to collect, preserve, and utilize cultivated and wild peanut species. Peanut germplasm maintenance, evaluation, distribution, enhancement, and utilization of cultivated and wild peanuts.

PROFESSIONAL ACTIVITIES:

Crop Science Society of America (CSSA)
USDA Crop Advisory Committee--Peanut
Sigma Xi
Diversity

PUBLICATIONS:

Journals:

1. Johnson, B.L. and Pittman, R.N. Factors affecting in vitro differentiation of explants from mature leaves of Arachis villosulicarpa Hoenhe. In Vitro Cell. Devel. Biol. 22:713-715. 1986.

2. Banks, D.J., Eskins, K. and Pittman, R.N. Analysis of the chloroplast pigments of Chico (Arachis hypogaea L.), a wild peanut (Arachis chacoense Krap. et. Greg. nom. nud.) and their tri ploid and hexaploid hybrids. Oleagineaux 40(1):29-33. 1985.

3. Pittman, R.N., Johnson, B.L. and Banks, D.J. In vitro differentiation of a wild peanut, Arachis villosulicarpa Hoehne. Peanut Sci. 11:24-27. 1984.

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Abstracts:

1. Banks, D.J. and Pittman, R.N. Origin, inheritance, and characteristics of a yellow-flowered peanut from Bolivia. Proc. Am. Peanut Res. Educ. Soc. 18:31. 1986.

2. Moffett, J.O., Banks, D.J. and Pittman, R.N. Floral visits by honey bees to three caged peanut genotypes and the resulting increase in hybrid seed. Am. Bee J. 12:833. 1986.

3. Banks, D.J., Pittman, R.N. and Moffett, J.O. Honey bees increase outcrossing in peanuts (Arachis hypogaea L.). Am. J. Bot. 72(6):875. 1985.

4. Johnson, B.L. and Pittman, R.N. The effect of explant composition, explant orientation, and light intensity on the in vitro differentiation of Arachis villosulicarpa Hoehne. Proc. Am. Peanut Res. Educ. Soc. 17:67. 1985.

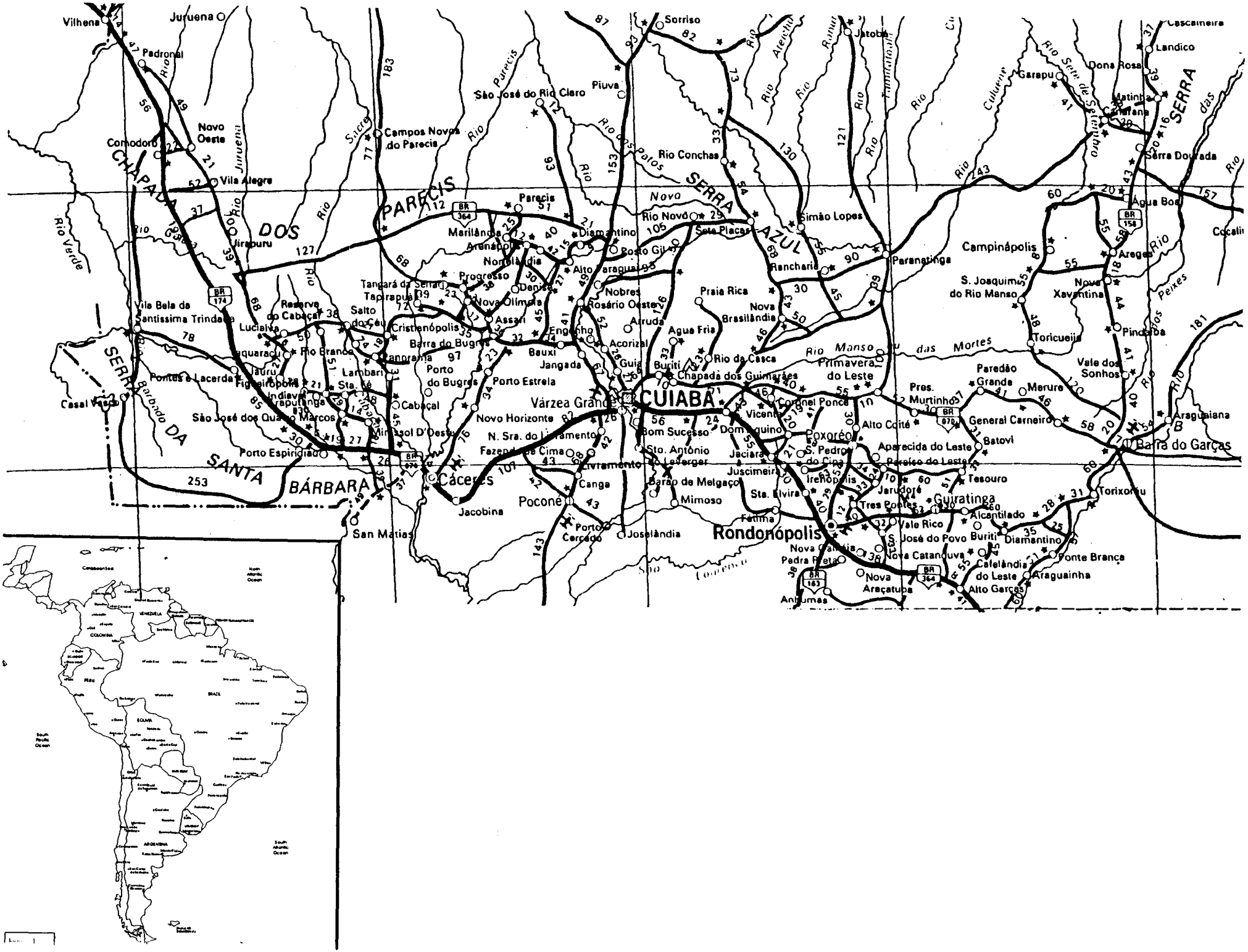
5. Banks, D.J., Pittman, R.N. and Heald, C.M. A wild Arachis winter nursery in south Texas. Proc. Am. Peanut Res. Educ. Soc. 16:38. 1984.

