MINUTES OF THE MEETING OF THE S-9 TECHNICAL ADVISORY COMMITTEE:

THE INTRODUCTION, MULTIPLICATION, AND EVALUATION OF NEW PLANTS FOR AGRICULTURAL AND INDUSTRIAL USES AND THE PRESERVATION OF VALUABLE GERMPLASM

4-5 June 1996

Conference Room, Second Floor
Stuckey Building
Georgia Experiment Station
Griffin, Georgia

SUBMITTED BY

Bill Rhodes, Secretary
S-9 TECHNICAL ADVISORY COMMITTEE 1996

AGENDA
S-9 REGIONAL TECHNICAL ADVISORY COMMITTEE MEETING
4-5 June 1996

Conference Room, Second Floor
Stuckey Building
Georgia Experiment Station
Griffin, Georgia

Tuesday 4 June

8:00A Call to Order
- D. Labonte Chair, S-9 RTAC
- Introduction of Attendees
- Official Welcome
- G. F. Arkin Director, Georgia Experiment Station
- Additions to Agenda for 1996 Meeting
- Appointment of Committees
  - Nominations
  - Future Meeting Plans
  - Resolutions

8:30A Activities of the U. S. National Genetic Resources Program
9:00A Activities of the National Genetic Resources Laboratory
9:30A Activities of the National Seed Storage Laboratory
10:00A Coffee Break
10:30A CSREES Activities on Genetic Resources
11:00A Overview of Unit Activities for Review of Efforts
12:00P Lunch
1:30-5:00P Curation Activities in Griffin
- Peanut
- Cowpea
- Clovers and Special-Purpose Legumes
- Grasses
- Vegetable Crops

Support Groups
- Seed Storage and Database
- Disease Detection and Therapy
- Genetic Analysis

6:00P Dinner

Wednesday 5 June

8:00A Discussion/Review of Unit Activities
- Recommendations
- Linkages

10:00A Coffee Break
11:30A Committee Reports
- Nominations
- Future Meeting Plans
- Resolutions

12:00P Adjournment

Tuesday: 4 June, 1996

1. CALL TO ORDER

The Regional S-9 Technical Advisory Committee (TAC) was called to order at 8:00 am on June 4, 1996 by Chairman Don LaBonte in the Conference Room of Stuckey Building of the Georgia Experiment Station, Griffin, GA.

2. OFFICIAL WELCOME

Dr. G. F. Arkin, Director, Georgia Experiment Station, advisor and representative of the Southern Agricultural Experiment Stations, welcomed the TAC Committee. He noted that the Governor's Science and Technology Committee was on campus, with a potentially positive impact on the Station, and that he would only be present intermittently. Dr. Stephen Kresovich, Research Leader of the Genetic Resources Unit, had met with the SAES directors to brief them, and that the outcome was positive with renewed SAES support of $200-300,000 annually, despite continued budget tightening. They noted increased productivity at the PGRCU. A review of the Unit by the SAES directors, with probable joint participation of the USDA/ARS, is scheduled for late July or early August (**See Appendix O: Regional Research Report S-009**). Collectively, the S-9 program remains well-funded. He noted that **Roger Devries**, Area Director of the Southern Region of the USDA/ARS, Southern Region, had spent considerable time at the Unit learning about needs and finding resources to meet some critical needs.

3. INTRODUCTION OF ATTENDEES

Name	Address	Phone/Fax/e-mail
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Mark Hopkins	USDA, ARS, PGRCU	MHopkin@GAES.Griffin.Peachnet.edu
Bob Jarret	USDA, ARS, PGRCU	BJarret@gaes.Griffin.peachnet.edu
Stephen Kresovich	USDA, ARS, PGRCU	skresov@gases.griffin.peachnet.edu
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Gordon M. Prine*	U Florida Dept. Agronomy 304 Newell Hall Gainesville, FL 32601	904/392-1811 Fax: 904/377-1098
Ken Quisenberry*	U Florida Dept Agronomy Gainesville, FL 32611	Clover@GNV.IFAS.UFL.EDU
Bill Rhodes	Clemson U Dept Horticulture E142 Poole Ctr. Clemson, SC 29634-0375	864/656-0410 Fax:864/656-4960 brhodes@clemson
R. J. Schnell	USDA, ARS, Miami	miars@ars-grin.gov
Henry L. Shands	USDA/National Program BARC-West, Bldg. 005, Rm 140 Beltsville, MD 20705	shands@ars-grin.gov
Jim Strickland	USDA, ARS, PGRCU	
Loren Wiesner	USDA, ARS NSSL	LWiesner@ars-grin.gov

*denotes S-9 Committee members

4. Additions to Agenda for 1996 Meeting

Dr. Kresovich indicated that considerable flexibility in the program would allow the Committee to address all agenda items and concerns. He asked that we review the program with last year as a reference point. He indicated that the Committee would use the second day of the meeting to look at recommendations and linkages. He indicated that Avis Miller and Jim Strickland were key coordinating individuals at the Unit.

5. Activities of the U. S. National Genetic Resources Program

Dr. Henry Shands gave the National Program Staff Report (**National Program Staff Report, Appendix #1**). He noted that funds for germplasm resources will not increase in the near future and that no new funds are available for the S-9 Project this year. Paperwork adjustments to Congress impede research. International issues are becoming more complex. The convention on biodiversity this fall in Buenos Aires will shift from discussions on biodiversity to the benefit sharing concept. It is becoming a political conference. He noted that FAO has conducted a study summarized in the State of the World report **(Appendix #2).** FAO has conducted a Global Action Plan for Plant Genetic Resources requiring an est. $150-300 million dollars. This Plan budgets support for plant breeding programs.

Dr. Shands noted that internationally, there is a struggle for control of genetic resources. We must pay more attention to our own conservation programs. We are trying not to restrict the flow of genetic resources. We are trying to get a multilateral agreement to maintain the status quo of free exchange. How do we deal with private restrictions on genetic resources? How much more complex and difficult will the future of germplasm resources be? High tech varieties are replacing landraces. In the short term, we need to communicate the benefits of free exchange. The fate of international collections are still in doubt. There are material transfer agreements related to the international germplasm centers. The large collections we have gotten from these centers may get linked to germplasm restrictions. For example, the NSSL corn collection from CYMMT may be legally restricted. Eighteen agreements with the former IBPGR have been obliterated by global changes. Pearl millet cannot even be grown in Canada. There are problems related to phytomedicinal products. The future of germplasm may depend on networking of individual scientists.

Dr. Shands noted programmatic changes were coming in ARS - the shape of these changes still in doubt. In summary, our national germplasm resources program is in transition. Dr. Ken Frey has surveyed the germplasm needs of plant breeders nationwide and will present the results of his survey at the Crop Germplasm Committee Chairs Meeting in July at Beltsville, and Dr. Shands will respond to this survey.

6. Activities of the National Germplasm Resources Laboratory

A Report of the National Germplasm Resources Laboratory **(Appendix #3)** is attached. And the Summary of Review Procedure for Plant Exploration Proposals **(Appendix #3a).** No formal report was given.

7. Activities of the National Seed Storage Laboratory

Dr. Loren Weisner, Research Leader of the Seed Viability and Storage Unit, gave the report of the NSSL **(NSSL 1995 Progress Report. Appendix #4).** Dr. Weisner indicated phase-out of greenhouse seed quality evaluations in order to expedite checking in of CYMMT backup materials (wheat, triticale and maize) as well as the University of Arizona Desert Legume Program. The following summarizes from the Report:

Administration. Adjustments were made to accommodate the reality of increased operating costs and no increases in operating funds. Research also improved efficiency. The NSSL Plant Germplasm Preservation Unit showed that seed storage moisture content can be optimized for any given storage temperature by drying to equilibrium at the appropriate relative humidity. This finding eliminates the necessity for wholesale seed moisture evaluations, reducing costs and increasing expected longevity of stored samples.

Agreements have been made with respect to handle international collections, PVP seed specimens, the Desert Legume Program of the University of Arizona (**See Appendix #4**).

Seed Viability and Storage Research Unit. The Unit placed 21, 517 samples into long-term storage and has a backlog of 6000 samples (about one and one-half years behind). A plan has been developed to handle this backlog. A total of 4,223 accessions were distributed to 202 scientists. Cryopreservation progress has been made on apples. Endogenous raffinose plays a unique role as a cryoprotectant during freezing of woody plant tissues. Scarification studies and evaluation of duplication of accessions have been made.

Plant Germplasm Preservation Research Unit. The NSSL will host a symposium, "Seed Biology and Technology: Applications and Advances" on August 13-15, 1997. A number of research projects have been reported, including the finding that there is an optimum water content for seed storage, increasing NSSL efficiency(**see Appendix #4**).

Shands: "How many samples are in quarantine processing?"

Weisner: 3-4000.

Quisenberry: How many accessions are *only* NSSL held?

Weisner: A low number, probably 50,000.

8. Appointment of Committees

The following Committee appointments were made by Chairman La Bonte:

Nominations: David Coffey, Jorge Mosjiidis
Future Meeting Plans: Ken Quisenberry
Resolutions: Gordon Prine, Carlos Ortiz

9. Overview of Unit Activities

PGRCU Director Stephen Kresovich gave an overview of Unit activities (Plant Genetic Resources Conservation Unit (**Appendix 5.1**). This appendix has been organized by curator and assistant curator responsibilities and by order of presentation). Key points are summarized from page 6 of this overview:

1. A fundamental change in the U. S. National Plant Germplasm System occurred in the '80's when the mission changed solely from plant introduction to both introduction and long-term conservation of crop genetic resources. Consequently, at Griffin a tremendous backlog currently exists with respect to regeneration, maintenance, and documentation.

2. Progress at Griffin, though constrained by current funding, is being made on a priority basis, on 1,500 species representing 250 genera.

3. To provide the service needed for long-term conservation and use, significant increases/upgrades in personnel, operating funds, and infrastructure are needed, based on true operating costs and established priorities.

These notes are in addition to Appendix #5: Kresovich noted that the Unit was depending on NSSL for germination tests. (Because of the backlog at NSSL, which also has a flat budget, the consensus toward the end of the meeting was that the Unit needed to do their own germination

tests. See Weisner's comments on germination priorities on the second day.) He noted that the Unit had a 3-year plant to get everything backed up. Quisenberry asked how many duplicates there were in the collection, and Kresovich said that the Unit had not worked through that yet. Jarrett noted that he had all accessions of vegetables under control and prioritized. Kresovich said that a curators' meeting was held every Friday. Regarding distribution, he noted that each curator decides what is a bonafide user. He noted that over 500 oligomers were distributed as molecular markers to profile accessions and map useful characteristics. He noted the budget had been flat since 1988, with an increase in salaries and a parallel decrease in operating funds (page 2). Commodity allotments were not distinguished. Shands noted that the breakdown was not too informative. Kresovich noted that he plans the budget with the curators. He said the allocations followed the allotments established by the national program staff: 20% for grain sorghum, 20% for grain, 20% for peanut, 15% for vegetables, 10% for sweet potato, and 10% for oil seed. He noted that Shands increased funds for regeneration by $50,000. He said that a collective field crew was managed by Jim Strickland. He noted that Georgia contributed more than 100,000 in building costs each year, but the new seed storage and peanut headhouse facilities incurred new utilities costs. He noted that Jarret had enlisted the aid of the private sector (and some public plant breeders) to help increase cucurbits regeneration. Kresovich noted that regeneration is curator-driven, and that many tasks were done by consensus.

LaBonte asked how the research component at the Unit worked. Kresovich noted that most of his people are funded by outside sources. He said that his research runs "autonomously". He mentioned that he was involved in $12 million proposal ($3.5 million for genetic research) with the Georgia system. He noted that the work done in his Lab was primarily "technology transfer", and that most of the people he worked with were the curators. A dialogue ensued among Schnell, Branch and Quisenberry regarding the value of molecular markers in appraising variability and the need for a large collection of sorghum. Schnell perceived a collection replete with uniformity; Quisenberry perceived molecular marker analysis secondary to preservation, growouts and morphological data at this point in the history of the collections. Kresovich stated: "We will never run molecular markers on sorghum indiscriminately." Shands made the comment that core collections are hard to define and reduce without losing important genes. Another dialogue ensued regarding "balance" in the collections. Kresovich noted that the Ames unit has more than $200,000 more than Griffin for growouts and more land, and that they were no longer indiscriminately doing pathogen detection. In response to Kresovich's comment on germplasm unit budgets, Shands put these statistics on the board:

Germplasm Units	Formula	SAES
Griffin	234K	350K
Ames	479	317
Geneva	142	-
Pullman	352	186
Sturgeon Bay	153.5	119.2

10. Curation Activities in Griffin

Peanut: Roy N. Pittman, Curator. (**Arachis Curation Project. Appendix 5.2**). Objectives, Status and Needs of the Project were outlined with respect to acquisition, maintenance, evaluation and distribution of germplasm as well as collaborative activities with Plant Pathology and Tissue Culture Services on *in vitro* preservation and pathogen detection. The core collection of cultivated peanut has been regenerated and is available for distribution. More than 90% of the wild peanut collection is available. More than 84% of the cultivated peanut collection is backed up at NSSL. Five of the wild collection is backed up. Regeneration of

850 accessions in '95 and 1200 accessions of cultivated peanut was accomplished in '96. Long season accessions (primarily wild peanuts) cannot be increased at Griffin. After '96, 300-1000 accessions of cultivated peanuts are anticipated. Regeneration of the wild collection is a ten-year project.

An on-site comments included increased handling efficiencies; quarantines and virus monitoring; current storage life on cultivated peanut (10 years) versus projected storage life at -20C (est 30 years); storage of wild vs. cultivated and value of in vitro methods of storage; value of local accessions; and Brazilian and Ecuadorian collections. The idea of better maintaining a smaller, better-characterized collection was emphasized.

Vigna: A. Graves Gillaspie, Curator, (Plant Pathology and Vigna Curation Project. **Appendix 5.3**). Objectives, Status and Needs of the Project were outlined with respect to acquisition, maintenance, evaluation, and distribution as well as detection, diagnosis and elimination of pathogens on introduced germplasm in collaboration with Plant Pathology and Tissue Culture Services. A core collection of 700 cowpea accessions has been established. The cowpea collection has been bar-coded and many backup samples sent to NSSL. Virus elimination from 80 lines of cowpeas has been accomplished. Regeneration of 36 cowpeas, 50 lines of Bamberra groundnut and 102 mung beans were done. At current funding levels, annual regeneration will stay at about 150 lines in the field and 50-80 in the greenhouse, and the requests of the CGC can be met in a minimum of 10 years. Gillespie noted a crop failure of virus indexed material in St. Croix, daylength requirements and disease have been major problems. Perhaps 10% of the collection won't flower in the long summer days of Georgia. There are 16 known seed transmitted viruses. Serology is being augmented with PCR analysis to improve virus detection. There is minimal distribution of this large collection.

Quisenberry made the comment that "more and more is not better and better", and that there seemed to be an extremely high cost of maintenance and regeneration of accessions so little used. Shands noted that everyone should do an extensive cost analysis of maintaining accessions. Gillespie re-emphasized that there is now a core collection of cowpea.

Clovers and Special-Purpose Legumes. Brad Morris, Curator, (Status of Clover and Special-Purpose Legumes Curation Project. **Appendix 5.4**). Objectives, Status and Needs of the Project were outlined with respect to acquisition, maintenance, evaluation and distribution as well as rescue of low viability seed by tissue culture. These very large and diverse collections consisting of 5378 accessions of 424 species, and considerable demand has been demonstrated for these collections over the past 5-8 years. Curatorial activities were broken down by collections of Trifolium (clover), Cyamopsis, Legumes and Psophocarpus. Sixty-four percent of the seed database of the clover collection is now complete. Regeneration of 100 accessions from legume species has been accomplished, and an *in vitro* protocol for rescue of low viable seed has been developed.

Grasses and Others. Gil Lovell, Curator. (Activity Report to the Technical Advisory Committee S-9 Regional Project. **Appendix 5.5**). Status and Needs of the Project were outlined with respect to acquisition, maintenance, evaluation and distribution. Lovell noted 7,171 accessions of forage and turf, 357 castor, 1,079 sesame, a sorghum and pearl millet collection in Puerto Rico and St. Croix (Jeff Dahlberg, Sorhum Curator), 164 Kenaf and 49 Roselle(Hibiscus species). Not now available for distribution are 1,017 forage and turf grasses, 85 castor, 19 sesame, 2,123 sorghum (total 27,280), and 357 pearl millet (total 527). The 164 Kenaf and 49 Roselle are under review for possible transfer to the Cotton Germplasm Unit at College Station, Texas because they are subject to short days, cross-pollination and frost. Regenerations in '95 and '96 included 235 and 253 forage and turf grass PI's, 7 and 10 castor PI's, 7 and 13 sesame PI's, and 8 and 17 miscellaneous PI's.

Vegetable Crops. Bob Jarret, Curator. (Vegetable Crops Germplasm Maintenance - A Synopsis; Vegetable Crops Germplasm Maintenance - Today and Tomorrow. **Appendix 5.6**) Objectives, Status and Needs of the Project were outlined with respect to maintenance, evaluation and distribution. Jarret noted that Griffin maintains approximately 13,000 vegetable crops accessions including watermelon, squash, okra, luffa, eggplant, sweetpotato and several other species. Eighty watermelon PI's were pre-increased in the greenhouse in '95 for further increase in the field in '97. Adequate space is available in Bryon for watermelon increase. Regeneration of a minimum of 250 watermelon PI's per year is needed to put the collection on a 10 year regeneration cycle. Sixty PI's of squash are being increased collaboratively and ten PI's locally. Clones of 600 and a seed collection of 250 comprise the sweetpotato collection. The UGA-Athens are evaluating 1500 sweetpotato propagules for root characteristics per an SCA. Pepper increases of 40 PI's were made in '95 and '96. In Mexico, an additional 400 PI's are being increased collaboratively. In '95, 240 accessions of eggplant were increased. No okra was increased in either '95 or '96. NCSU is increasing the Luffa collection by agreement.

11. Support Groups

Seed Storage and Database. Merrelyn Spinks, Lee Ann Chalkley, Verlene Byous, Lebus Kilgore, and Paulette Kitchens (Seed Storage/Database Maintenance. **Appendix 5.7**). The objective of this Support Group is to coordinate and conduct seed storage/database maintenance and acquisition/distribution for Unit germplasm activities. Since '95, 6,486 accessions have been backed up at NSSL; 27,927 inventory records have been added to GRIN; 2,132 samples of 7 crops have been rebagged, barcoded and moved to -18C storage; the entire collection (7,819 PI's) of cowpeas and the entire collection of castorbeans have been rebagged and barcoded; inventory records checks have been made on 162,187 records; renovation of the old cold storage facility begun; development of a local area network begun with matching funds from the lottery; and the PGRCU Operations Manual completely revised. Merrelyn Spinks and her support group received national recognition for their work.

Disease Detection and Therapy. Mark S. Hopkins, David L. Pinnow, and Stephanie L. Dunn. (Plant Pathology and Tissue Culture Services. **Appendix 5.8**). The objective of this group is to assist curators with their specific needs pertaining to disease diagnosis and therapy, embryo rescue of seeds with low or no germination, and genetic conservation of germplasm through tissue culture techniques. Activities of the Group have included research on **peanut** (peanut stripe potyvirus testing; cleanup of peanut by shoot tip culture/heat therapy; embryo rescue via embryo axis culture;visual and/or serological examination of quarantined material; culture of rhizomatous peanut collection, serological detection of virus infected plant samples); **cowpea** (testing of six seedborne viruses in seedlings; serological detection of peanut stripe virus in seedlings, serological detection of virus in samples from field increases); **sweetpotato** (indexing of clones for sweetpotato feathery mottle virus and sweetpotato virus disease comples via grafting onto indicator plants;implementing pcr protocol for detection of viruses); **summer legumes** (visual and/or serological seedling screening for field increases and subsequent field screening for virus diseases; embryo rescue); **grasses and miscellaneous** (embryo rescue; in vitro conservation of bamboo).

On-site comments were on *in vitro* maintenance of peanut; geographical locations of peanut collections and ways to sample diversity in the collection to reduce duplication; natural pollination of peanut; bamboo micropropagation; mechanical peanut thresher.

Genetic Analysis. Stephen Kresovich, Unit Director (Applied Genetic Analysis, **Appendix 5.9**). The objective of this group is to apply genetic analysis technologies to improve plant genetic resources conservation and utilization. Status of Activities are listed in Appendix 5.9.

Comments by Kresovich were made in the lab: Lab projects are curator-driven, and major funding is from outside sources. Duplicates have been identified in sorghum using a set of molecular markers with 70% reduction in regeneration concomitant with only 4.6% loss of genetic variability. We attempt to measure loss of genes with molecular markers when the collection is reduced. We attempt to reduce collections to a rational level. Useful phenotypic variation is correlated with molecular markers. There are some exceptions. But consider the phenotypic variation caused by genotype x environment interaction.

12. Call to Order

The S-9 TAC Committee was again called to order by Chairman LaBonte and resumed its activities at 8 am on Wednesday, June 5, 1996.

13. Discussion/Review of Unit Activities

The Minutes of the '95 meeting were approved as written.

Kresovich asked for input. He noted that documentation was provided on all the Curators' efforts. He also noted that, in some cases, regeneration would be down for the next couple of years. Within 2-3 years, Curators will have a data set on which to move forward.

La Bonte: I would have liked to have seen a much more detailed budget. That was what we stressed last time. We wanted to look at the budget and see where the money is going. Particularly, since all states are providing $200- $300,000 a year. The budget outline was skimpy.

Kresovich: For the most part, you have seen (that). Basically, we take out the labor, and then we try to split 15-20 thousand dollars for all other categories amongst PIs's.

Shands: Each Curator should know his costs, specifically the cost per accession. It needs to be broken down from the Curator up instead of top-down.

La Bonte: We (must) have that information to evaluate the efforts.

Branch: I would like to see the budget kept by commodity. The CAC should be aware of any reversal of their decisions. I objected to (lumping the peanut budget) before, and I'm objecting to it again, and I want it noted in the record. From the standpoint of the other Curators, it might be good to have their budgets broken out, too.

Kresovich: It's not my call on that one. We can make recommendations.

Shands: We can't go to nickel-and-dime record keeping. I t's hard to be flexible that way. We do need to know the cost per accession.

Kresovich: This is the first year we went through budget planning in a collaborative way. We can go around the table.

Jarret indicated that he would like more division of the budget.

(There was a general round of discussion on budgets from Curators and a general consensus that things were "ok".)

Kresovich: A labor pool is needed to increase efficiency. In the past the summer employees didn't work out too well. (Asked Jim Strickland, the Labor Manager for input.)

Labor Manager Jim Strickland: There is a better labor force now than previously when more college help was used.

Lovell: I would like more direct control over the labor I need.

Hopkins: Not much change in my case.

Chalkey: More help has been available since the labor pool was instituted.

Spinks: The current setup is ok.

La Bonte: It is reasonable to have a general labor pool, but *how many funds are really directed toward each crop*? We really don't know that.

Kresovich: Ok. Every Curator has at least one assistant. Some have two. How about Ames?

Shands: Ames is consolidating labor forces to manage work better. You can't have people sitting while someone else is working.

Rhodes: How much is each crop consuming in resources?

Kresovich: I will make the accounting system more transparent.

Mosjidis: How much is each crop consuming?

Kresovich: We can do a better job of calculating out regeneration costs. It's going to be interesting.

Quisenberry: The Pullman Unit has a breakdown. If we can contract out more regeneration, we may be able to increase efficiency. Can we get to the point of asking, "Can I do this better by contracting out (regeneration)?"

Kresovich: We must work through costs associated with regeneration. We can do that.

Prine: With regard to reducing numbers in the greenhouse, I urge caution. Some accessions are very hard to replace. If we need to jump-start a breeding program, we need to have the material to do it.

Lovell: I would like to look genus-by-genus at our needs. We need input from experienced scientists to refine our collection.

Quisenberry: What is the potential for *in vitro* conservation with the grasses?

Lovell: So many grasses have proven to be amenable to *in vitro* storage. Our budget limits us and forces us to set priorities.

Branch: I urge caution on eliminating the wild peanut collection. It is the only complete collection in the United States and cost a lot to collect.

Quisenberry: Have there been considerations with respect to turf collection?

Lovell: I will meet with turf grass committees on how to handle this collection.

Quisenberry: Turf is big business. It has high visibility. Forage may take a backseat to turf.

Lovell: The turf industry should support its maintenance.

Quisenberry: Is maintaining sweet potato *in vitro* cost efficient?

Jarret: We need to make some calculations.

Kresovich: Nine species account for 70% of our collections. Flexibility is needed to manage all species.

Prine: I am surprised by the changes in numbers of accessions.

Kresovich: It doesn't surprise me that political pressure increased sorghum numbers.

Branch: We need to hold the line on threatened species against the political pressure.

Kresovich: We need to examine all of our assumptions regarding collections.

Jarret: The eggplant collection has been culled.

Pittman: We need more information on our collections.

Kresovich: Germination tests are increasing. The numbers don't tell the whole story. We started as a PI system. Now we are involved in conservation. We now have a large backlog to work through. Our goal is to back up the 56,000 accessions we are short on.

Branch: We need to move more aggressively with peanut in that direction.

Arkin: With regard to germplasm maintenance, "Assumption is the mother of all screw-ups".

Shands: We still have to put high quality seed in Ft. Collins. DNA sequencing may be strategic in the future. Right now, we have to deal with critical accessions.

Kresovich: How do we make rational decisions without the information we need?

Branch: Do you run germination tests before items go into cold storage?

Kresovich: A lot more documentation is needed.

Lovell: We must make efficient use of what little information we have.

Pittman: We've had to limit our regeneration to local locations. We have two-thirds or more accessions with no information.

Quisenberry: One-third are backed up. What the period of time during this backup? (A long time.)

Weisner: It will take a year or more to get germination data. Our seed are stored at -18C and yours are stored at 5C.

Quisenberry: Again, what was the time period in which the backup was accomplished?

Lovell: Over a long period of time.

Kresovich: We don't really know. Please refer to my "Key Points".

Weisner: If NSSL has 65% regeneration, we don't retest immediately. If the germination if more than 85%, it's ten years. If it is less than 65%, we test periodically. But we do have a backlog now.

Quisenberry: So the recently received germplasm has not yet been germination tested.

Weisner: We are trying to catch up and we have a protocol to do that.

Schnell: So, with respect to many plant collections, you just have a lot of "stuff".

Branch: Not in the case of peanut.

Kresovich: We are trying to prioritize conservation. The TAC is here to help us to prioritize resources. Our numbers don't reflect quality.

Quisenberry: Maybe next year. Curators should provide their status and projections.

Kresovich: Projects are a valid point. "Nickels and dimes" are not the issue; conservation is.

Quisenberry: This information is helpful to CGC's.

Lovell: I f we don't know viability, and the seed are very old, we should regenerate.

Weisner: Just knowing viability will save regeneration. It is the simplest data to get -very necessary.

Kresovich: Should we do more germination?

Weisner: Yes. We're (NSSL) moving too slow. We need viability before regeneration decisions.

(End of Early Morning Session)

Dr. Kresovich introduced Dr. Roger Vries, ARS Southern Director. He noted that he had been a big help in procurement of resources.

Kresovich encouraged the previous frank discussion to continue.

Quisenberry: We need to more response from the user community.

Kresovich: The TAC complements the CGC's. It's important that you (members of the TAC) convey the importance of your organism.

14. Committee Action

La Bonte offered the following **motion:** That the Unit Director provide, at least three weeks prior to the TAC meeting, a curator-derived budget. The objective is to identify costs associated with collections, research, preservation and support activities.

The motion was seconded by Prine.

Kresovich offered a friendly amendment to coordinate budget planning with the fiscal year - this summer or fall.

LaBonte noted that such an action did not affect the amendment.

Branch: We need to act to see that peanut gets a separate peanut budget.

Vries: We need to separate "accounting" from "accountability". Are you getting what you need?

Branch: We have in the past.

Vries: My job is to find the money. The Unit's job is seed. Tell us clearly what you want.

***The Motion passed.* (See Appendix 7)**

La Bonte: So your budget is derived in the fall?

Kresovich: Oct 1-Sept 30.

Vries: The budget proposal is known. It is the same as this year. And the same for Griffin. But Congress hasn't passed it. The best case scenario for Griffin is the same budget next year.

Quiesenberry: With regard to the -20C freezer, as Shands asked, are you putting in moveable shelves?

Weisner: A backup generator is important. But redundancy in compressors is even more important. Repair parts are seldom if ever available immediately.

Kresovich: Your point is well taken.

Quiesenberry: The TAC is out of the loop with regard to plant exploration.

Branch: Not so.

Kresovich: I haven't seen many explorations rejected.

Quiesenberry: Curators should know if a trip is planned regarding their project.

Kresovich: I will communicate your concern to Ned Garvey.

La Bonte: We have less than 50% representation here in the TAC. What can we do to get involvement from all the states?

Kresovich: I can go to Arkin.

La Bonte: It is incumbent on Arkin to move Directors of the AES's to get better representation. I will write a letter to Arkin.

15. Committee Reports

Coffey reported the results of the Committee work.

The Nominations Committee (Coffey) nominated Bill Rhodes of Clemson University for Chair and Thomas Stocker of North Carolina State University for Secretary of the '97 meeting. The nominations were approved. (**See attached letter from La Bonte to Stocker, Appendix 6**).

The Future Meeting Plans Committee. Quiesenberry noted Item 7 of last year's minutes: "Committee at Griffin most years." On that basis he moved to meet again in Griffin in '97. A motion was made for a combined meeting in Ames in '98. The motion on meeting sites for '97 and '98 was seconded and passed. It was decided to try to meet the first week in June in Griffin and the second week in July in Ames (**See Appendix 8**), and to keep the meeting as short as possible.

The Resolutions Committee Report. Gordon Prine and Carolos Ortis.

1. The S-9 Technical Advisory Committee (TAC) expresses our thanks to Gerry Arkin for his leadership as Administrative Advisor, his welcome to the Georgia Experiment Station and use of the facilities of the Georgia Experiment Station.

2. The S-9 TAC also expresses thanks to Stephen Kresovich and Curators and Staff members of the South Atlantic Region Plant Genetic Resources Conservation Unit for being good hosts and giving us informative reports and greenhouse, laboratory and field tours.

3. The S-9 TAC expresses thanks to Henry Shands and the National Plant Germplasm Staff and other USDA workers for their valuable reports and information on the current status of the Plant Introduction germplasm program.

4. Let it be resolved to thank Don La Bonte and Bill Rhodes for their service to the S-9 TAC as Chairman and Secretary, respectively.

5. Congratulations to Bill Rhodes and Tom Stalker for their selection as new Chairman and Secretary of the S-9 TAC.

15. Adjournment

ANNUAL REPORT OF COOPERATIVE REGIONAL PROJECTS

Supported by Allotments of the Regional Research Fund,
Hatch Act, as Amended August 11, 1955
January 1 to December 31, 1996

PROJECT: Regional Research Project S-009

Plant Genetic Resources Conservation and Utilization

COOPERATING AGENCIES AND PRINCIPAL LEADERS:

State Agricultural Experiment Station Representatives

AL	J.A. Mosjidis*	NC	W.T. Fike*
AR	T.E. Morelock*	OK	J. Kirby*
FL	G.M. Prine*	PR	C.E. Ortiz*
GA	W.D. Branch*	SC	B.B. Rhodes* (Secretary)
HA	P.J. Ito*	TN	D.L. Coffey*
KY	N. Taylor*	TX	F. M. Hons*
LA	D. LaBonte* (Chair)	VA	R.E. Veilleux*
MS	C.E. Watson*		

Administrative Advisor G.F. Arkin

U.S. Department of Agriculture

Co-Administratve Advisor, ARS	R.G. Breeze
National Genetic Resources Program, ARS	H.L. Shands
National Germplasm Resources Lab, ARS	A.K. Stoner*
National Seed Storage Lab, ARS	S.A. Eberhart
NCGR-Subtropical Horticultural	R.J. Schnell
NCGR-Tropical Fruit, ARS	F.T. Zee
Tropical Agricultural Res. Stn., ARS	F. Vazquez
Northern Regional Res. Center, ARS	T. Abbott
Cooperative State Res., Edu., and Ext. Serv.	D. A. Sleper
Soil Conservation Service	H.W. Everett*

Plant Genetic Resources Conservation Unit
Cooperative ARS and SAES

Regional Coordinator	S. Kresovich
Research Plant Pathologist	A.G. Gillaspie, Jr.
Research Horticulturist	R.L. Jarret
Curator, Agronomist	G.R. Lovell
Curator, Agronomist	J.B. Morris
Curator, Agronomist	R.N. Pittman

* Indicates voting member of the Technical Committee

PROGRESS OF WORK AND PRINCIPAL FINDINGS:

Genetic resources representing over 1,200 new accessions were received, increasing the Unit holdings to in excess of 78,000. New introductions represented a broad range of genera and species. Over 7,500 seed regenerations were accomplished at Griffin or through cooperators across various sites. In response to more than approximately 1,000 requests, more than 35,000 distributions were made (approximately 90% were supplied to domestic users). Over 300 oligomers were distributed as molecular markers to profile ('type') accessions and map useful characteristics. In complement, enhanced effort on database development of the Germplasm Resources Information Network (GRIN) occurred.