6. Pittman, R.N., Banks, D.J. and Johnson, B.L. In vitro culture of peanuts and preliminary yield evaluation of cloned material. Proc. Am. Peanut Res.

Educ. Soc. 16:30. 1984.

Posters

1. Pittman, R.N., Johnson, B.L., and Banks, D. J. Pathways of in vitro differentiation in peanuts (Arachis spp.). Beltsvilles Symposium VII, Genetic Engineering: Application to Agriculture, May 16-19, 1982.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Jiparuru
Campos Novos do Parecis
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Piuva
Sorriso
Jatobá
Cascalheira
Landico
Dona Rosa
Garapu
Matinha
Serra Dourada
SERRA DAS
Rio Conchas
Parecis
Marilândia
Arenápolis
Diamantino
Rio Novo
Sete Placas
Simão Lopes
Paranatinga
Rancharia
Posto Gil
Nortelândia
Progresso
Denise
Nova Olímpia
Assari
Tangará da Serra
Tapirapuã
Nobres
Rosário Oeste
Alto Paraguai
Engenho
Bauxi
Jangada
Acorizal
Guia
Aruda
Agua Fria
Buriti
Rio da Casca
Chapada dos Guimarães
Praia Rica
Nova Brasilândia
Primavera do Leste
Campinápolis
S. Joaquim do Rio Manso
Areges
Nova Xavantina
Toricueiia
Pindaíba
Vale dos Sonhos
Paredão Grande
Merure
Pres. Murtinho
General Carneiro
Batovi
Araguaiana
Barra do Garças
Vila Bela da Santíssima Trindade
Reserva do Cabaçal
Salto do Céu
Cristianópolis
Barra do Bugres
Lucialva
Rio Branco
Jauru
Figueirópolis
Indiavaí
Lambari
Sta. Ié
Pontes e Lacerda
Casal Vasco
Porto do Bugres
Porto Estrela
Cabaçal
São José dos Quatro Marcos
Minassol D'Oeste
Porto Espiridião
SERRA DA SANTA BÁRBARA
Cáceres
Jacobina
San Matias
Várzea Grande
CUIABÁ
Novo Horizonte
N. Sra. do Livramento
Fazenda Cima
Livramento
Canga
Poconé
Porto Cercado
Joselândia
Bom Sucesso
Sto. Antônio do Leverger
Barão de Melgaço
Mimoso
Vicente
Coronel Ponce
Domiquino
Poxoréo
S. Pedro do Cipa
Jaciara
Juscimeira
Alto Coité
Aparecida do Leste
Pereiro do Leste
Tesouro
Irenópolis
Sta. Elvira
Fátima
Rondonópolis
Jarudoré
Guiratinga
Tres Pontes
Vale Rico
S. José do Povo
Alcantilado
Buriti
Diamantino
Torixoréu
Nova Catanduva
Pedra Preta
Nova Araçatuba
Anhumas
Cafelândia do Leste
Alto Garças
Araguainha
Ponte Branca
Rio Verde
Rio Juruena
Rio Sacre
Rio Parecis
Rio Paraguai
Rio Manso
Rio das Mortes
Rio Peixes
Rio Culuene
Rio Sete de Setembro
Rio Tamitatoala
Rio Aleixo
Rio Roncador
Rio Patos
São Lourenço
BR 364
BR 174
BR 070
BR 163
BR 158

Attachment #7

PLANT EXPLORATION IN INDONESIA TO COLLECT SWEETPOTATO (*IPOMOEA BATATAS*) AND RELATED SPECIES FOR CROP IMPROVEMENT

PROJECT SUMMARY

The Sweetpotato Crop Advisory Committee (CAC) has determined that there is a need for additional sweetpotato germplasm from Indonesia. This germplasm is needed for breeding programs and other crop improvement activities and must be collected before it disappears. All germplasm will be incorporated into the National Plant Germplasm System (NPGS) where it becomes the property of the U.S. Government and will be available to all qualified scientists/organizations, domestic and foreign, who are eligible to receive it. Germplasm will be collected as seed when possible and as vegetative cuttings only if necessary. When appropriate, collections will be documented with voucher herbarium specimens. All collections will be documented with complete 'passport' data. All germplasm will be shipped or carried to the Plant Germplasm Quarantine Center, Beltsville, MD, from where it will be distributed according to policies in effect at the time of receipt.