In collaboration with crop experts, evaluation studies were conducted on morphological and agronomic/horticultural traits in forage legumes, grasses, sorghum, peanut, watermelon, and pepper. Associated characterizations were conducted in all regenerations by all curators.

Various genetic analysis techniques (PCR-based), *i.e.*, RFLPs, RAPDs, AFLPS, and SSRs, are being applied to established genetic identity, relatedness, and structure of accessions held in *ex situ* plant genetic resources repositories in the U.S. (work focused on holdings from Griffin, Mayaguez, Ames, Miami, and Geneva Based on our experiences to date, we have improved efficiency, simplified protocols, increased the level of automation, and deceased the unit costs of each assay. This genetic analysis is conducted in collaboration with Pioneer Hi-Bred International, Perkin-Elmer, AgraTech Seeds, and Linkage Genetics.

Significant effort went to infrastructure improvement during 1996. Renovation of seed storage facility was completed. Computer hardware, software, and peripherals were purchased for installation. The local area network is the final stage of completion and all staff will be on line by Spring 1997. To support controlled pollination efforts, and addition 55 cages were purchased and will be used for 1997 regenerations of vegetable and annual forage legumes.

USEFULNESS OF FINDINGS:

Results obtained via collaborative efforts among scientists at the regional repository, federal laboratories, state agricultural experiment stations, and industry are mutually beneficial as sources of information and products for all. Through the efforts at the repository, broad genetic representation of crop plants and their weedy/wild relatives is maintained for ready access. Cooperators identifying desirable traits among accessions aid in crop improvement efforts to produce a higher quality product more efficiently and in an environmentally safe manner. Information gained from cropping system studies of potential new crops may lead to greater diversification of agriculture in the southeastern United States.

STATEMENT OF ACCOMPLISHMENTS:

Over the past four years, approximately 120,000 seed packets were distributed to public- and private-sector scientists. Eighty percent of the distributions were made to researchers in the U.S. These requested and evaluated genetic resources included traits used for incorporating disease resistance, insect resistance, and quality factors to recently released lines of sorghum, peanut, watermelon, cowpea, and pepper among other commodities. Documentation of these desirable traits and other related characters can be accessed through the GRIN (Germplasm Resources Information Network).

WORK PLANNED FOR NEXT YEAR:

Continued emphasis will be placed on regeneration and documentation efforts. Molecular marker development research will focus on applications in the sorghum, peanut, sweet potato, and vegetable crops collections. Pathology research will center on characterization and assay development for viruses of legumes.

PUBLICATIONS:

See attachment.

APPROVED:

Chair, Technical Committee	Date
Administrative Adviser	Date

PUBLICATIONS

Alabama

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National Germplasm Resources Lab

No publications.

National Seed Storage Laboratory

No publications.

NCGR-Subtropical Horticultural Res. Stn., ARS

No publications.

Northern Regional Res. Center, ARS

No publications.

Tropical Agricultural Research Station, ARS

No publications.

USDA-Soil Conservation Service

No publications.

USDA-CSREES

No publications.

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National Program Staff Report
June 4, 1996
Henry L. Shands

Budget. The FY 1996 budget had a $750,000 increase for plant germplasm that did not clear the markup process. The Brownwood, TX repository will be consolidated at College Station, Texas, where much of the collection has been relocated and with no loss of funds for the repository. Backup collections from Miami will be continue to be located to Mayaguez, Puerto Rico, or Hilo, Hawaii, as appropriate.

The FY 1997 President's budget has a $1,500,000 increase for plant germplasm. Congressional Conference action will be taken later this summer.

Germplasm funding:

Activity (STP Codes)	FY 1994	FY 1995	FY 1996
Acquisition 2111,2112	$4,453,600	$4,097,200	$3,855,100
Preservation 2113	12,266,900	12,559,325	12,732,100
SUB-TOTALS:1/	16,720,500	16,656,500	16,587,200
Characterization 2114	3,782,600	3,377,300	2,900,100
New Crops 2115	309,400	---	---
TOTALS:	20,812,500	20,073,800	19,487,300

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 September 18-19, 1995, and February 14-15, 1996, Washington, D.C., under the leadership of Chair John Barton and Vice Chair Richard Lower. The Council examined cryopreservation in insects, aquaculture, and the status of potato late blight in the September meeting. In the February meeting, the Council looked at development of a strategic plan and management of the program by ARS and made four recommendations[2] to Deputy Secretary Rominger who responded positively. However, with the departure of Under Secretary Stauber, resolution will be left to Acting Under Secretary Catherine Woteki.

Convention on Biological Diversity. The issue of access to genetic resources and Farmers' Rights will be addressed at the Conference of the Parties-III (COP-III) in November at Buenos Aires. This will include an FAO report on the status of the renegotiation of the International Undertaking which has had no action since the COP-II in Jakarta, Indonesia.

FAO Commission on Plant Genetic Resources and the Fourth International Technical Conference on PGR. The FAO will sponsor the 4th International Technical Conference on Plant Genetic Resources in Leipzig, Germany from 17-23 June 1996. Dr. Cary Fowler is the Conference Secretary for Leipzig from FAO. The meeting's objective is to present a report on the State of the World's Genetic Resources and a Global Action Plan (GPA) for Plant Genetic Resources
to a high-level conference. The delegates will continue to debate and shape the language of the GPA at Leipzig after a workgroup spends 3 days in the preceding week at Rome trying to reconcile

comments provided by countries after a one-week Extraordinary Meeting of the Commission on Genetic Resources for Food and Agriculture (CGRFA). The Commission was renamed to recognize its broadened mandate given by the FAO Conference in November 1995.

The Sixth Session of the Commission was held June 19-30, 1995 to begin renegotiating the International Undertaking on Plant Genetic Resources. The result could be another voluntary agreement, a binding treaty, or a protocol to the Convention on Biological Diversity. In any case, it will bring change to how we exchange germplasm and how we deal with other countries for collecting. The session resolved little. It added bracketed material which will be futher addressed in early December, 1996. The key issues for the debate are access to genetic resources, scope of species covered, and sharing of benefits (to enable access).

1996 Beltsville Symposium. The 1996 Beltsville Symposium on Global Genetic Resources: Access, Ownership and Intellectual Property Rights, was held May 19-22. It was co-sponsored by the Beltsville Area and the Association of Systematics Collections. It focused on plants and microbes, in particular. Attendance was approximately 250 with 14 countries represented. Discussion was excellent and the speakers and audience brought the current international dialogue to the floor. Paul Raeburn (author of The Last Harvest; also see May 1996, Popular Science) was a media panel member. Panel conclusion: Scientists have not made a compelling case to the public for genetic resources.

Crop Germplasm Committee Chairs Meeting. The Chairs of the Crop Germplasm Committees will meet July 15-16, 1996 at Beltsville, Maryland with ARS Program Staff and NPGS curators and support services personnel. All CGCs are updating their group's summary of germplasm needs for acquisition, evaluation, and enhancement. Dr. Ken Frey will be presenting the results of his plant breeding survey.

Personnel. The National Program Leader position is now on hold as ARS examines it structure and headquarters budget.

RECOMMENDATIONS of NGRAC to Deputy Secretary Rominger:

1. A standing, interagency committee within USDA should be appointed of agency heads and/or their empowered designees to be responsible for assisting the Director of the NGRP in coordinating their agencies' roles in the NGRP and for those genetic resource conservation activities, including forestry, microbial, and aquatic organisms, whose management greatly transcends the Department. These persons should specifically seek to develop understanding of all government and private activities in these areas as a basis for defining effective Department activity.

2. To assist in coordinating this program, the Department should create an annual crosscutting budget compilation of all Department expenditures on genetic resources conservation as part of the NGRP. This total should be made public, and its breakdown should be made available to the National Genetic Resources Advisory Council after the budget has been presented by the President to the Congress.

3. The U.S. Department of Agriculture should, through the Agricultural Research Service (ARS), define and implement a new overall goal or objective (supplementing ARS' existing seven overall goals or objectives) on the conservation of genetic resources in order to provide programmatic and budgetary emphasis for this important area.

4. A person, perhaps on loan from a university or detail, should be appointed on a short-term (6 months to 1 year) basis to assist the Director of the NGRP in completion of a strategic plan and development of procedures for management and coordination of the program. Among the issues to be explored by this person are the development of an operational subcommittee structure dealing with specific categories of genetic resources and the structure of the communications and database systems for germplasm and genomic information. This person should be directed to consult with the National Genetic Resources Advisory Council.

Appendix No. 2
S-9 TAC 1996

CPGR-6/95/11
April 1995

Item 7.2 of the Provisional Agenda

COMMISSION ON PLANT GENETIC RESOURCES

Sixth Session

Rome, 19 - 30 June 1995

OUTLINE OF THE GLOBAL PLAN OF ACTION FOR THE CONSERVATION AND SUSTAINABLE UTILIZATION OF PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE

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OUTLINE OF THE GLOBAL PLAN OF ACTION FOR THE CONSERVATIONAND SUSTAINABLE UTILIZATION OF PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE

I. INTRODUCTION

1. The FAO Conference, at its Twenty-sixth session, agreed that a Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture should be developed within the context of the Global System (1). At its Twenty-seventh session, the Conference agreed that this should be done through a country-driven process in preparation for the Fourth International Technical Conference on Plant Genetic Resources, which will be held in Leipzig, Germany in June 1996. The Commission on Plant Genetic Resources, which provides guidance on the preparatory process, requested, at its first extraordinary session in November 1994, that an outline of the Global Plan of Action be prepared for its consideration at its sixth regular session. This discussion paper has been prepared by the Secretariat in response to that request.

(1) See Document CPGR-6/95/4

2. The outline presented here provides a framework for the preparation of the Global Plan of Action, and provides indicative examples of its possible contents. It is not intended that this outline prejudge the outcome of the country-driven preparatory process. The final form and content of the Global Plan of Action will depend on inter alia : deliberations of the Commission on Plant Genetic Resources and its Working Group, the content of Country Reports on PGR; sub-regional synthesis reports and the outcome of sub-regional and regional meetings; and commissioned studies and scientific consultations.

II. BACKGROUND

3. In line with the aims and strategy of the Fourth International Technical Conference and its preparatory process, as endorsed by the FAO Conference at its twenty-seventh session in 1993, the Global Plan of Action for Plant Genetic Resources (GPA/PGR) will complement and draw upon the Report on the State of the World's Plant Genetic Resources (SW/PGR) (2). Building upon the skeleton programme of action in Agenda 21, it will:

(2) An outline of the Report on the State of the World's Plant Genetic Resources is provided in document CPGR-6/95/10 for consideration by the Commission

- i) propose polices and strategies for the conservation and utilization of plant genetic resources for food and agriculture at the national, regional and global levels, with particular attention to the linkages between conservation programmes, and utilization capabilities and programmes;

- ii) assist countries in elaborating plans or programmes of priority action for conservation activities at the national level;

- iii) assist countries in strengthening national capabilities for utilizing plant genetic resources, and their national plant breeding and seed production capacities;

- iv) propose appropriate and feasible measures to make the Global System for Plant Genetic Resources more effective; and

- v) include costed programmes, projects and activities, to be financed by an international fund and other mechanisms.

4. At its first extra-ordinary session in 1994, the Commission on Plant Genetic Resources emphasized the importance of support for sustainable utilization of plant genetic resources as a major objective for the Global Plan, in addition to support for their conservation. Other suggested elements for the Global Plan of Action included training and the transfer of technology. In all these activities, the Commission stated that particular attention should be given to supporting farmers and their communities directly (3).

(3) CPGR/94/Ex1/REP. This is consistent with Resolution 5/89 on Farmers' Rights.

III. OVERALL STRUCTURE OF THE GLOBAL PLAN OF ACTION

5. It is proposed that the Global Plan of Action would consist of a preamble, three major parts and an annex:

- The Preamble might be in the form of a Declaration which would set the tone for the Global Plan of Action. The Fourth International Technical Conference might adopt a Declaration which would provide a brief statement recognizing the importance of plant genetic resources and the need for action to ensure their conservation and sustainable utilization. The Declaration would be concise and over-arching. It might be a few paragraphs or a few pages. The Declaration might emphasize links with food security and/or sustainable agriculture (4).

(4) Such a Declaration might refer to the invaluable nature of plant genetic resources as the basis for sustained and increased food production, and the need to improve the utilization of these resources for such purposes. It might also refer to the need to maintain genetic diversity as a means of adaptation to future environmental or socio-economic changes, and the consequent moral imperative of conserving resources/diversity for future generations. It might acknowledge the roles played by generations of farmers, farming communities and indigenous populations in conserving, utilizing and improving plant genetic resources, as well as the role of scientific plant breeding. It might note that the benefits derived from the use of plant genetic resources are not fully appropriated by those who manage, use and conserve them, and therefore mechanisms are needed to correct this situation, in the interests of both equity and conservation.

- Part I: A Framework for Action: This part would provide the rationale for the Plan. It would include the following elements (further details are provided below):

  - Section A: a statement of overall aims;

  - Section B: a statement of principles;(The aims and principles would probably be derived from existing instruments such as the Convention on Biological Diversity and the International Undertaking on Plant Genetic Resources);

- Section C: a strategy to be considered in the implementation of the Global Plan
- Section D: the major areas of action of the Global Plan;
- Section E: lists of criteria and priorities for the allocation of funds to programmes and projects; and
- Section F: an indicative budget.

- Part II: Details of activities: This part would provide details of activities required to meet the objectives of the Global Plan of Action. It would constitute the main technical body of the Plan. The activities would follow logically from the recommendations of the Report on the State of the World's Plant Genetic Resources according to the Framework for Action. Ideally, the following information would be given for each of the main areas of activity defined in Part I:
  - Basis for the activity: statement of the problem; summary of relevant conclusions from SW/PGR; and relevant recommendations from Agenda 21 etc.;
  - Activity: specific objectives; approach; statement of assumptions; sub-activities; and expected benefits;
  - Implementation of the activity: priority level and resource allocation; and list of indicative projects and costings
- Part III: Policy Recommendations: This part would provide policy recommendations required, in conjunction with the Activities of Part II, to meet the objectives of the Plan. Policy recommendations are required because project and programme activities aimed at promoting the conservation and sustainable utilization of plant genetic resources will ultimately be successful only if the external policy environment is favourable. Policy recommendations would be drawn up on the basis of guidance by the Commission on Plant Genetic Resources, the conclusions of the Report on the State of the World's Plant Genetic Resources, inputs from the Country Reports and Regional or Sub-regional meetings, and other inputs.
- Annex: A provisional project portfolio with indicative projects and programmes would be provided. Depending on the preparatory process, actual projects or programmes might be proposed for the Global Plan of Action. Some of these projects might have financing secured, others may require financing to be secured. Once the Global Plan of Action has been adopted and financial resources made available, this would, be replaced by an agreed portfolio, assembled from the set of Activities (Part II) by the appropriate decision making body, according to the agreed criteria and priorities.

IV. CONTENT OF PART I OF THE GLOBAL PLAN OF ACTION

6. At this stage of the preparatory process, detailed proposals are made only for Part I of the Global Plan of Action: "Framework for Action" which provides the policy context for the Plan including aims, strategy, priorities and criteria as well as indicating its major areas of activity.

(A) Framework for Action: Aims

7. This would be a general statement of broad aims. The Global Plan of Action should be consistent with the Convention on Biological Diversity and with the International Undertaking (5).

(5) With respect to the International Undertaking, special attention might be given to the FAO Resolution 5/89 on Farmers' Rights, annex two of the Undertaking, which endorses the concept of Farmers' Rights (Farmers' Rights mean rights arising from the past, present and future contributions of farmers in conserving, improving, and making available plant genetic resources, particularly those in the centres of origin/diversity. .....) in order to:

(a)ensure that the need for conservation is globally recognized and that sufficient funds for these purposes will be available;

(b)assist farmers and farming communities, in all regions of the world, but especially in the areas of origin/diversity of plant genetic resources, in the protection and conservation of their plant genetic resources, and of the natural biosphere;

(c)allow farmers, their communities, and countries in all regions, to participate fully in the benefits derived, at present and in the future, from the improved use of plant genetic resources, through plant breeding and other scientific methods.

8. The aims might therefore include elements such as:

- to promote the conservation of plant genetic resources for food and agriculture (PGRFA) as a basis for food security;
- to promote better utilization of PGRFA, in order to promote development and to reduce hunger and poverty in developing countries;
- to ensure a better sharing of the benefits derived from PGRFA with the countries, farmers and communities which supply such PGRFA, through improved utilization, including through plant breeding, and through other means;

and, in order to meet these objectives:

- to mobilize the necessary financial resources;
- to facilitate access to PGRFA and to related technologies.

(B) Framework for Action: Principles

9. This section would include the principles on which the Plan is based. Like the statement of aims, to a large extent these would probably be drawn from the Convention, (in particular its preamble) as well the International Undertaking.

10. The following elements might be included:

- recognition of the value of PGRFA (intrinsic, ecological, genetic, social, economic, scientific, educational, cultural, recreational and aesthetic); importance for global, national and local food security and for sustainable development;
- reaffirmation of state sovereign rights over their own genetic resources, and state's responsibility for conserving their PGRFA and for using them in a sustainable manner;
- reaffirmation of the precautionary principle: the need to anticipate, and react effectively to the causes of significant genetic erosion;
- recognition of interdependence of countries for essential PGRFA and common concern of

humankind for their conservation and sustainable utilization;

- recognition of the importance of, and the need to promote, international, regional and global cooperation among States and intergovernmental organizations and the non-governmental sector;

- acknowledgment that the provision of new and additional financial resources and appropriate access to relevant technologies required especially to meet the needs of developing countries;

- endorsement of the concept of Farmers' Rights (Farmers' Rights mean rights arising from the past, present and future contributions of farmers in conserving, improving, and making available plant genetic resources, particularly those in the centres of origin/diversity);

- recognition of the close and traditional dependence of many indigenous and local communities embodying traditional lifestyles on PGRFA, and the desirability of sharing equitably benefits arising from the use of relevant traditional knowledge, innovations and practices;

- recognition also of the vital role that women play in the conservation and sustainable use of PGRFA and affirming the need for the full participation of women at all levels of policy-making and implementation for PGRFA conservation and utilization.

(C) Framework for Action: Strategy

11. This section would define the overall strategy for the implementation of the Global Plan of Action. The overall strategy would be in line with the principles of the Framework for Action and on the basis of an analysis of the current situation as provided in the Report on the State of the World's Plant Genetic Resources, taking into account opportunities and limitations identified in the Report (6).

> **(6) Implementation of the Global Plan of Action, at any point in time, is limited by the capacity of human resources and institutions and by the available technical and scientific methods. These would have been assessed in the Report on the State of the World's Plant Genetic Resources, and would be referred to here. Of course, expansion of human and institutional capacities through training and capacity building, and development of technical and scientific methods through research would be major modalities of the Global Plan of Action. Nevertheless, implementation at any point in time will be limited by existing capacities at that time.**

12. Such an overall strategy might include the following elements:

- (1) a country-based approach emphasizing action at the national and community levels where possible, including through capacity building, with complementary action - mainly coordination - at the international level;

- (2) conservation for development, emphasizing actions which strengthen synergistic links between utilization and conservation. (This might be promoted inter alia, through identifying and overcoming obstacles to greater use of conserved PGRFA; and integrating PGRFA conservation into strategies for plant breeding and seed production and distribution;

- (3) access and exchange, emphasizing actions which facilitate access to and exchange of plant genetic resources for food and agriculture and related technologies and information at community, national, regional and world levels as appropriate. (This approach to be coupled with fair and equitable sharing of benefits with the providers of PGRFA and related technologies and information);

- (4) participatory approaches emphasizing actions which enhance the participation of farmers,

plant breeders and other relevant users of PGRFA through the inclusion of formal and informal sectors in the processes of implementing the Global Plan of Action;

- (5) decentralization and rationalization, emphasizing actions which promote, as appropriate, the decentralization of activities towards countries and the level of the user, and rationalization of activities to improve efficiency and reduce duplication.

(D) Framework for Action: Major areas of action and specific objectives

13. This section would outline the major areas of action of the Global Plan. To a large extent, these activities would follow from the aims and strategy. However, the activities would also be determined as a result of the country-driven process, and from the Report on the State of the World's PGRFA, taking into account the existing international consensus, such as that achieved in UNCED (Agenda 21 Programme area 14G: "The Conservation and Sustainable utilization of Plant Genetic Resources as part of the Chapter "Sustainable Agriculture and Rural Development") and the Commission on Plant Genetic Resources, as well as inputs such as the Global Initiative for the Security and Sustainable Use of PGRFA (of the Keystone Dialogue Series), recommendations of the US National Academy of Sciences Study on Managing Global Genetic Resources and other sources.

14. An indicative list of the major areas of action is provided below:

- i) monitor genetic diversity and erosion and establish an early warning system in order to mitigate loss of genetic resources, and identify sites for collecting or in situ conservation;
- ii) explore and collect important and/or threatened plant genetic resources;
- iii) ensure the long-term safety of existing germplasm collections through a programme of regeneration and safe duplication;
- iv) establish and/or strengthen germplasm conservation facilities, technologies, and programmes as part of an integrated conservation and utilization strategy;
- v) characterize, evaluate and document germplasm collections;
- vi) identify and strive to overcome the obstacles for the utilization of conserved genetic resources in order to promote their use;
- vii) develop methodologies for and promote on-farm and community-level conservation and use of plant genetic resources as part of an integrated conservation and utilization strategy;
- viii) promote the in situ conservation of wild plants as part of an integrated conservation strategy;
- ix) strengthen plant breeding capabilities, utilize greater diversity in plant breeding and promote approaches to plant breeding which promote the maintenance of diversity;
- x) improve the availability of good quality seeds and other planting material to farmers, including through the development of appropriate technologies;
- xi) improve conservation and utilization of under-utilized species and local crop and promote crop diversification;
- xii) facilitate access to plant genetic resources, information and technologies;
- xiii) promote the development of legal and other mechanisms to protect the rights of providers of germplasm;

- xiv) develop methodologies for the economic valuation of plant genetic resources and for the realization of these values;

- xv) promote national and regional planning for the conservation and sustainable utilization of plant genetic resources and integration with planning for sustainable agriculture;

15. Specific, concrete objectives would be developed for each area of activity. As far as possible, these would be formulated so that they could be used to monitor and assess the progress of the Plan. Details of the activities would be developed in Part II of the Global Plan of Action.

16. For each of the major areas of activity, various modalities of implementation would be employed, including:

- (a) National Capacity Building and Development, including training and other forms of human resource development, institutional development, and physical capacity building. In accordance with the Convention on Biological Diversity, and with recommendations of the Commission (7), the main level for implementation of the GPA would be at the national level, including action taken at the level of the community, farm etc. This modality would include material support to national programmes and technical assistance to countries. It might include a specific allocation for action at the Community level.

  (7) The Commission agreed at its fourth session, that the Global plan of Action would be a global framework for local, national and regional activities, to be implemented by national institutions, supported, when appropriate, by FAO and other intergovernmental, as well as non-governmental institutions.

- (b) Support to Sub-Regional and Regional Networks and Cooperation. This modality would include material support and technical assistance provided on a regional or sub-regional basis, including the strengthening of networks and other cooperative arrangements.

- (c) International Cooperation and Coordination. Whilst the emphasis of the Global Plan of Action would be at the local, national and regional levels, a certain amount of international coordination is required. This stems in part from factors such as the interdependence of countries for access to PGRFA and the nature of PGRFA as a global public good. Such activity might include mechanisms to facilitate the exchange of germplasm, information and technologies, as well as activities such as global programmes to ensure regeneration and safe duplication of ex situ collections. The Global System for the Conservation and Utilization of Plant Genetic Resources might provide the framework for international coordination including through components such as the World Information and Early Warning System and the International Network of ex situ Collections.

- (d) Policy formulation and implementation. Policies might need to be developed both for the national and international levels in order to promote conservation of genetic resources, transfer of technologies etc.

- (e) Scientific, Socioeconomic and Legal Research. The field of PGRFA is advancing rapidly both in technical/scientific areas, and in policy/legal matters. Further research may be warranted as part of the Global Plan of Action in order to improve the tools available for the conservation and sustainable utilization of PGRFA.

(E) Framework for Action: Criteria and priorities for allocation of funds

17. This section would contain agreed criteria and priorities for funding of activities as part of the Global Plan of Action. Projects would be constituted from the list of Activities proposed in Part II according to these criteria and priorities.

18. The following criteria are provided as indicative examples. They are largely derived from the criteria and priorities for funding as agreed by the first Conference of the Parties of the Convention on Biological Diversity (8).

> **(8) Policy, strategy, programme priorities and eligibility criteria for access to and utilization of financial resources, UNEP/CBD/COP/1/17, Annex I.**

All projects and programmes should be one of two types:

EITHER they should have an integrated approach (including institutional and human capacity building, promotion of national strategies, policies and plans for priority action, socio-dimensions such as those related to poverty alleviation) addressing both conservation and utilization

OR they should address clearly identified factors which limit the conservation and sustainable use of PGRFA, or address emergency situations.

Additionally, where appropriate, projects should:

- promote the conservation and/or sustainable use of indigenous species in the centres of origin and other areas of high diversity in PGRFA;
- promote the conservation of and sustainable use of PGRFA in environmentally vulnerable areas such as arid and semi-arid and mountainous areas;
- identify PGRFA of actual or potential socio-economic importance under threat and processes which threaten such PGRFA;
- strengthen the conservation, management and/or sustainable use of PGRFA under threat;
- promote the sustainability of project benefits;
- include innovative measures, such as economical incentives, aiming at conservation and/or sustainable use of PGRFA (including measures which assist developing countries to address situations where opportunity costs are incurred by local communities and measures to identify ways and means by which these can be compensated);
- strengthen the involvement of local and indigenous people in the conservation and sustainable use of PGRFA (including, where appropriate through the involvement of local non-governmental organizations and community organizations, and with particular attention to the role of women in PGRFA conservation and use);
- have national priority status and contribute to fulfilling the obligations of the Convention on Biological Diversity and the International Undertaking;
- offer a potential contribution to experience in the conservation of and sustainable use of PGRFA which may have application elsewhere;
- contribute to building cooperation at-the sub-regional, regional and international levels;
- promote utilization of local and regional expertise;
- promote cooperation for joint development of, access to, and transfer of technology;
- encourage scientific excellence;

- provide access to other International, national and/or private sector funds and scientific and technical cooperation.

- 19. Priorities might also be set for species and for areas of diversity. More detailed lists of priorities would be provided for each activity area in part II.

- 20. The Global Plan of Action will be implemented over a number of years, and be updated periodically. The Plan would take account of the fact that activities vary in urgency, as well as in importance as well as in their total resource requirement. For instance, some activities such as characterization might require a large amount of financial resources over the first, say, five or ten year period, in order to deal with the "back-log" of samples. In subsequent periods however, lower levels of financial support might be required for such activities on a routine basis. On the other hand, for activities such as on-farm conservation, where a substantial period of research might be required before any large scale introduction of projects is justified, a gradually increasing demand for financial resources might be required and planned for.

(F) Framework for Action: Indicative Budget

21. This section would include an indicative budget for the main elements of the Global Plan of Action (9). More detailed costings would be included for each activity in Part II. Various budget options might be presented, pending final agreement on the amount of financial resources which will be made available.

(9) The Commission agreed at its fourth session, that the Global plan of Action should include a general budget, as well as priority programmes and projects.

22. At least to some extent, the implementation of the Global Plan of Action will depend on the availability of net additional financial resources. The Global Plan of Action should, therefore, be accompanied by a Statement or Agreement on Financing (10).

(10) Whilst the requirements for financing might, in part, be determined by the costing of the Global Plan of Action, the magnitude of the net additional resources available might be influenced or determined by the negotiations between countries on the revision of the International Undertaking. The Statement or Agreement on Financing would, therefore, constitute one link between the Global Plan of Action and the revised Undertaking.

V. FINANCIAL AND INSTITUTIONAL ARRANGEMENTS FOR THE IMPLEMENTATION OF THE GLOBAL PLAN OF ACTION

23. The basis of the financial and institutional arrangements required for the implementation of the Global Plan of Action have been agreed previously by the Commission on Plant Genetic Resources and endorsed by the FAO Conference through FAO Resolution 3/91 and related decisions (11). However the final arrangements will have to be negotiated and agreed between countries, perhaps in the context of the negotiations for the revision of the International Undertaking, currently underway through the Commission. Were the International Undertaking to become a protocol of the Convention on Biological Diversity, the financial and institutional arrangements of the Global Plan of Action might then be linked, in some way, to the financial and institutional arrangements of the Convention. Document CPGR-6/95/9 explores legal and institutional matters related to the revision of the International Undertaking.

(11) Through Resolution 3/91, annex 3 to the International Undertaking, FAO Conference endorsed (.....):

that Farmers' Rights will be implemented through an international fund on plant genetic resources which will support plant genetic conservation and utilization programmes, particularly, but not exclusively, in the developing countries; that the effective conservation and sustainable utilization of plant genetic resources is a pressing and permanent need, and, therefore, the resources for the international fund as well as for other funding mechanisms should be substantial, sustainable and based on the principles of equity and transparency; that through the Commission on Plant Genetic Resources, the donors of genetic resources, funds and technology will determine and oversee the policies, programmes and priorities of the fund and other funding mechanisms, with the advice of the appropriate bodies.

The Commission also agreed, at its fourth session in 1991, that implementation of Farmers' Rights be based on a scientifically sound Global Plan of Action.

24. Without prejudice to future decisions regarding financial and institutional arrangements for the Global Plan of Action two components can be identified in line with FAO Resolution 3/91 (Chart 1).

- a financing mechanism. As noted above (para 23), it is expected that the implementation of the Global Plan of Action would require both net additional financial resources as well as re-allocation of some existing resources. According to Resolution 3/91, funding should be "should be substantial, sustainable and based on the principles of equity and transparency". Therefore the implementation of the Plan will require an agreement on financing, either in the context of the revised International Undertaking, if agreement on this is reached in time, or through an independent Statement on Financing (12).

(12) A number of possible sources of funding for the GPA/PGR might be identified. Some of these might be accessed on an ad hoc basis, others after negotiations in the Commission on Plant Genetic Resources including those on the revised International Undertaking, and in the Conference of the Parties for the Convention on Biological Diversity. Amongst possible sources might be included funds from the Global Environmental Facility (whether or not formally linked to the Convention), and other Existing bilateral and multilateral financing and reallocation of existing bilateral and multilateral financing, new bilateral and multilateral financing developed through the negotiations in the Commission including those on the revised Undertaking and the ICPPGR Process; domestic expenditure including funds released through the reallocation of existing budget as well as new resources, and finally funds generated through new mechanisms (such as taxes, surcharges on products of PGRFA, share of royalties from IPRs, etc).

- a decision making body for the allocation of resources. This body would monitor the implementation of the Global Plan of Action, and allocate resources based on the priorities and criteria set out in the Plan. According to Resolution 3/91, this body would be the Commission on Plant Genetic Resources and would "determine and oversee the policies, programmes and priorities of the fund and other funding mechanisms". In the case that the International Undertaking becomes a protocol to the Convention on Biological Diversity, this body would be the parties to the protocol (13). In either case, the Commission, or a successor body, might act on the advice of a scientific and technical advisory body.

(13) See also document CPGR-6/95/9 on Stage III of the Revision of the International Undertaking.

25. The full implementation of the Plan is also likely to be premised on certain assumptions concerning the availability of plant genetic resources, which should be consistent with the agreement on mutually agreed terms of access, being negotiated as part of the revision of the International Undertaking.

VI. ISSUES FOR THE ATTENTION OF THE COMMISSION

26. The Guidance of the Commission is sought on the general approach proposed for the preparation of the Global Plan of Action, and in particular on the proposed "Framework for Action" which provides its policy context including issues such as aims, strategy, priorities and criteria.