CERTIFICATION

1. I certify that I have read the Guidelines for Conduct of Foreign Plant Explorations. When the exploration is complete I will promptly comply with reporting requirements explained in the guidelines. I will provide a summary report, a narrative report, information on genetic erosion in the region visited and a catalog of collections, including collector's name and number, plant name, collection locality, including latitude and longitude, and appropriate descriptive information (of plant and environment), etc.

Don R LaBonte 6/10/94

Signature Date

R A Scott 6/14/94

Signature Date

2. I certify that I have consulted the appropriate official of my institution who has agreed to waive overhead.

Don R LaBonte 6/10/94

Signature Date

R A Scott 6/14/94

Signature Date

1.) **SUBMITTED BY:**

Dr. Don R. La Bonte, Associate Professor, Department of Horticulture, Louisiana State University, Baton Rouge, Louisiana 70803, USA. (Tel. 504-388-1024)

and

Dr. R.L. Jarret, Curator/Research Horticulturist, USDA/ARS, Regional Plant Introduction Station, 1109 Experiment Street, Griffin, GA 30223 USA. (tel. 404/228-7255)

2.) **OBJECTIVES:**

a.) **Taxa to be collected:**
Ipomoea batatas, *I. littoralis* and other members of the genus *Ipomoea*.

b.) **Specific or general characteristics sought:**
Representative examples of the species mentioned above especially white-fleshed hexaploid *Ipomoea batatas* that might be utilized in existing cultivated *I. batatas* breeding programs. *I. littoralis* and related species will be collected to support ongoing research examining systematic relationships in section *Batatas*.

c.) **Use to be made of collected germplasm:**
I. batatas germplasm will be incorporated into existing sweet-potato improvement programs. White-fleshed sweetpotato germplasm is in demand by U.S. breeders as alternative uses for sweetpotato are identified. New uses for sweetpotato require the introduction of diversity for the white-fleshed and low sweetness characteristics. At present, the U.S sweetpotato collection contains fewer than 10 accessions of white-fleshed *I. batatas* and only a single clone known to be of low sweetness. Related species germplasm will be incorporated into phylogenetic studies being conducted at Florida Atlantic University, Tuskegee University and the clonal repository in Griffin. All germplasm will be used to support crop improvement research in the U.S. and abroad.

3.) **DATES OF TRAVEL:**

Travel will occur in November or December of 1995 or early 1996 as this is the period of time during which *I. batatas* is most likely to be in flower with mature seed present. If possible, only botanical seed will be collected in order to avoid problems of movement of vegetative materials through quarantine. However, some root or vine cuttings (up to a maximum of 60) might be collected.

4.) **HOST COUNTRY:**

Indonesia: As no previous collecting for *Ipomoea* species has been conducted in Indonesia, this first collecting mission will focus on brief visits to the maximum number of diverse environments possible but also including several older sweetpotato collections at Bogor Research Institute for Food Crops, West Java and Cendrawasih University, Irian Jaya. Areas which may be visited include: Java (the most important production area), Irian Jaya (second in production, foremost in germplasm), Sumatra, and possibly, Nusatenggara.

5.) **SUGGESTED PARTICIPANTS:**

Dr. Don La Bonte, Assistant Professor, Department of Horticulture, Louisiana State University, Baton Rouge. Chairman of the Sweetpotato CAC. Principal sweetpotato breeder/geneticist at LSU. Responsible for sweetpotato improvement and germplasm evaluation. Has collected *Ipomoea* species in Papua New Guinea. Born: Springfield, Illinois, April 4, 1958. Passport holder

Dr. Robert L. Jarret, Curator of the sweetpotato germplasm collection. Responsible for acquisition of *Ipomoea* germplasm for U.S. Sweetpotato Repository. Has collected *Ipomoea* species in Australia, Costa Rica, Ecuador, Columbia, and elsewhere. Born: Woonsocket, Rhode Island, March 15, 1949. Official passport.

6.) **HOST COUNTRY REQUIREMENTS TO OBTAIN COLLECTING PERMIT AND PERMIT FOR EXPORT OF GERMPLASM:**

No requirements known; contacts have been made with potential collaborators in Indonesia (Dr. Peter Scmiediche, International Potato Center) who will aid obtaining permits as necessary, particularly to collect in Irian Jaya.

7.) **JUSTIFICATION:**

Until recently, virtually all sweetpotato breeding activity has been focused on the development of sweet orange-fleshed "yam" type roots for fresh market or canning. However, alternative uses for sweetpotato have been identified. These include commercial production of starch and vitamin C, for use in snack foods, production of biomass, and as an alternative for *Solanum tuberosum* in some instances. White-fleshed low sweetness types are the preferred form of sweetpotato in numerous countries, including the Caribbean, and there is a growing demand for these types as evidenced by the popularity of 'boniato' types in South Florida, New York City, Chicago, etc. The development of alternative sweetpotato forms, adapted to U.S. growing conditions, requires a germplasm base containing variability for white flesh color and variable sweetness, not presently available in the U.S. collection. Although *I. batatas* is not endemic to the islands of Indonesia, the genetic diversity of sweetpotato found in Irian

Jaya, maybe comparable to that found in Papua New Guinea (Yen, 1974). The sweetpotato crop in Indonesia is grown on 100,000 ha, and white-fleshed types predominate in the marketplace. Sweetpotatoes are grown from the coastal lowlands to the high mountain valleys, evidence of great variability for adaptability to a diverse array of climatic conditions. Resistance to numerous disease and insects attacking sweetpotato has been identified in Plant Introductions from this area. For instance, PI 153655 ("Tinian") collected in the neighboring Northern Mariana Islands in 1946, was the original source of resistance to Fusarium wilt caused by *Fusarium oxysporum*. This disease nearly destroyed the U.S. sweetpotato industry. A sweetpotato introduction from the island of Java in Indonesia is belived to be the source of resistance to soil rot \ in U.S. breeding programs (T. Hernandez, personal communication).

Efforts to introduce germplasm of *I. batatas* to the U.S. have been extremely ineffective due to the severe quarantine restrictions on the movement of vegetative cuttings, roots and in vitro maintained materials. We propose to partially circumvent these difficulties by introducing germplasm containing the characteristics of white-flesh and low, or no, sweetness as botanical seed collected from landraces of *I. batatas* grown by subsistence farmers in Indonesia. Upon return to the U.S. seed will be germinated and plants grown in Griffin, Georgia and Baton Rouge, Louisiana to identify superior selections possessing the desired traits. These materials will then be either maintained clonally or polycrossed in Griffin for further distribution and maintenance as seed.

I. littoralis is the only Old-World species assigned to section *Batatas*. Collection of *I. littoralis* is a secondary objective.

8.) GERMPLASM CURRENTLY AVAILABLE:

The U.S. sweetpotato germplasm collection currently maintains between 400 to 500 clones of *I. batatas*. This collection is composed primarily of U.S.-developed cultivars, breeding lines and a limited number of landraces introduced from Latin America and to a lessor extent, from the South Pacific. The existing collection contains a single accession of *I. batatas* with white flesh and low sweetness. The U.S. collection contains only a single accession of *I. littoralis* from Australia. The Sweetpotato Repository has not been able to distribute this accession, despite repeated requests for germplasm of this species, due to the complete sterility of the plant material collected and thus the inability to produce botanical seed for distribution.

9.) HOW DOES THE EXPLORATION RELATE TO EARLIER EXPLORATIONS OR SUBSEQUENT EXPEDITIONS:

No previous collections have been made by U.S collectors in Indonesia for *Ipomoea batatas* or related species. The proposed collecting trip complements past and current

efforts by the CAC to obtain germplasm of *I. batatas* exhibiting the diversity known to exist within this species. Past introductions of *I. batatas* germplasm have been largely restricted to in vitro materials from other national programs. However, white-fleshed and low sweetness types have not been a priority in these collections and germplasm containing these characteristics is not available through other programs.

Funding ($2,000) was approved in 1992 whereby collaborators in Hawaii will identify, collect and provide seed to the sweetpotato Repository of *Ipomoea littoralis*. Arrangements for this collaborative effort are currently being made. A collecting trip to to Papua NewGuinea ($14,000) was funded in 1993. Numerous collections of *Ipomoea* sp. were made throughout the islands comprising PNG. The sweetpotato CAC, in developing a 5-year plan for germplasm acquisition, recognizes that the U.S. collection does not contain representative specimens of section *Batatas* species from more than a few countries although the species sought are native to southern North America, Mexico, Central America, northern South America and the South Pacific including Hawaii. Numerous additional collecting trips are anticipated for *I. batatas*.

10.) CAC OR OTHER CONCURRENCE:

The need for the rapid and systematic collection of sweetpotato and related species has been a continuing topic of discussion at CAC meetings. This collecting proposal has been developed in response to these discussions.

11.) STATUS OF MAPPING AND MAP REQUIREMENTS:

Maps will be obtained prior to travel from contacts in Indonesia (Il-Gin Mok and P. Schmiediche). More exact directions on collecting sites will be obtained from herbarium records and through local contacts. Collecting will be conducted principally along major and secondary roads and in the countryside. It is not known, at this time, if topographic maps are available for all areas to be visited.

12.) VEHICLE AND FUEL REQUIREMENTS, AVAILABILITY AND COST:

A four wheel drive vehicle will be rented in Jakarta and other larger towns to be visited through one of several rental agencies or local contacts arranged by IGM and PS. The estimated cost for a 4WD vehicle is USD$150/day. Gas will be available along the major highways and in the larger towns to be visited or passed through. If necessary additional fuel will be carried with the team.

13.) CURRENCY/EXCHANGE RATE:

The monetary unit in Indonesia is the Rupiah. Relative exchange rates vary greatly, in 1993 the currency was 2,096 Rb/USD=1.

14.) **HOLIDAYS:**

No holidays, national or local, are known to occur during the proposed dates of this trip.

15.) **SUPPLIES AND EQUIPMENT:**

All supplies, relative to the proposed trip, will be acquired in Jakarta or locally. Plant presses and an altimeter and a global positioning device will be carried from the U.S.