27. The Guidance of the Commission is also sought concerning the scope of the Global Plan of Action. It was previously agreed that the Global Plan of Action should cover "the conservation and utilization of plant genetic resources for food and agriculture", including forest species. The inclusion of the latter has been questioned.

WORLD PLANT COLLECTION PLACED UNDER INTERGOVERNMENTAL AUSPICES

Washington/Rome, October 26. The Consultative Group on International Agricultural Research (CGIAR) today signed agreements to place the international plant genetic resources collections housed in 12 CGIAR Centers under the auspices of the Rome-base United Nations Food and Agriculture Organization (FAO). The move gives legal weight to the CGIAR's commitment to hold the collections in trust for the international community. The agreements were signed by CGIAR Chairman Ismail Serageldin on behalf of the international research Centers of the CGIAR, and by Mohamed S. Zehni, Director of the FAO Research and Technology Development Division, on behalf of FAO Director-General Jacques Diouf. The arrangement has received strong support from parties to the Convention on Biological Diversity, the international legal instrument governing the conservation and use of biological resources and signed by more than 150 countries at the 1992 United Nations Conference on Environment and Development held in Rio.

The CGIAR is an association of 43 public and private sector donors jointly supporting 17 international agricultural research Centers mostly located in developing countries. The CGIAR is co-sponsored by the FAO, the United Nations Development Programme (UNDP), and the World Bank. Research at CGIAR Centers covers crops that provide 75% of food energy and protein requirements for developing countries. To support this research, 12 of the 17 Centers have assembled over 500,000 different samples of major food, forage and forest species in genebanks, constituting the world's largest internationally held collection of genetic resources. For the past 25 years, these genetic resources have supported the development of higher-yielding, more stable, pest and disease resistant varieties of staple foods consumed in the developing world.

The agreements were signed at International Centers' Week, the CGIAR's annual meeting that brings together 350 administrators, donors, policymakers and scientists concerned with sustainable agriculture.

Speaking on behalf of the Director General, Mohamed Zehni said "FAO welcomes the the conclusion of these agreements, an important step in the realization of the FAO Global System on Plant Genetic Resources, which comes under the FAO Commission on Plant Genetic Resources. The signature of the agreements today marks the culmination of years of work to bring the important collections of the CGIAR under the auspices of the FAO Global System and its Network of Base Collections and it contributes to the implementation of the International Undertaking on Plant Genetic Resources. It demonstrates the CGIAR's continued commitment to work with FAO in our task of ensuring food security for millions of people in the developing world."

Mr Timothy Rothermel, UNDP's Director of the Division of Science, Technology and the Private Sector, said "As part of UNDP's support to the Agenda 21 priorities that emerged from the UNCED Conference in Brazil, we aim to strengthen national capacities. This action by the CGIAR Centers will help to develop national capacity to conserve and manage genetic resources in many countries. UNDP is delighted to be partners with FAO and the World Bank as fellow co-sponsors of the CGIAR at this milestone in international cooperation in the field of genetic resources conservation as an essential element of sustainable human development."

After signing the agreements, the CGIAR Chairman, Ismail Serageldin said "I welcome these agreements that make the CGIAR's Centers the founding members of the FAO network. This unparalleled international effort

to conserve the world's precious genetic resources has benefited greatly from generous donations by many countries. These genetic resources will be invaluable in the application of science for the benefit of the world's poor. The CGIAR stands ready to work with all parties towards the urgent task of preserving genetic resources for the benefit of all humanity and for future generations."

The CGIAR Centers have assembled sizeable germplasm collections of their respective mandate crops, through an active collaborative collecting program and donations by national research institutes. The Centers act as custodians for the countries which have donated germplasm for the benefit of the global community.

During the 1980s, issues of intellectual property rights, ownership and compensation for the use of germplasm began to receive greater attention in intergovernmental fora, where concern was expressed over the legal status of the collections held by the CGIAR Centers.

In 1987, an International Network of Ex Situ Base Collections was established under the auspices of FAO. The historic agreement signed today brings these collections into the International Network and allows the Centers to become the formal trustees of the germplasm maintained in their genebanks, thus ensuring the protection of this critical component of the Earth's irreplaceable plant heritage.

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Appendix No. 3
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Report

of the

National Germplasm Resources Laboratory

to the

Regional Technical Committees on Plant Germplasm

June 1996

Chapter 1 National Germplasm Resources Laboratory (NGRL) Programs

Allan Stoner

The programs of the National Germplasm Resources Laboratory (NGRL) support the mission of the National Plant Germplasm System (NPGS), which is; "To effectively collect, document, preserve, evaluate, enhance, and distribute plant genetic resources for continued improvement in the quality and production of economic crops." The NGRL activities are performed by the following groups; the Plant Germplasm Quarantine Office (PGQO), the Plant Exchange Office (PEO), the Germplasm Resources Information Network/ Database Management Unit (GRIN/DBMU), and the molecular virology investigation. In addition, the Laboratory facilitates the activities of the 40 Crop Germplasm Committees that provide technical advice to the NPGS.

Particularly significant accomplishments during the past year included the continued progress made by the PGQO in eliminating backlogs of germplasm in quarantine and shortening the time required to process quarantined germplasm. Also the continued development of the Quarantine Information System (QIS) has improved our in-house ability to track inventories and pathogen testing records of quarantined germplasm and to make the status of germplasm more accessible to the user community.

The constant evolution of the GRIN hardware and software continues to make the database more useful to the NPGS maintenance sites and to the eventual users of the NPGS germplasm. Access to the GRIN data via the Internet has greatly increased the number of users viewing and downloading data about NPGS germplasm collections.

During the past year the PEO began to refocus some of its resources. Especially important is the renewed effort to try to identify and prioritize the germplasm acquisition needs of the NPGS. Also, projects on in situ conservation of plant genetic resources and the application of GIS and computer mapping of plant explorations and germplasm origin were initiated.

The NGRL was asked to take the lead in preparing the United States Country Report and submitting it to the Secretariat of the International Conference and

Program for Plant Genetic Resources, FAO. This report and those from 151 other countries served as the basis for the State of the World report prepared by the Secretariat. The latter has defined the starting point from which the International Technical Conference on Plant Genetic Resources, to be held in Leipzig, Germany in June 1996, will identify problems to be addressed by a Global Plan of Action.

Chapter 2 Plant Germplasm Quarantine Office (PGQO)

Progress Report on Quarantined Stone Fruits, Grasses, Ornamentals, Small Fruits and Tropical - Howard Waterworth

Backlog

The backlog of these crops , especially stone fruits, in quarantine has been eliminated. During the past year, we received 62 accessions of stone fruits, 20 roses, and 229 of the other crops. Current inventories not released from quarantine consist of about 175 vegetative accessions and 20 lots of seed accessions of stone fruits, 35 grasses and 50 of other crops including elms, currants, *Philadelphus*, lilac, *Ligustrum* and raspberries. Because the testing period for stone fruits requires 2 to 3 years to complete, inventories of stone fruits will never be lower than now. The grasses will become eligible for release in April 1996.

Tests

Each stone fruit accession was subjected to 15-20 tests in an effort to detect some 75 or so virus-like pathogens that may be present. Grasses, ornamentals, and small fruits each received 4 to 8 tests for a combined total of another 75 or so pathogens. Depending on the crop, various combinations of graft, sap transmission, ELISA, and EM tests were performed.

Results

Percent of virus infected accessions were: small fruits, 10%; stone fruits, 15%; grasses, ornamental shrubs and trees, 5%; and tropical crops, <1%. Among the viruses detected were cherry necrotic ringspot, prune dwarf, green ring mottle, plum pox, tomato ringspot, currant reversion, apple mosaic, and unidentified viruses in grasses, raspberries, elm, lilac, and mulberry. No pathogens were detected in small numbers of accessions of barberry, mangoes, cassava, juniper, mahonia, strawberries, or chestnuts.

Release

Upon release from quarantine, germplasm was sent to the importer and for stone fruits, to the clonal repository. Except for restricted items, stone fruits were also offered to an additional 20 breeders in the US and Canada. During the past 12 months approximately 210 genotypes of stone fruits were distributed to some 16 breeders and repositories. Also distributed were 59 accessions of grasses, 22 small fruits, 22 ornamentals, and 20 post entry accessions.

Research

Research focused on developing improved methods to detect stone fruit pathogens. In cooperation with others, *Prunus tomentosa* was found to be a good indicator for plum pox virus. An ELISA test was developed to detect plum line pattern virus, and PCR evaluated to detect prune dwarf virus and peach latent mosaic viroid.

Progress Report on Quarantined Sugarcane, Potatoes, Sweet Potatoes and Pome Fruits - Suzanne Hurtt

The sugarcane quarantine facility was relocated from Range 3 to a new greenhouse and laboratory in Range 2 on the BARC-West campus. The new greenhouse completely meets all quarantine requirements, is more efficient to operate and is a significant improvement for worker safety.

During the year, the unit received 100 sugar cane accessions. Eighty-three of the acquisitions were for interstate shipment. Two clones were found infected with virus and two are undergoing additional testing for leaf scald. Of the seventeen clones from foreign origins, two failed to germinate and have been reordered. No disease has been detected in the foreign clones.

Distributions were temporarily reduced because of the facility move, since all clones had to be moved as cane sets and re-germinated in the new location. Nonetheless, 125 clones were distributed. Ninety-nine clones were of domestic and 16 of foreign origin.

The potato quarantine program saw significant change this year when APHIS accepted a new operating procedure for this crop. Under the new protocol, indexing and distribution can be accomplished within one, rather than two, testing cycles if the imported germplasm is free of undesirable pathogens. Infected germplasm will require longer to process because of the time needed to apply therapeutic treatments and retest the germplasm. This change should at least halve the cost, as well as the time, involved in processing tuber-bearing *Solanum* germplasm imported as vegetative propagations.

Clonal accessions of Solanum acquired this period totaled 73. Tests were performed on 221 potatoes. As a result of this testing, 63 accessions were released and distributed. Virus-infected accessions were placed in the tissue culture therapy program. An additional 51 lots of true potato seed were tested and released from quarantine. This testing was part of a cooperative project with the Potato Introduction Station, Sturgeon Bay, WI where seed lots were grown out and increased while the NGRL testing was under way.

Acquisitions of sweet potato (Ipomoea spp.) for this period totaled 43. Tests were performed on 79 accessions, and 17 were released. Those not released were held over for the required second set of tests or placed in the tissue culture meristem tip culture program for pathogen elimination.

The pome fruit program lost a valuable employee upon the retirement of Bill Povish in January, 1996. Bill assisted with the apple and pear indexing for 35 years. At this time, a replacement has not been selected.

Twenty-nine new pomes were acquired including 14 collected in Kazakhstan by Phil Forsline, 12 apple rootstocks from Japan (originally developed in the United States and lost), and 1 pear from Italy. Tests were begun on 47 poems, many of which were heat treated progeny of virus-infected introductions. Second-year greenhouse testing was continued on 66 additional pomes. Release of these and other pome accessions is pending completion of the orchard bioassays. Germplasm of 19 diseased pears was sent to Joseph Postman (pathologist, Clonal Repository in Corvallis, OR) who will apply *in vitro* therapeutic treatments to the accessions. Thirty pears also were sent to Postman for NGRL for treatment last year. Heat treated progeny will be returned to NGRL for testing. NGRL continued its therapy program and subjected 20 more apples to heat therapy and micro-grafting.

Progress Report on Potato and Sweet Potato Tissue Culture and Rice Quarantine - Bruce Parliman

Potato and Sweet Potato Accessions

All quarantined potato and sweet potato accessions received as vegetative material have been established and are being maintained in tissue culture resulting in improved germplasm safety/security, reduced maintenance costs, and improved shipping speed, survival, and safety. The backlog of potato and sweet potato accessions needing therapy has been eliminated. Of the 255 accessions held in tissue culture, only 13 potato and 18 sweet potato accessions are in therapy currently and these accessions were received in the last 3 months or are accessions requiring reprocessing. All potato and all but two sweet potato accessions

requiring testing have been sent to testing in the first test season after becoming available.

Procedures

Procedures for *in vitro* establishment, maintenance, therapy, and shipping potato and sweet potato accessions have been modified resulting in increased accession security, reduced number of samples required in therapy, reduced therapy processing time, increased production of therapy derived clones, and more efficient shipping.

Rice

With the exception of the 10,000 plus new accessions held at the National Seed Storage Laboratory, the backlog of rice accessions has been eliminated. There are (as of 2/8/96) 136 accessions in production, 301 new accessions ready for evaluation, and 74 accessions released from quarantine and ready to ship. There are 511 accessions inventoried. With improved protocols in place, approximately 450 accessions can be processed annually.

The tissue culture lab is in the process of expanding responsibilities for other crops. In 1995 several pear, apple, cassava, currant, and cherry cultivars were grown in vitro. Procedures for establishing, maintaining, conducting therapy, and shipping Rubus, and Ribes cultivars, indicators, and controls are being established at this time.

Quarantine Information System (QIS)

The Quarantine Information System (QIS) is now operational and contains the complete inventory of germplasm held in quarantine at the PGQO. Results of completed pathogen testing for most genera have also been loaded into the database. QIS is intended to assist NGRL personnel track inventories and testing results and to facilitate the recipients of the germplasm getting information on the status of their germplasm. Inventories and summary data of pathogen testing can be viewed by accessing GRIN through the Internet.

Chapter 3 Plant Exchange Office

Ned Garvey

Personnel Changes

Dr. Ned Garvey, formerly Curator of the Woody Landscape Plant Germplasm Repository at the U.S. National Arboretum, accepted the Plant Exchange Officer position in October, 1995. Ned has been asked to take an "aggressive" role in prioritizing the NPGS exploration proposals and in soliciting proposals to fill identified collection gaps.

Dr. David Williams accepted a position with the International Plant Genetics Resources Institute (IPGRI)'s Office for the Americas in Cali, Colombia. His new duties include facilitating interactions between the NPGS and genetic resource programs in Latin America.

Judi duCellier and Mary Jo Bogenschutz-Godwin have joined the Plant Exchange Office. They both previously worked with Dr. James Duke of NGRL who retired in October, 1995. Judi is working with the Geographical Information System (GIS) and supporting plant exploration activities. Mary Jo is assisting with passport data entry and PI number assignment.

Dan Harmon retired in December, 1995. Dan is volunteering a couple of days a week in the PEO, entering historical PI records in the GRIN database.

Exchanges

During 1995, a total of 20,894 items in 506 shipments to scientists in 71 countries passed through the Plant Germplasm Quarantine Center, Building 580, BARC-East. Additionally, 136 shipments of 2,827 non-permit items were received from foreign cooperators for use by U.S. scientists.

Shipping Procedures Update

A majority of NPGS sites have conscientiously been screening their foreign requests through the APHIS inspectors at the Quarantine Inspection Station in Beltsville so that when packages arrive for shipping all the necessary paperwork, permits, additional declaration statements, or any special requirements arrive with the package. This has saved much wasted time in phone calls, faxes and waiting for necessary paperwork to arrive. PEO is still asking <u>all</u> NPGS sites to work

towards making local arrangements with their state APHIS inspectors to have the Phytosanitary Certificates generated by the local inspectors. To facilitate this, Dr. Arnold T. Tschanz, Branch Chief at the Plant Germplasm Inspection Station, Beltsville, will provide names and phone numbers of APHIS Inspectors who should be able to provide these services. The only problem which may be encountered is that APHIS only takes cash for payment on Phytosanitary Certificates, but payments through imprest or similar means could be worked out through your procurement systems. Since Dan Harmon's retirement, Maryann Loftus has assumed his shipping duties. She is trying to limit her time at the Quarantine Center to 2 or 3 afternoons per week, depending on the number of shipments received for processing. During the spring's growing season "rush", somewhat more of her time has been devoted to shipping than was originally envisioned. Maryann can be reached most mornings at her office (301) 504-5020.

Plant and Materials Seed Project

This AID-funded project which provides larger quantities of seed and plant materials to AID Missions, and other persons working in developing countries, supplied 12 countries with 16 shipments totaling 170 items during 1995. Unfortunately, the Project's funding was severely cut in 1995, and to date, remains unfunded for FY-96. Any requests for germplasm received by the PEO, which would have been handled through this Project, are being treated as regular requests and are forwarded to NPGS sites for handling.

PI Documentation

Becky Norris continues to coordinate the documentation and assignment of PI numbers. 6,562 PI numbers were assigned and passport data verified for inclusion in the GRIN database. This includes 238 new Crop Science registrations and 373 new PVP accessions. Over 700 CSR registration certificates were issued during this time period.