16.) **FIELD PLAN:**

Sweetpotatoes are grown throughout Indonesia. Most production is centered on the highly populated island of Java. Farmers in this region grow only a few popular cultivars. Manwan and Dimyati (1989) consider genetic erosion severe on Java. Collections need to be made of remaining indigenous cultivars grown in small plots. Existing collections on Java at Bogor and Malang will be visited, as well as the Cendrawasih University collection on Irian Jaya. The island of Sumatra is another major production region. A trip to this island is planned to collect extant germplasm. Most efforts will be focused on Irian Jaya. Irian Jaya comprises the eastern half of the island of New Guinea. Local farmers, like in Papua New Guinea, grow a large number of cultivars in a particular field. The high altitude and the large number of cultivars grown in small plots is an ideal situation for collecting true seed of self-incompatible sweetpotato. A representative sample of the genepool extant in Irian Jaya can be collected and readily sent to the United States. True seed can be grown out, plants set out in crossing nurseries, and increased for deposition in the NPGS. A seed population presents several advantages to U.S. breeders not found in traditional Plant Introduction clones. A population can be screened for a given trait directly or combined in a crossing nursery and improved.

No international borders will be crossed. Road conditions are not expected to pose a significant problem. Adequate food and lodging are available along the collecting route as planned.

Herbarium records will be examined for potential collection sites for *I. littoralis* will be noted and visited as time permits since acquisition of this species is a secondary objective.

17.) **APHIS REQUIREMENTS FOR IMPORT OF GERMPLASM:**

When possible, all germplasm of *I. batatas* will be collected as botanical seed. At the present time there are no restrictions on the importation of *Ipomoea* spp. seed. Vegetative material, when collected, will be brought into the U.S. under a permit issued through Suzanne Hurtt, NPGQC Beltsville, MD.

18.) **TRANSPORT OF COLLECTED GERMPLASM TO THE U.S.:**

All plant materials, seed and vegetative, will be hand carried. Authorization from APHIS will be obtained in advance.

19.) **DISPOSITION OF GERMPLASM AFTER ARRIVAL IN U.S.:**

All vegetative materials will be immediately forwarded to the National Plant Germplasm Quarantine Center in Beltsville, MD. Seed samples will be forwarded to the Plant Introduction Office for processing. Ultimately, all accessions will be forwarded to the Sweetpotato Repository (Southern Regional Plant Introduction Station) in Griffin for increase, distribution and maintenance.

20.) **CONTACTS AND COOPERATORS:**

The principal contacts in Indonesia are Dr. Peter Scmiediche, International Potato Center, Jalan Mordoka 147, Bogor 16111 and Dr. Il-Gin Mok, CIP, Central Research Institute for Food Crops, Jalan Mordoka 147.

21.) **REFERENCES CONSULTED:**

Manwan, I. and A. Dimyati. 1988. Program and accomplishments of sweet potato research at Central Research Institute for Food Crops. CRIFC. Mimeograph.

Shukor, N.M. and M.H. Khelikuzzaman. 1989. Sweetpotato production, utilization and research in Indonesia. *In*: Improvement of Sweetpotato (*Ipomoea batatas*) in Asia. International Potato Center, Lima.

Yen, D. 1974. The sweetpotato in Oceania, Bernice P. Bishop Museum Bull. 236, Bernice P. Bishop Press, Honolulu, Hawaii. 389pp.

22.) <u>ITINERARY</u>:

The collecting team will assemble in Jakarta and procede to Bogor to visit the Central Research Institute for Food Crops and the CIP regional headquarters. Our plans will be coordinated with CIP to focus on collecting in regions previously not collected by national and international teams (note: only recently has CIP collected Irian Jaya). The team will travel by 4 wheel drive vehicle (4WD) from Jakarta to Malang, return to Jakarta and fly to Palembang, Sumatra and proceed by 4WD. Return to Palembang and fly to Jakarta or directly to Ujungpandang on Sulawesi and proceed from Ujungpandang. Return to Ujungpandang and fly to Jakarta or directly to Manokowari, Irian Jaya. Visit sweetpotato germplasm collection at Cendrawasih University and proceed by 4WD. Return to Jakarta and organize accessions and arrange for transport of vegetative materials, if any, to Beltsville. Return to U.S.

23.) **BUDGET ESTIMATE:** (in USD):

We are requesting funding for this collecting trip. Funding is requested to cover expenses of DRL and RLJ and general expenses for the team including vehicle rental, cost of local labor, per diem (lodging, food misc.) and expenses for guides and in-country airfare for team members.

Airfare (DRL)..Baton Rouge-Jakarta-Baton Rouge	2,500
Airfare (RLJ)..Atlanta-Jakarta-Atlanta	2,500
Per diem (DRL) 16 days @ $175/day*	2,800
Per diem (DRL) 16 days @ $175/day	2,800
Per diem (guide) 16 days @ $150/day	2,400
Vehicle rental and gasoline	2,400
Airfare (in-country for RLJ, guide, DRL)	1,500
Supplies	500
Estimated approximate total (USD).....	$17,400

*U.S. State Dept. AID rates for meals and lodging.

24.) **VITAE:**

(see attached) All funds are to be USDA.