Becky also continues to assist curators and maintenance site personnel with updating and modifying passport data and work closely with the GRIN personnel to standardize and correct records in the GRIN database.

Plant Inventory No. 203 for 1994 has been published and distributed. It displays a new cover of a *Helianthus* selected by Ms. Norris. Plant Inventory No. 204 for 1995 is at the publishers and should be distributed soon. It contains 774 pages and consists of two parts.

Becky is part of two DBMU committees, Quality Control and User Interface, providing feedback necessary for developing GRIN systems.

A sampling of collections at NSSL and other sites assigned PI numbers follows:

Vitis, *Malus*, *Prunus* - Geneva New York
Beta vulgaris - Pullman Washington
Sweet Potatoes from Papua New Guinea
Marigolds from Mexico
Soybeans from China
Clover from Bulgaria
Corn from Maurtius
Barley from Egypt
Millets from Singapore
Sorghum from Australia

In situ Projects

Karen Williams contributed the chapter on native plant genetic resources to the U.S. Country Report for the International Conference and Programme for Plant Genetic Resources. In addition, a preliminary list of wild U.S. native genetic resources and their distribution by state has been compiled. This list provides the basis for plans for an *in situ* conservation program. NPGS curators received sections of the list pertaining to their crops and were asked for their input on the priority and appropriateness of the species for *in situ* conservation. Vicki Binstock is working with plant taxonomist John Wiersema to add many of these taxa to the taxonomy area of the GRIN database. Vicki has almost completed compiling literature and information on the taxonomy and locations of indigenous populations of wild rice, *Zizania*.

Plant Exploration

The Plant Exchange Office provided support for 4 domestic and 6 foreign plant explorations in FY 1995 and is supporting 9 explorations in FY 1996. A proposal to streamline the plant exploration review process was approved by the Plant Germplasm Operations Committee in August, 1995 and will be in effect for proposals funded in FY 1997. Plant Exploration Proposals should now be sent directly to the Plant Exchange Office rather than to the Regional Coordinators. The new deadline for receipt of proposals is June 15. Proposals will be reviewed by the Plant Exploration Subcommittee to which has been added a representative from each of the 4 Regional Technical Committees on Plant Germplasm.

Karen Williams continues to coordinate ARS-funded plant explorations. Questions relating to plant explorations and requests for exploration proposal guidelines should be directed to her. Karen participated in a joint INIAP/IPGRI/USDA plant exploration for rare landraces of peanuts in Ecuador in October and November of 1995, and for wild strawberries in North Carolina in May, 1996. Karen plans to participate in a plant exploration for peanut landraces in additional areas of Ecuador in August, 1996.

The Plant Exploration Tracking System (PETS) database is operational. This database tracks the status of germplasm collected on plant explorations and can produce reports on many aspects of plant exploration. A computer in the Plant Exchange Office is dedicated to use by a GIS. The GIS is used for many applications including the mapping of collection sites and the display of geographic distribution of plant taxa.

USDA/ARS Plant Explorations Undertaken in FY 1995

Plant Exploration	Country	Principal Contacts
Small Fruits	Bolivia	J. Ballington, W. Messinger, D. Williams
Prunus spp.	USA	C. Weeks, W. Okie, C. Ledbetter
Fragaria virginiana	USA	J. Ballington, J. Payne
Oilseed crops	USA	D. Dierig, J. Rebman
Trifolium spp.	USA	N. Taylor, K. Quesenberry
Phaseolus vulgaris	Argentina	J. Steadman, C. Sandlin, R. Neuman
Arachis spp.	Brazil	R. Pittman, C. Simpson, J. Valls
Forage legumes	Russia	S. Greene, M. Rumbaugh, A. Afonin
Solanum spp.	Guatemala	D. Spooner, F. Vargas
Malus spp.	Kazakhstan	P. Forsline, E. Dickson, J. Luby

USDA/ARS Plant Explorations Planned/Undertaken in FY 1996

Plant Exploration	Country	Principal Contacts
Woody landscape plants	People's Rep. of China	R. Lewandowski, K. Conrad, J. Ault, K. Kim
Fragaria virgiana	USA	J. Ballington, J. Payne, K. Williams
Oilseed Crops	USA	D. Dierig, T. Coffelt, A. Salywon
Legumes and other vegetables	Bulgaria	R. Hannan, W. Kaiser
Small fruits	People's Rep. of China	M. Thompson, J. Postman
Glycine spp.	Australia	T. Hymowitz, A. Brown, J. Grace
Solanum spp.	Costa Rica	D. Spooner, W. Quirós
Cool-season grasses/legumes	Mongolia	D. Johnson, D. Sheehy
Small fruits	USA	K. Hummer, C. Wright

Chapter 4 GRIN DBMU Accomplishments

Jimmie Mowder

The DBMU continues to provide database support for 23 seed and clonal germplasm maintenance sites, four genetic stock sites, and the Desert Legume Program site. Reports are continually generated for various personnel within the National Plant Germplasm System.

New software and hardware have been purchased to facilitate a Windows access to GRIN. Once the software has been developed, GRIN can be easily transported to a personal computer. Additionally, we are developing a new pcGRIN maintenance module that will have the functionality of GRIN. GRIN data are now available on the Internet with newly revised formats for querying and presenting the data. About 900 users access GRIN on the Internet monthly with about 60 users retrieving pcGRIN data files monthly. We distribute pcGRIN on diskettes to approximately 200 scientists annually with distribution encompassing 55 countries.

A 30 Gigabyte Redundant Array of Inexpensive Disks (RAID) has been installed resulting in an increase of database performance. The RAID also provides mirroring and striping of data increasing data security and recovery in case of a system failure. We continue to work closely with the 40 Crop Germplasm Committees in collecting and storing data for NPGS.

The DBMU also maintains two internal Local Area Networks pertinent to the operation of the laboratory. DBMU personnel are leading the installation of the Beltsville Area's campus wide network in addition to providing Area personnel assistance with the development of Web pages.

Although Gail Juvik was detailed to the Animal Genome project since October, 1994, she has now permanently left the Beltsville Area for a position with Stanford University.

We continue to work with Canada, India, and Brazil in the development of their germplasm databases. To permit the Canadians to understand our information system at an in-depth level, two members of their plant germplasm system will become members of the GRIN Advisory team.

Chapter 5 Crop Germplasm Committee Facilitation

Mark Bohning

Forty Crop Germplasm Committees (CGC) continue to provide support to the National Plant Germplasm System (NPGS) and all have been active over the last year. NGRL continues to assist in coordinating their activities and participated in 30 of their meetings. Though not all inclusive, the CGC's are supporting the NPGS by:

- identifying gaps in U.S. collections and developing proposals to fill them through exchanges or collecting trips,
- assisting crop curators in identifying duplications in collections,
- prioritizing traits for evaluation and developing evaluation proposals,
- assisting curators and GRIN personnel in correcting and standardizing passport and evaluation data and ensuring that complete information is entered into the GRIN database,
- assisting curators with regeneration projects,
- identifying germplasm in breeder working collections that should be incorporated into NPGS collections and assisting with arrangements to accomplish this,
- working with quarantine officials to identify and ensure implementation of new techniques for pathogen identification,
- evaluating the potential benefits and problems associated with the development and use of core subsets.

A sixth biennial CGC Chairs meeting will be held in Beltsville, MD July 15-16, 1996. This meeting provides an opportunity for the chairs to interact with each other, NPGS personnel and members of the National Program Staff. Numerous topics relating to NPGS and genetic resources maintenance and use in general will be discussed. These will include:

- status reports from NPGS sites,
- the role and expectations of CGCs,
- impact of the Convention on Biological Diversity,
- the status of global genetic resource programs,
- intellectual property rights,
- plant quarantine issues,
- and the possible role of core subsets.

Each of the CGCs have been asked to update their reports on crop vulnerability and needs for acquisition, preservation, evaluation and enhancement. These reports will be forwarded to the NGRL where they will be summarized and priorities across all crops will be established.

Chapter 6 Molecular Virology Investigations

Ahmed Hadidi

Sensitive, rapid and reliable methods, based on polymerase chain reaction (PCR) and recombinant DNA technologies have been developed for detection and identification of apple stem pitting virus from apples, its related pear vein yellows virus from pears and related viruses from peach, cherry and apricot plants. PCR and recombinant DNA technologies have also been extended for the identification and detection of faba bean necrotic yellows virus, potato vein yellows virus, chrysanthemum stunt viroid, a new variant of potato spindle tuber viroid from Chilean pepino plants, pear decline and peach liptonecrosis phytoplasmas, cherry lethal yellows and jujube witches' broom phytoplasmas as well as aster yellows and X-disease phytoplasmas. The complete nucleotide sequence of the coat protein gene of the sour and sweet cherry isolates of plum pox virus (PPV) from Moldova and Italy, respectively, have indicated that the two isolates are prototypes of a new group of PPV, termed PPV Cherry. Serological reactivity of the two PPV isolates with PPV monoclonal antibodies also conformed the above conclusions and showed that the cherry isolates represent a new serotype of PPV which does not fall into the conventional D- or M- serotype. A cRNA probe has been developed which is specific for identification and differentiation of the cherry isolates of PPV from conventional isolates. This probe may be useful for the studying of identity, epidemiology and geographical distribution of members of PPV-Cherry group in different species of stone fruits. The sour cherry isolate of PPV has been successfully transmitted by aphids to herbaceous and woody plants. Demonstrated by nucleotide sequence analysis that dapple apple and pear rusty skin viroids from China are distinct variants of apple scar skin viroid and that the phytoplasmas associated with cherry lethal yellows and jujube witches' broom diseases in China represent a new subspecies level taxon. The results of research will be used by plant pathologists and plant quarantine officials responsible for keeping foreign plant diseases from entering the United States.

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May 28, 1996

SUMMARY OF REVIEW PROCEDURE FOR PLANT EXPLORATION PROPOSALS

Proposals are prepared following the current Guidelines for Plant Exploration Proposals. Proposals are reviewed by the appropriate Crop Germplasm Committee and crop curator.

June 15 Deadline for submission of proposals to the Plant Exchange Office. (Review of proposals by the NPGS Regional Technical Committees is no longer required.)

Proposals are reviewed by Plant Exchange Office and checked for all required documentation and approvals.

August 1 Proposals are sent to the members of the Plant Germplasm Operations Committee (PGOC) Plant Exploration Subcommittee for review and ranking. This subcommittee consists of members of the PGOC and one representative from each of the four NPGS Regional Technical Committees.

Sept. 1 The Plant Exploration Subcommittee returns reviews to the Plant Exchange Office.

Reviews from the Plant Exploration Subcommittee are summarized by the Plant Exchange Office.

Sept. 30 Proposals, ratings of proposals, and requests for funding are sent to the National Program Staff Germplasm Matrix Team.

The Germplasm Matrix Team returns decisions on funding to the Plant Exchange Office.

The Plant Exchange Office delivers the decisions of the Germplasm Matrix Team to potential plant explorers.

Requests for further information or assistance regarding plant exploration proposals should be directed to:

Karen Williams
Plant Exchange Office
National Germplasm Resources Laboratory
Rm. 402, Bldg. 003, BARC-West
Beltsville, MD 20705-2350
Telephone: 301-504-5421
FAX: 301-504-6305
Email: kwilliams@ars-grin.gov

NPGS Supported Plant Explorations for FY 1996

Woody Landscape Plants

PARTICIPANTS: Rick Lewandowski (Morris Arboretum), Philadelphia, Pennsylvania; Kevin Conrad (USDA/ARS), Washington, D.C.; Jim Ault (Chicago Botanic Garden), Chicago, Illinois; Kunso Kim (Norfolk Botanical Garden), Norfolk, Virginia; Tiencheng Cui (Xian Botanic Garden), Xhaanxi, People's Republic of China.
LOCATION: People's Republic of China.
SPECIES: Many species of woody landscape plants.
DATES: August 31 - October 15, 1996.

Fragaria virginiana

PARTICIPANTS: James R. Ballington (North Carolina State Univ.), Raleigh, North Carolina; J.A. Payne, Byron, Georgia; Karen Williams (USDA/ARS), Beltsville, Maryland.
LOCATION: United States, southeastern region.
SPECIES: *Fragaria virginiana.*
DATES: May - June, 1996.

New Oilseed Crops

PARTICIPANTS: David A. Dierig (USDA/ARS), Phoenix, Arizona; Terry Coffelt (USDA/ARS), Phoenix, Arizona; Andrew Salywon (USDA/ARS), Phoenix, Arizona.
LOCATION: United States.
SPECIES: *Lesquerella* and *Physaria* spp.
DATES: Several trips in spring and summer, 1996.

Legumes and Other Vegetables

PARTICIPANTS: Richard Hannan (USDA/ARS), Pullman, Washington; Walter Kaiser (USDA/ARS), Pullman, Washington; Miho Mihov (Academy of Agriculture), General Toshevo, Bulgaria; Siyka Angelova and Ivan Lozanov (Institute of Introduction and Plant Genetic Resources), Sadovo, Bulgaria.
LOCATION: Bulgaria.
SPECIES: *Cicer, Pisum, Lens, Vicia, Lupinus, Trigonella, Lathyrus, Allium, Beta, Lactuca* spp.
DATES: June 29 - July 25, 1996.

Small Fruits

PARTICIPANTS: Maxine Thompson, Corvallis, Oregon; Joseph Postman (USDA/ARS), Corvallis, Oregon; Xi Sheng Ke (Chinese Academy of Forestry), Beijing, People's Republic of China.
LOCATION: People's Republic of China.
SPECIES: *Rubus, Vaccinium, Ribes,* and *Fragaria* spp.
DATES: July 15 - August 15, 1996.

***Glycine* spp.**

PARTICIPANTS: Theodore Hymowitz (Univ. of Illinois), Urbana, Illinois; Anthony H.D. Brown (CSIRO), Canberra, A.C.T, Australia; James P. Grace (CSIRO), Canberra, A.C.T., Australia; David Albrecht (CCNT), Alice Springs, NT, Australia.
LOCATION: Australia.
SPECIES: *Glycine tomentella, G. clandestina, G. falcata, G. canescens.*
DATES: August 20 - September 10, 1996.

***Solanum* spp.**

PARTICIPANTS: David M. Spooner (USDA/ARS), Madison, Wisconsin; Walter Quirós (CRF), San Jóse, Costa Rica.
LOCATION: Costa Rica.
SPECIES: *Solanum longiconicum*, *S. oxycarpum*, and others.
DATES: November - December, 1996.

Cool-season Grasses and Legumes

PARTICIPANTS: Douglas Johnson (USDA/ARS), Logan, Utah; Dennis Sheehy, Union, Oregon.
LOCATION: Mongolia.
SPECIES: Cool-season grasses and legumes.
DATES: August 15 - September 22, 1996.

Small Fruits

PARTICIPANTS: Kim Hummer (USDA/ARS), Corvallis, Oregon; Catherine Wright (Alaska Div. of Agriculture), Palmer, Alaska.
LOCATION: United States, Alaska.
SPECIES: *Fragaria*, *Vaccinium*, *Ribes*, *Rubus* spp. and other small fruits.
DATES: August 5 - 17, 1996.

Cucurbits

PARTICIPANTS: James McCreight (USDA/ARS), Salinas, California; Todd Wehner (North Carolina State Universifty), Raleigh, North Carolina; Mariana Jooste (Agricultural Research Council), South Africa.
LOCATION: South Africa.
SPECIES: *Cucumis*, *Citrullus*, *Lagenaria*, *Momordica* spp. and other cucurbits.
DATES: April 24 - May 7, 1996.

Arachis hypogaea

PARTICIPANTS: David Williams (IPGRI), Cali, Colombia; Karen Williams (USDA/ARS), Beltsville, Maryland; César Tapia (INIAP), Quito, Ecuador.
LOCATION: Ecuador.
SPECIES: Landraces of *Arachis hypogaea*.
DATES: August 19 - September 6, 1996.

Plant Exchange Office
National Germplasm Resources Laboratory
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Appendix No. 4
S-9 TAC 1996

United States Department of Agriculture
Agricultural Research Service
Northern Plains Area National Seed Storage Laboratory
1111 South Mason Street
Fort Collins, CO 80521-4500
Telephone: 970 495-3200
Fax: 970 221-1427

May 16, 1996

presented by Loren Weisner

SUBJECT: NSSL 1995 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

ADMINISTRATION

Steve A. Eberhart, Director

With increased operating costs for the expanded facility and no increases in operating funds, changes were required. Greenhouse regeneration rescue of NSSL accessions with low viability was discontinued on December 31, 1995. Former greenhouse staff were given responsibilities for routine preservation of vegetative propagules and assisting with the security backup storage of CIMMYT maize samples from the ARS/USAID/CIMMYT Maize Regeneration Project.

Research by scientists in the NSSL Plant Germplasm Preservation Unit indicates that seed storage moisture content can be optimized for any given storage temperature by drying to equilibrium at the appropriate relative humidity (RH). In addition, use of these technologies eliminates the necessity for conduction large numbers of seed moisture evaluations. Recommendations based on cost/benefit research and analysis by PGPRU scientists were reviewed, and operating costs of drying rooms were checked. Based on these findings, changes in procedures were made to obtain a slight reduction in costs and an increase in expected longevity of stored samples. Drying is now done at 10°C with about 30% RH, and at this temperature the dehumidifier rarely runs. At 15°C, RH dropped below the desired 35% because of the naturally low RH at Fort Collins. Either of these combinations gives the same optimum seed moisture as 5°C and 25% RH for long term storage. After drying, seed samples are now immediately placed in temporary storage at -18°C while queued for final processing. As the seed counts and germination tests are being conducted during the final processing, a final equilibration is done at 5°C and 25% RH prior to long-term storage at -18°C or -160°C. When high quality seed is stored under these conditions, longevity of several decades can be expected.

Memorandums of Understanding (MOU) were completed to continue the security backup storage of CIMMYT wheat/triticale and corn. CIMMYT is in the process of designating a core subset (about 10%) for Latin American maize landrace collections, and the LAMP project has identified elite landrace collections. The most cost effective and practical policy for NPGS will be to enter the core subset, the elite LAMP accessions, and the Caribbean flints (and certain other germplasm requested by the maize CGC or deemed important by the maize curator) to both the base and active collections. The remaining landrace accessions in the Latin American maize collection will be placed in security backup storage at NSSL.

A MOU to formalize the long-term storage of Plant Variety Protection (PVP) seed voucher specimens at NSSL was completed. Because the revised PVP Act extends PVP to tuber crops, including potato, technologies are needed to provide long-term storage at NSSL of voucher specimens for vegetative propagules of cultivars and parental lines licensed by the PVP office.

The U.S. Department of Agriculture, Agricultural Research Service, Northern Plains Area, is an equal opportunity/affirmative action employer and all agency services are available without discrimination.

MOUs have been drafted to provide security backup storage for germplasm from the Desert Legume Program of the University of Arizona (DELEP), sorghum from ICRISAT, and for seeds of species with limited longevity from the N. I. Vavilov All-Russian Research Institute. CSSA is still considering modifying Crop Science crop registration policies to add registration for varieties and parental lines licensed under the Intellectual Property Rights which NSSL would store as security backup plant materials not to be distributed. A revised MOU has been drafted for consideration by CSSA.

The Stage 4 Results from Homologous Areas 1 and 5 of the Latin American Maize Project (LAMP) have been distributed as a printed catalog and on a CD-ROM. A joint Maize Regeneration Project and LAMP meeting is planned to be held at CIMMYT headquarters, June 4 - 6, 1996.

A review of genebanks of IARCs in the CGIAR system, coordinated by IPGRI and FAO, was conducted with Professor Lindsay Innes, retired from the Scottish Plant Breeding Institute, as Chair. I participated as a member of the review team for Latin America, which included CIAT, CIMMYT, and CIP.

SEED VIABILITY AND STORAGE RESEARCH UNIT

Loren E. Wiesner, Research Leader

The Seed Viability and Storage Research Unit, during the past year, has received 27,873 new samples. Seed samples included 337 from the Plant Variety Protection Office, 1 endangered species from a botanical garden, 328 from plant quarantine, 22,913 from active sites, 290 from Crop Science registration, 3,171 from the Latin American Maize Regeneration Project, and the remaining 524 from plant breeders, individuals and organizations. Also included in the samples received were 60 sweet potato cuttings and 249 apple buds from active sites. Of the samples received, 3,201 were replacement samples for accessions at NSSL. A total of 21,517 samples were placed into long-term storage and 25,937 quality evaluation tests were conducted. >6000 samples backlogged

In the cooperative USDA/USAID/CIMMYT maize regeneration project, 2,888 seed samples have been received at NSSL from Argentina, Bolivia, Chile, Ecuador, Mexico, Venezuela, Peru, Colombia, Brazil, Guatemala, and Cuba. In total, 6,892 accessions have been received for storage during the period 1991 to 1995. Small seed driers have been purchased and installed in Mexico, Argentina, Guatemala, Venezuela, and Colombia. These seed driers will be used to properly reduce seed moisture to safe storage levels. Ing. Jorge Franco, a Ph-D student, is evaluating various analytical procedures to be used in selection of a maize core subset from the LAMP data. Various tools were developed for the CIMMYT International Wheat Information System. These tools were cooperator input tool, data manager's tool, and the output or querying tool.

A total of 4,223 accessions were distributed to 202 Scientists. Sorghum (1,190) and maize (291) accessions were packaged, washed, and sent to St. Croix for increase under quarantine. Cooperative studies with the Plant Germplasm Preservation Research Unit and the Geneva Plant Genetics Resources Unit to cryopreserve apple buds are continuing. An additional 249 apple accessions were stored above liquid nitrogen (LN2).

Research conducted by Dr. C. Stushnoff under a Specific Cooperative Agreement on the cryopreservation of cold tender apple germplasm indicates that encapsulation into an alginate gel protects cold tender tissues so they can be stored in LN2. Cryopreservation of encapsulated and imbibed buds from 3 cultivars of cold tender apple survived (40-80%) over a moisture range of 12-32%. Untreated buds with 12 -23% moisture survived 0-40%. Treated bud survival was not related to moisture content, while untreated bud survival was significantly related to moisture levels. The treatment of these buds consisted of encapsulation, imbibition in high concentrations of sucrose, and desiccation at -1°C in an air stream, followed by a slow freeze cryopreservation protocol. Xylem ray parenchyma tissues in apple stems treated with MPVS survived -160°C. Raffinose is a more

effective stabilizer than sucrose during multiple freeze-thaw events. These findings implicate a specific and unique role for endogenous raffinose as a cryoprotectant during freezing of woody plant tissues.

Highest germination of *Penstemon* occurred using scarified seed (either hand or mechanical) on a thermogradient plate at 10-30, 15-25, 20-30, 25, 25-30, and 15-30°C. Individual germinators were used to verify thermogradient plate results and speed of germination analysis suggests that 15-30°C is the optimum temperature for rapid germination of *P. pendlandii* after mechanical scarification. Mechanical scarification (20-30 psi and 10-80 sec) and laboratory germination at 15-30°C were correlated with seedling emergence after 23 days of growth in a greenhouse. Scarification rates of 30 psi and 10-20 sec produced the highest rates of germination in the laboratory and greenhouse tests. A germination procedure has been submitted to the Association of Official Seed Analysts for inclusion into the Rules for Testing Seed.

Work has continued on the evaluation of duplication in the NSSL pea collection. Pea DNA has been extracted from duplicate cultivars and RAPD's are being run. These data will be compared with morphological characteristics of pea accessions considered to be duplicates.

The SVSRU continues to have a considerable backlog of samples not processed. Presently we are about one and a half years behind in processing samples for storage. The large number of samples received in 1995 plus maize from CIMMYT and accessions with limited seed supply from the sites has added to this backlog. The good news is that we have worked out the procedure as to how these accession will be handled, and we now can proceed in processing these CIMMYT and backup samples.

Presently the NSSL has a total of 377,526 samples in long-term storage which include 248,873 unique accessions in the base collection. The remaining samples are multiples of these unique accessions and non-base accessions such as 5,354 genetic stocks, 5,043 quarantine accessions, 339 endangered species, and 4,601 Plant Variety Protection voucher specimens. NSSL has 681 of the PVP voucher specimens duplicated in the base collection and more will be added as the 20 year protection expires.

Among the accessions only in the NSSL base collection, we sent to all priority sites lists of those accessions which have no inventory greater than 65% or were marked -1 (indicating that accessions were received with too few seeds to test for germination). There were 3,507 accessions at NSSL in this category. Lists of these accessions were provided to both Curators and Chairs of CGC to assist them in determining if all of these accessions should be placed in the active collections. Accessions that are then designated for both the base and active collections will need to be regenerated, and the remainder will be transferred from the base collection to the group of miscellaneous materials in long-term storage at NSSL.

PLANT GERMPLASM PRESERVATION RESEARCH UNIT

Eric E. Roos, Research Leader

The following report presents a synopsis of activities and research conducted by the scientists in the Plant Germplasm Preservation Research Unit at the National Seed Storage Laboratory. Each project is briefly summarized and includes personnel assigned, the problem area, approach, and results for the past year. Following the reports is a list of publications appearing in print in 1995.

PERSONNEL: Dr. Sheila Blackman completed her post-doctoral appointment September 30, 1995 and has taken a position with Weyerhauser Company in Seattle, WA. Dr. Vertucci has changed her name to Christina T. Walters.

VISITING SCIENTISTS: Once again, the PGPR Unit attracted several scientists for short-term study and training. Drs. Patricia Berjak and Norman Pammenter from South Africa were in residence during the months of January and February. Accompanying them was one of their post-doctoral students, Dr. David Mycock. Dr. Abdullah Alsadon from King Saud University in Saudi Arabia joined us in September to begin a one year sabbatical working on vegetable seed storage and vigor analysis. As part of some on-going cooperative work with EMPRAPA CENARGEN in Brazil, graduate student, Ms. Mirian Eira, spent one month here in October. Mr. Hyung-Jin Baek, from the Korean genebank, is spending about 18 months working in the germination laboratory and doing part-time research with our unit. In addition, we entertained the usual large number of visitors from all over the world for periods of 1-2 days.

GRADUATE STUDENTS: Mr. Jian Fang, from the Peoples Republic of China is finishing his M.Sc. studies and will begin work toward the Ph.D. in the area of seed deterioration. He was joined by Ms. Joyce Pennycooke from the Commonwealth of Dominica who will be working on an M.Sc. degree in the area of cryogenic storage of sweet potato. Ms. Kim Davidson is continuing her Ph.D. studies on seed germination.

TECHNOLOGY TRANSFER: We have set up a World Wide Web page on the Internet which can be accessed as "http://www.ars-grin.gov/ars/NoPlains/FtCollins/nsslmain.html". A complete list of publications, except for abstracts, from the NSSL dating from 1960, was compiled and is available for distribution. Copies of papers can be requested from Dr. Roos, and the list of publications is also available through this web site.

The NSSL will host a symposium entitled "Seed Biology and Technology: Applications and Advances" on August 13-15, 1997. This symposium is sponsored by Regional Research Project W-168. Please write to Dr. Roos for further information or access the WWW site listed above to direct you to the WWW site for this symposium.

FOREIGN TRAVEL: In June of 1995, Dr. Roos attended the XVIII Pacific Science Congress held in Beijing, China and also attended a satellite conference, the International Symposium on Research and Utilization of Crop Germplasm Resources. In September, Dr. Christina Walters (Vertucci) attended the Fifth International Workshop on Seeds held at the University of Reading in England. In October, Dr. Roos was invited to spend two weeks in Japan and visited several universities, as well as the genebank at Tsukuba. On all of these trips, several papers/lectures were presented highlighting the various research accomplishments from NSSL.

INJURY MECHANISMS DURING MAIZE SEED IMBIBITION AND DRYBACK

ERIC E. ROOS (Supvry PI Physiol); Christina Walters (PI Physiol); Don Davidson (Biol Sci Tech); Jian Fang (Grad Stud, China); Kim Davidson (Grad Stud); Frank D Moore, III (Prof CO St Univ)

PROBLEM: In previous cooperative work with Dr. Frank Moore at Colorado State University, we attempted to develop a non-destructive test for seed viability using the concept of seed leachate conductivity as a measure of seed deterioration. The theory says that membrane damage occurs during deterioration which results in a loss of cell electrolytes when seeds are imbibed. This is measured by soaking the seeds in water and measuring the conductivity of the water, usually after 24 hr. By reducing the time of soaking and the dryback time we were able to do repeated tests on maize seeds before loss of germination was detected. In this project we are attempting to understand the causes of seed viability loss, which eventually does occur after several cycles of imbibition and dryback.

APPROACH: Maize seeds were soaked in distilled water for periods of 2 to 12 hr, followed by rapid dryback to the initial seed moisture content (mc). This procedure was repeated until we began to see loss of vigor and viability. Data collected included: seed mc following soaking; seed leachate conductivity; root lengths after 3 days; and final germination percentage. In addition, seeds were hydrated to various levels, predetermined to coincide with "types" of "bound" water. Each type of water is associated with a physiological state. After holding the seeds for a period of days, seeds were either germinated immediately or dried and then germinated.
RESULTS: Maize seed were soaked for 2 hr and redried for a total of 14 cycles. After each 2 hr soak, mc was measured and found to continually increase with number of cycles from an initial value of about 23% (dwb) after the first cycle to 39% after the 14th cycle. No loss of germination was evident until after the 8th cycle. Root lengths were generally higher than the control (not previously imbibed) values up to the 6th cycle. Beginning with the 8th cycle, root lengths were lower than controls. Leachate conductivity failed to predict loss of vigor or viability. Leachate conductivity was highest during the first imbibition period and then declined dramatically in the 2nd through 14 cycles with essentially no trend in the response.

Maize seeds were imbibed to three mc levels, 27, 34 and 41% and then held for up to 10 days. Each day samples were taken and either dried first or germinated immediately. In this way we were able to distinguish between desiccation injury and deterioration. Seeds held at 27% mc showed the same pattern for dried and non-dried seeds. Those held at 34% showed an earlier loss of germination if dried first and this was even more evident in seeds held at the 41% level. The same general pattern was seen for the root length data except declines in root length were detected sooner than was the case for germination. This indicates that at high mc desiccation damage is a factor in loss of viability as well as aging. The conductivity data were again less indicative of deteriorative changes. In a preliminary study we did find that excising the embryo prior to leaching resulted in a greater leakage as germination dropped. Thus, it would appear, at least for maize, that the conductivity test is much less useful as a predictor of seed quality.

SEEDLING VIGOR OF WYOMING BIG SAGEBRUSH

E. E. ROOS (Supvry PI Physiol); D. Terrence Booth (Range Sci, ARS Cheyenne, WY); Yuguang Bai (Res Assoc, Cheyenne, WY); Stuart P. Hardegree (PI Physiol, ARS Boise, ID)

PROBLEM: Interest in revegetating rangelands, and more specifically disturbed sites, such as mine spoils, abandoned crop land or road cuts, receives considerable attention when the responsible party is required by law to restore the land to its original state. Seedling establishment is difficult, at best, on these sites. Drs. Booth and Roos obtained a grant from the Abandoned Coal Mine Lands Research Program to examine "The influence of post-harvest and preplanting seed treatment on sagebrush seedling vigor."
APPROACH: Seeds from naturally occurring stands of Wyoming big sagebrush (*Artemisia tridentata* Nutt. ssp. *wyomingensis* Beelte & Young) were harvested following seed maturity and examined in various experiments for the response to cleaning using a debearder, and the response to humidification at various temperatures. Germination and vigor (axil lengths) were recorded following the various treatments.
RESULTS: Seed stalks harvested from two locations in Wyoming in late October were stored in an unheated warehouse for 4.5 months before processing with a Simon-Day debearder. Thermocouples placed inside the chamber showed that the temperature increased linearly (14 to 22°C) during the period of operation (2 to 10 min). Humidity increased linearly from 59 to 81%, however, seed moisture content did not change during this period. Stem length decreased with processing duration, while percent of seed with pericarp removed increased. Germination was monitored during a subsequent 16 month storage period. Seed germination increased in the first

4 months and then remained at that level up to 16 months. Germination rate (time to 50%) decreased with storage time, but axil length was unaffected.

Seeds from the above experiment were sorted, after debearding treatment, into those with and without pericarp for further tests. Seeds were humidified for up to 48 hr prior to germination under water stress. Solutions of PEG 8000 were prepared with seven water potentials ranging from 0 to -1.5 MPa. Seed germination was not influenced by the initial moisture content at any water stress level. Even though the moisture content of seeds with pericarp was lower than that without pericarp after humidification, there was no effect on germination percentage. These results suggest debearder processed seeds are more germinable in the field and may have less carryover in the soil seed bank than naturally dispersed seed.