CURRICULUM VITA

NAME: Don R. LaBonte

PRESENT BUSINESS ADDRESS:

Department of Horticulture
Louisiana State University
Baton Rouge, LA 70803-2120
(504) 388-2158

EDUCATION:

1981 B.S.	Botany/Chemistry, Zoology, Eastern Illinois University, Graduated magna cum laude
1983 M.S.	Botany, Eastern Illinois University
1988 Ph.D.	Horticulture, University of Illinois

PROFESSIONAL BACKGROUND:

1994-Present	Associate Professor Vegetable Crop Breeding and Genetics Department of Horticulture Louisiana State University Baton Rouge, LA 70803
1988-1994	Assistant Professor Vegetable Crop Breeding and Genetics Department of Horticulture Louisiana State University Baton Rouge, LA 70803

MEMBERSHIP IN PROFESSIONAL SOCIETIES:

American Society for Horticultural Science
Gamma Sigma Delta

AREA OF RESEARCH:

Development of sweet potato cultivars
Genetics of sweet potato

AWARDS:

ASHS Vegetable Publication Award. Most outstanding research paper on vegetable crops in 1990 published by ASHS.

First place, graduate student oral presentation competition-ASHS Regional Meeting-South Dakota State University-1987.

PUBLICATIONS:

L.H. Rolston, D.R. La Bonte, W.A. Mulkey, C.A. Clark, J.M. Cannon and P.W. Wilson. 1994. 'L 86-33 sweetpotato germplasm. HortScience (in press)

M.E. Wright and D.R. La Bonte 1993. Surface areas of convex bodies using shrink-wrap. Appl. Engin. Agric. (in press)

D.R. La Bonte and M.E. Wright. 1993. Image analysis quantities reduction in skinning injury by preharvest canopy removal. HortScience 28:1201.

Arthur Q. Villordon and Don R. LaBonte. 1993. Variation in yield and RAPD markers among ipomoea batatas cv. Jewel Clones, 28:464 (Abstract)

D.R. La Bonte and D.H. Picha. 1992. Compositional changes in sweetpotato during development. HortScience 27:591 (Abstract).

D.R. La Bonte, W.A. Mulkey, C.A. Clark, L.H. Rolston, J.M. Cannon, P.W. Wilson, and P.C. St. Amand. 1992. 'Hernandez' sweetpotato. HortScience 27:377.

P.C. St. Amand and D.R. La Bonte. 1991. A database for sweetpotato breeding programs. HortScience 27:268

M.R. Hall, D.R. La Bonte, and C.K. Bonsi. 1992. New techniques and conventional breeding of sweetpotato. Proceedings from the International Symposium on Sweetpotato Technology for the 21st Century, Montgomery, AL P. 477-483.

C.A. Clark and D.R. La Bonte. 1992. Disease factors in breeding and biotechnology for sweetpotato. Proceedings from the International Symposium on Sweetpotato Technology for the 21st Century, Montgomery, AL. P. 484-494.

P.C. St. Amand and D.R. La Bonte. 1992. Data management in sweetpotato breeding programs. Proceedings from the International Symposium on Sweetpotato Technology for the 21st Century, Montgomery, AL. P. 559-562.

D.R. La Bonte and J.A. Juvik. 1991. Sugary enhancer (*se*) gene located on the long arm of chromosome 4 in maize (zea mays L.). Journal of Heredity 82:176-178.

P.C. St. Amand and D.R. La Bonte. 1991. User's guide to Louisiana State University sweet potato breeding database. Louisiana Agricultural Experiment Station Bulletin: Computer Applications series No. 100.

D.R. LaBonte and J.A. Juvik. 1990. Characterization of sugary-1 (*su-1*) sugary enhancer (*se*) kernels in segregating sweet corn populations. J. Am. Soc. for Hort. Sci. 115:153-157.

P.C. St. Amand and D.R. LaBonte. 1990. Database for sweetpotato breeding programs. HortScience 25:855 (Abstract).

D.R. La Bonte and P.C. St. Amand. 1989. Effect of early vine removal on skinning of sweetpotato. ASHS Prgrm. & Abst. 62.

J.A. Juvik and D.R. La Bonte. 1988. Single-kernel analysis for the sugary enhancer (*se*) gene in sweet corn. HortScience 23:384-386.

D.R. La Bonte and R.L. Darling. 1988. Noncompetitive effects of morning glory on growth of soybeans. Ill. State Acad. of Sci. 81:39-44.

D.R. La Bonte and J.A. Juvik. 1988. Segregation of the sugary enhancer (*se*) gene in F2 kernel populations. HortScience 23:121 (Abstract).

D.R. La Bonte and J.A. Juvik. 1987. Update: Research progress on the sugary enhancer (*se*) gene. National Sweet Corn Breeders Association Ann. Conf., Chicago, IL.

D.R. La Bonte and J.A. Juvik. 1987. The chromosomal location of the sugary enhancer (*se*) gene. HortScience 22:136. (Abstract).

D.R. La Bonte and J.A. Juvik. 1987. The expression of the sugary enhancer (*se*) gene in a starchy (*Su*) background. ASHS North Central Regional Meet. (Abstract).

D.R. La Bonte and H.J. Hopen. 1985. Apparent safening of chloramben for cucumbers by combination with naptalam. Proceedings North Cent. Weed Cont. Conf. 40:41 (Abstract).

D.R. La Bonte and H.J. Hopen. 1985. Increased amiben tolerance in cucumbers by preemergent combination with alanap. Ill. Veg. Res. Rept. 56:1-4.

CURRICULUM VITAE

Robert L. Jarret
USDA/ARS
Regional Plant Introduction Station
Griffin, Georgia 30223-1797 USA

1. EDUCATION AND BACKGROUND

A. Purdue University, West LaFayette, IN.
Department of Horticulture - Ph.D. 1982
Major: Genetics and Biochemistry
Dissertation: Biochemical Characterization of the Effects of the Tomato (*Lycopersicon esculentum* Mill.) Mutants *hp, dg, 1,* and *Gr* on Ripening and Fruit Quality.

B. Purdue University, Department of Horticulture - M.S. 1979
Major: Genetics and Plant Tissue Culture
Thesis Title: Factors Affecting Adventitious Shoot Formation in Tuber Discs of Potato (*Solanum tuberosum* L.)

C. Bridgewater State College, Bridgewater, MA
Department of Biology - B.S. 1976
Major: Biology; Minor: Chemistry

2. PROFESSIONAL HISTORY

July 1986 to Present
United States Department of Agriculture,
Agricultural Research Service
Southern Regional Plant Introduction Station
Griffin, GA 30223-1797

April 1986 to July 1986
Visiting Scientist, Department of Biology
Florida International University
Miami, Florida

November 1983 to June 1986
Rockefeller Foundation Fellow
University of Florida, Homestead, FL 33031

August 1982 to October 1983
Principal Scientist, Plant Tissue Culture
Laboratory, Centro Agronomico Tropical de
Investigation y Ensenanza (CATIE).
Turrialba, Costa Rica

3. RECENT PLANT GERMPLASM COLLECTING ACTIVITIES:

1988 Collected *Ipomoea* species in Queensland and the Northern Territory of Australia in collaboration with QDPI, Dr. Bob Johnson and Dr. D. Austin.

1989 Collected *Ipomoea trifida* and related species in Columbia in collaboration with the National Agricultural Research Service, and CIP.

1990 Collected *Ipomoea* spp. in Costa Rica in collaboration with the Centro Agronomico Tropical de Investigacion y Ensenanza (CATIE).

1992 Collected tetraploid *I. batatas* in Ecuador as a joint effort with INIAP, Florida Atlantic University and the International Potato Center.

Invited by CIP to participate in all CIP-directed sweetpotato (*Ipomoea* spp.) collecting activities.

4. MEMBERSHIP IN PROFESSIONAL SOCIETIES;

American Association for the Advancement of Science
American Genetics Association
American Society for Horticultural Science
International Society for Plant Molecular Biology
International Society for Tropical Root Crops
Sweetpotato Collaborators Group
Ad hoc Member Sweetpotato Crop Advisory Committee
Gamma Sigma Delta

5. RESEARCH EMPHASIS (Present)

A. Germplasm curator with responsibility for the establishment and operation of a National Clonal Repository. Research emphasis is on the development and application of improved techniques for the collection, evaluation and maintenance of vegetatively propagated crops germplasm. The use of molecular and biochemical genetic markers to estimate genetic diversity within the collections
and to establish taxonomic and evolutionary relationships between crop plants and their related species. Acquisition and evaluation of plant genetic diversity using morphological descriptors. Development and application of improved techniques for the elimination of viruses from clonally propagated plant materials. Sweetpotato germplasm enhancement.

6. MANUSCRIPTS/PRESENTATIONS (1990 - PRESENT)

Jarret, R.L., M. Spinks, G. Lovell and A.G. Gillaspie. 1990. The S-9 plant germplasm collection at Griffin, Georgia. Diversity 6(2):23-25.

Florkowski, W.J., R.L. Jarret and B. Goggin. 1990. Benefitting the sweetpotato industry through germplasm preservation. Univ. Georgia Agric. Econ. Rpt. 5(2):6-9.

Florkowski, W.J. and R.L. Jarret. 1990. Economic incentives and approaches to germplasm preservation. J. Econ. Finance. 13:433.

Florkowski, W.J. and R.L. Jarret. 1990. The cost of alternative strategies for the maintenance of sweet potato germplasm. Quart. J. Intnl. Agric. 29:79-87.

Gawel, N.J. and R.L. Jarret. 1990. Detection of cytoplasmic genetic variability in *Musa* using chloroplast DNA RFLPs. Proc. 26th Ann. Meet. Caribbean Food Crops Soc., Mayaguez, Puerto Rico. (abstract)

Chen, J., C.J. Chang, R.L. Jarret and N. Gawel. 1990. Cloning of DNA fragments isolated from walnut witches' broom (WWB) mycoplasmalike organism (MLO). Proc. IOM Letts. pp. 227-228.

Jarret, R.L. 1990. Molecular methods for detecting genetic diversity in *Musa*. In: R. Jarret (ed.) Proc. Estimating Genetic Diversity in the genus *Musa*, Los Banos, Philipines. pp. 56-66.

Chen, J., C.J. Chang, R.L. Jarret and N. Gawel. 1990. Isolation and cloning of DNA from a mycoplasmalike organism (MLO) associated with walnut witches' broom (WWB) disease. Proc. 1990 Ann. Meet. Amer. Phytopath. Soc. (abstract).

Prakash, C.S., G.S. Varadarajan, A. Almazan, U. Varadarajan, S. Rao and R.L. Jarret. 1990. RFLP approach to the identification of sweetpotato cultivars. Proc. IV Interntl. Symp. Development and Application of New Technologies for Varietal Identification, Iowa State University, Ames, Iowa.

Jarret, R.L. (ed.). 1990. Identification of Genetic Diversity in the Genus *Musa*. Proc. Internatl. Workshop on Genetic Diversity, Los Banos, Philippines, Sept. 1988, INIBAP, Montpellier. 211pp.

Pimentel, R., N. J. Gawel and R.L. Jarret. 1990. RFLPs for fingerprinting of plantain (*Musa acuminata* x *M. balbisiana*) cultivars. Proc. IV Internatl. Symp. Development and Application of New Technologies for Varietal Identification. Iowa State University, Ames, Iowa.(abstract).

Jarret, R.L. and N. Gawel. 1991. Chemical and environmental growth regulation of sweetpotato *Ipomoea batatas* (L.) Lam.) in vitro. Plant Cell Tiss. Org. Cult. 25:153-159.

Gawel, N. and R.L. Jarret. 1991. Cytoplasmic genetic diversity in bananas and plantains. Euphytica 52:19-23.

Jarret, R.L. and N. Gawel. 1991. Abscisic acid-induced growth inhibition of sweetpotato (*Ipomoea batatas* (L.) Lam.) in vitro. Plant Cell Tiss. Org. Cult. 24:13-18.

Gawel, N. and R.L. Jarret. 1991. Chloroplast DNA restriction fragment length polymorphisms (RFLPs) in *Musa* species. Theor. Appl. Genet. 81:783-786.

Jarret, R.L. and N. Gawel. 1991. ABA-induced quiescence of sweetpotato in vitro. Proc. 88th Annual Meet. Amer. Soc. Hort. Sci., University Park, PA. (abstract).

Gawel, N.J. and R.L. Jarret. 1991. A modified CTAB DNA extraction procedure for *Musa* and *Ipomoea*. Plant Molec. Biol. Rptr. 9:262-266.

Chen, J., C.J. Chang, R.L. Jarret and N. Gawel. 1991. Genetic variation among *Xylella fastidiosa* strains. Ann. Meet. Amer. Phytopath. Soc. (abstract).

Schalk, J.M., P.D.Dukes, A. Jones and R.L. Jarret. 1991. Evaluation of sweetpotato clones for soil insect damage. HortScience 26:1548-1549.

R.L. Jarret and N.G. Gawel. 1991. A simple DNA extraction technique for *Musa*. Musarama 4:3.

Jarret, R.L. 1991. Cultivo de tejidos de camote. In: W. Roca and L.A. Mroginski (eds.) Cultivo de Tejidos en la Agricultura, CIAT Press, Cali, Columbia. pp. 421-446.

Litz, R.E. and R.L. Jarret. 1991. Regeneracion de plantas en el cultivo de tejidos: embriogenesis somatica y organogenesis. In: W. Roca and L. A. Mroginski (eds.) Cultivo de Tejidos en la Agricultura, CIAT Press, Cali, Colombia. pp. 143-172.

Chen, J., C.J. Chang , R.L. Jarret and N. Gawel. 1992. Isolation and cloning of DNA fragments from a mycoplasmalike organism associated with walnut witches'-broom disease. Phytopath. 13:24-29.

L. Towill and R.L. Jarret. 1992. Cryopreservation of sweetpotato shoot tips. HortScience (accepted Plant Cell Tiss Org Cult)

Jarret, R.L.. 1992. In vitro maintenance of zoysiagrass (*Zoysia* spp.). (accepted Plant Genetic Res.)

Jarret, R.L., N. Gawel, A. Whittemore and S. Sharrock. 1992. RFLP-based phylogeny of the fe'i bananas of Papua New Guinea. (accepted Theor. Appl. Genet.)

Jarret, R.L., A. Whittemore and N. Gawel. 1992. Molecular systematics of the sweetpotato. (accepted J. Amer. Soc. Hort. Sci.)

Nadimpalli, R.G., R.L. Jarret, S. Phatak and G. Kochert. 1992. Phylogenetic relationships in the genus *Cajanus* based on nuclear restriction fragment length polymorphisms (RFLPs). V Internatl. Plant Biotech Sympos, Missouri Bot. Gard., St. Louis. (accepted for presentation)

Gawel, N.J., R.L. Jarret and A. Whittemore. 1992. RFLP-based molecular systematics of bananas and plantains. (accepted Theor. Appl. Genetic.)

Jarret, R.L. 1992. Random amplified polymorphic DNA (RADPs) detects patterns of genetic diversity in diploid *Musa acuminata* Colla. from Papua New Guinea. (submitted Ann. Meet. Amer. Soc. Hort. Sci., Honolulu, Hawaii. (accepted for presentation)

Austin, D., R.L. Jarret, C. Tapia and F. de la Puente. 1992. Collecting tetraploid sweetpotato in Ecuador. Plant Genetic. Res. (accepted Plant Genet. Res.)

Li, Z., R.L. Jarret, J. Demski and R. Pittman. 1992. Transformation of peanut with a peanut stripe virus coat-protein gene and regeneration of transformed plants. (accepted for presentation Amer. Soc. Plant Physiol.)