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

PHILLIP C. STANWOOD (Res Agron); Lana Wheeler (Biol Sci Tech)

PROBLEM: Seeds are used as the primary means of preserving plant diversity for future generations. In a very practical sense, seed moisture content and storage temperature are the two primary factors that one can control to lengthen the time seeds can be preserved. The use of ultra-cold temperatures for storage, cryopreservation over liquid nitrogen (about -160°C, -256°C), has been suggested as a means of greatly extending the storage life of seeds and other biological materials. Short-term studies (< 2 years), have demonstrated the efficacy of seed cryopreservation on over 130 species. However, longer term responses are needed to evaluate the full potential of this technology and how cryopreservation relates to current storage methodologies. Part of the problem is how one evaluates and monitors the deterioration of seeds over time.' Seed germination has been and is currently used as the evaluation technique. There are certain limitations to this technique. Early detection of deterioration before loss of germination would be highly desirable, reducing the likelihood of loss of genetic diversity from reduced seed viability.

APPROACH: Current research is directed at: 1) development and understanding of cryopreservation of seed and pollen using liquid nitrogen as a storage medium; 2) development and use of computer digital analysis to measure vigor (deterioration) of seed germplasm; and 3) evaluation of the concept of image oriented databases ("*electronic seed 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 robotic system including lettuce, onion, cucumber and sorghum seed. The 'SGRobot' is temperature controlled with slant boards 'slewing' continuously, providing the same micro-environment to each board, which significantly reduces experimental variation. This reduced error allows for more reliable results, use of fewer seeds per test, reduced labor and material cost and enhanced evaluation of the seed germplasm.

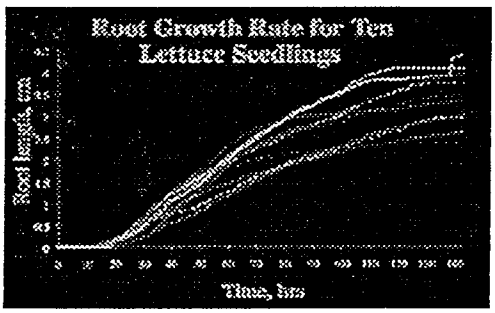
The output of the SGR system is a series of time course root growth curves for individual germinating seeds. From these curves, analyses can be done to determine the relative vigor (deterioration) of a sample. Reduction of vigor precedes loss of seed germination, thus, identification of vigor loss provides an extremely sensitive and valuable tool in accessing the storability of a sample and expected longevity. This information greatly enhances the management of genetic resources, ultimately improving the preservation of the material while reducing costs and labor inputs.

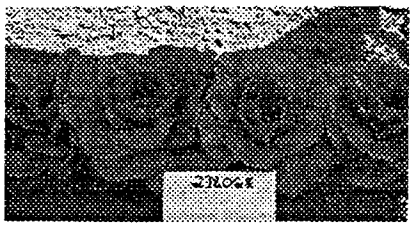
A digital image oriented database concept is being investigated to enhance information collection, storage and dissemination. Chickpea, lettuce and sugar beet image sets are being used as test species for this part of the project. Information from these studies is consolidated and provided on photo CD-Rom. Information and images from these image databases are also placed on the USDA-ARS, Germplasm Resources Information Network (GRIN) in Beltsville, Maryland which is available through the Internet and world wide web (www.ars-grin.gov).

Cryopreservation of plant genetic resources over liquid nitrogen offers the opportunity to enhance the longevity and quality of stored materials such as seeds, plantlets, cell suspensions, pollen and buds. This technique can also improve the reliability of the storage system, reduce costs and other resources needed per sample. Seeds from over 130 species have been successfully exposed and stored in liquid nitrogen. Long-term preservation studies are underway to determine the practical and biological feasibility of the cryopreservation technique for seed germplasm.

Results for onion seed stored 10 years in liquid nitrogen were published in 1995. A review of existing seed materials stored in liquid nitrogen and at -18°C and 5°C was conducted. Plans were made to evaluate approximately 2,000 accessions of seed that have been cryopreserved for approximately 18 years.

Most of the 1995 effort was directed at image databases and image analysis of seed materials. Two trials were conducted in cooperation with Dr. Reid Palmer, USDA, ARS, Ames, IA, investigating genetic inheritance of seed color in soybean seed germplasm. The' Cicer' image database work was continued. A 'Cicer disease' and 'Cicer insect' image database were created. These databases, along with seed images, field grown plant images, literature citations and a cooperator image database were combined into a working CD-Rom distribution copy. This "GARBS" CD-Rom was distributed to a number of individuals for evaluation. The Garbs CD is available to interested researchers. The images from the Cicer image project (approximately 1,500 high color images) were placed on the USDA, ARS GRIN National database and are available to the general public and researchers through the GRIN WWW (world wide web) site (http://www.ars-grin.gov). Approximately 500 images of mature Cicer field grown plants have also been submitted to GRIN for inclusion in the USDA, ARS GRIN database. In cooperation with USDA, ARS scientists in Fargo, ND, approximately 165 images of sugar beets were processed and an image database created. These images will be sent to GRIN in 1996. In cooperation with WRPIS scientists, Pullman, WA, approximately 970 images of field grown lettuce were digitized and placed in a working image database. These lettuce images will also be submitted to GRIN in 1996. The total number of images that have been prepared and sent to GRIN is approximately 2,500. Related to the above image database activity, a WWW site for the USDA-ARS National Seed Storage Laboratory was developed (see page 4).





The SlantGrowthRobot (SGR) was redesigned to enhance lighting options of the seedling roots. New programs were also written to allow multiple experiments to be conducted simultaneously. Several new algorithms were developed to enhance the analysis of the resulting root images. Three primary experiments were conducted to determine: 1) the effects of 'slewing' samples in the SGR device; 2) determine the minimum sample size needed for an experiment; and 3) evaluate different statistical analysis methods of the 'root growth curves' generated by the SGR system. Experiments have been started to define the relative deterioration of seed germplasm samples that have been stored for extended periods in time at -160°C (liquid nitrogen), -18°C and 5°C.

CRYOPRESERVATION OF WOODY, VEGETATIVELY PROPAGATED GENETIC RESOURCES

LEIGH E. TOWILL (PI Physiol); John W. Waddell (Biol Sci Tech); Tammi Cooper (Student) and Phillip Forsline (National Clonal Germplasm Repository, Geneva, NY)

PROBLEM: Long-term preservation of clonal stocks is needed to avoid potential loss of germplasm. Cryopreservation allows for safe, long term storage which then gives clonal repository options for minimizing costs with field or greenhouse maintenance. Apple (*Malus* spp.) was the first clonal species to be routinely placed into cryogenic storage at NSSL using dormant vegetative buds and information about application to other crops is needed. Certain aspects of the method need examination. How can the procedure be modified to be more efficient and effective? Since glasses are implicated in attaining the cryopreserved state, how do cooling rates from -30°C to -160°C and warming rates from -160°C to 22°C affect survival? What alternatives can be used with particularly cold-tender lines? Some of these studies are ongoing and are summations from 2-3 years of work.
APPROACH: In 1995, approximately 250 apple lines were processed using a routine procedure previously shown as effective for most lines. A budding test, performed at Geneva NY, assessed survival. The oxidative browning assessment of viability was used at Fort Collins. In experimental materials, variables of the procedure were examined with selected lines, including time held at -30°C, cooling rate between -30°C and -160°C, and warming rates for tender and hardy lines. Encapsulation/sucrose treatment/dehydration for one-bud twig sections was examined in preliminary tests. Other species were examined for possible inclusion into routine storage using techniques similar to that used for apple.
RESULTS: Of 241 lines used in 1995, representing a range of cold-hardiness potential, 237 lines showed some survival after -160°C exposure and 220 lines showed at least 40% survival. This reaffirms that the general procedure is useful, but that modifications are needed to improve percent survival and efficiency, particularly in tender lines. Samples that had been stored for up to 6 years at -160°C showed no decline in viability during storage. 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. In tests with diverse lines, desiccation was not obligatory since high levels of survival occurred in undried sections from many lines, probably those that show considerable cold acclimation potential. For dried and undried materials, increasing the holding time at -30°C improved survival in some lines, but was not consistent or predictable enough to be generally useful. Cooling rates between -30°C and -160°C did not greatly influence survival; again some lines benefitted from faster rates. Faster warming rates gave slightly higher viabilities, but the fastest rate used by direct plunging into warmed water was quite injurious. Experiments using longitudinally-sliced twigs and desiccation at other temperatures were initiated to see if some aspects of the procedure can be expedited. Survival was obtained after treatments, but in some cases drying was too quick and, thus, it became difficult to accurately adjust the moisture content.

Pear and *Vaccinium* from Corvallis were examined, but in preliminary tests viability was very low, probably due to the very low extent of acclimation occurring in the Corvallis, Oregon location

in fall 1994-winter 1995. Sour cherry, *Prunus cerasus*, from Geneva, NY was examined in greater detail for routine storage because of positive results from preliminary tests. Five lines were examined in 1995 and the general procedure gave greater than 40% survival in 4 of the 5. The 40% value is the criterion used to determine whether a sample is cryopreserved within the base collection. Assessments of viability by browning generally corresponded with the more conclusive test of budding. In several cases, the main bud abscised, but shoots developed, probably from basal axillary meristems. Survival was enhanced by using sections adjusted to 25% moisture compared to the routine 30%. A more extensive test with greater diversity in sour cherry is planned for 1996.

Some tests of the encapsulation/sucrose exposure/ dehydration method were performed. In observations done with the oxidative browning test, levels of survival were about the same as those found with the routine test. Sucrose exposure and desiccation alone were sufficient in some tests. The results obtained were positive enough to warrant further examination.

Many of the observations made are probably related to extent of cold acclimation and the potential to attain this within the genotype. Presently, most lines are uncharacterized with regard to extent of acclimation in a given year or what maximum hardiness potential is. It is not feasible to do the many tests each year to ascertain the information, but storage systems would benefit from a simple gauge to assess this information. With this, enhanced storage might be obtained by using appropriate modifications (holding time at -30, determining if drying is necessary, increasing warming rate etc.).

CRYOPRESERVATION OF SHOOT TIPS USING VITRIFICATION METHODS

L. E. TOWILL (PI Physiol), Devon Hawkins (part time technician), Dave Huber (student), Joyce Pennycooke (grad stud)

PROBLEM: Vitrification, a method to cryopreserve diverse cells, tissues and organs, has been shown by us and others to be effective for a range of species. This is a relatively new method and is, as yet, not used as a routine method for cryopreservation. Vitrification is a process containing a series of steps, a number of which must be optimized. Modifications of the vitrification process need to be explored to develop a procedure that is efficient and effective. When incorporated, cryopreservation will allow clonal repositories options for cost savings in managing their field, greenhouse or in vitro collections. We continue to investigate aspects of vitrification for several species.

APPROACH: Most of these studies were done with axillary buds excised from plants maintained in vitro. Such systems are axenic and minimize contamination when the treated axillary buds are cultured to produce the shoots. Both in vitro stock plants and the buds isolated from them may be treated prior to cryopreservation. Both liquid-based and encapsulation-based vitrification procedures are being examined.

RESULTS: A previous study of about 50 species of *Mentha* showed that most could be cryopreserved with a single method. We are continuing a pilot test with 50 clonal lines from the Corvallis repository that are identified as being part of the core collection. From this we will obtain cost information to allow us to plan for future practical studies at NSSL. Currently ten lines have been processed. Lack of trained personnel has hindered efforts in this area.

'Encapsulation and dehydration' methods for cryopreservation also are a form of the vitrification procedure. In preliminary tests, we determined the kinetics of drying and survival for mint shoot tips within capsules. The procedure has some technical advantages and was examined in more detail with potato in a modified system using encapsulated envelopes. Shoot tips survive considerable desiccation, but do not survive subsequent exposure to -160°C. In late 1995 we began to examine this method in sweet potato. Preculture treatments are being studied to determine their effect on survival.

A medium term project for storage of in vitro-maintained sweet potato lines from Griffin, GA. was initiated at NSSL. The objective was to provide a second site backup at NSSL since materials at GA are all held in one growth room and are at risk. Holding conditions at NSSL were at 18°C with an 18 hour photoperiod. Lower temperatures were examined in preliminary tests and chill injury was evident at about 14 to 16°C. Most lines have survived at least 9 months under these conditions (longest time used). This project drew awareness to the need for a backup site and currently materials are to be held at two physically different sites at the Griffin station.

Previous studies in this lab have shown that *Arachis glabrata* shoot tips survive a vitrification procedure. Based upon these methods, in conjunction with the Griffin, GA Plant Genetic Resources Unit, we are beginning the preservation of somatic embryos generated on leaf sections from several lines. We have previously shown that somatic embryos from walnut and somatic embryogenic materials from cotton could survive a vitrification method. These methods should allow long-term preservation of vegetatively-propagated *Arachis* species as they are introduced into in vitro systems.

ORTHODOX SEED STORAGE: OPTIMUM CONDITIONS AND MECHANISMS OF DETERIORATION

CHRISTINA T. WALTERS (PI Physiol); E. E. Roos (Supvry PI Physiol); Steve Eberhart (Dir, NSSL); Jennifer Crane (Biol Sci Tech); Lisa Hill (Biol Sci Tech); Melissa Andre (Student); Emily McCormick (high school student), Gabrielle Tarpey (high school student), Olivier Leprince (PI Physiol, Res Assoc); Julia Buitink (Visiting Scholar, Netherlands)

PROBLEM: All seeds inevitably lose viability during storage. The kinetics of seed aging varies among species, among lots of the same species and among different storage conditions. We have established that there is an optimum water content for seed storage, but that it varies with seed characteristics and temperature of storage. There are insufficient resources to determine optimum storage conditions and aging rates for every accession in the NPGS. The purpose of this project is to determine the mechanism(s) of seed deterioration so that: 1) the optimum conditions for storage for all seeds in the NPGS can be easily determined; and 2) the rate of deterioration of any lot can be predicted. This information will improve the efficiency of seed storage operations by ensuring that loss of viability is minimized while reducing the need for monitoring.

APPROACH: We have taken a biophysical approach to the study of mechanisms of seed deterioration and optimal conditions for seed storage. Our research shows that the metabolic status of seeds is linked to the physical status of water in the tissues. A major portion of our research is directed towards identifying the properties of water and how the nature and kinetics of the aging reactions are controlled. In addition, we are studying biochemical changes that occur in seeds under dry, cold conditions.

RESULTS: We have developed phase diagrams for seeds based on calorimetric measurements of water. We believe that the nature of deteriorative reactions varies according to the phase properties of water. We have detected state changes at specific water activities. When water exists in a glassy-rubbery state, aging kinetics are related to the viscosity of the cellular matrix and so standard thermal-chemical models (WLF kinetics, Arrhenius behavior) predict kinetics. When seeds are dried and/or cooled excessively, the glassy structure of the water is destroyed and this makes macromolecules in the cells susceptible to structural changes. Principles for predicting the kinetics of these reactions are not known as yet, but the research shows that reducing temperature does not always limit aging rates.

We believe that the principles used to determine mechanisms of aging and hence optimum conditions for seed storage hold for most seed species. This has allowed us to develop generalized protocols for storage and to make cost-benefit analyses of various storage practices. Our research provides the basis for more efficient protocols now used at the NSSL. Through our consultations

with IPGRI, we are helping to develop more efficient seed storage practices in under-developed countries.

CRYOPRESERVATION OF RECALCITRANT SEEDS

C.T. WALTERS (PI Physiol), J. Crane (Biol Sci Tech), Mirian Eira (EMBRAPA, Brazil), Patricia Berjak (U Natal, So. Africa), Norman Pammenter (U Natal, So. Africa), David Mycock (U Witwatersrand, So. Africa) L. Hill (Biol Sci Tech), M. Andre (student)

PROBLEM: Many economically important plant species from tropical areas and temperate wetlands or forests 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: We are studying the mechanisms and interaction of desiccation damage and freezing damage in seed tissues. We have shown that the expression of these stresses corresponds with the behavior of water in tissues. We are learning ways to manipulate water properties with various incubation procedures, cryoprotectants, and cooling treatments.

We have been also been focusing on developmental aspects of embryogenesis to determine processes leading to desiccation tolerance that are present in orthodox seeds, but absent in recalcitrant seeds. In fully mature seeds, we have been focusing on the dry-down process in order to distinguish between desiccation damage and damage associated with holding seeds at intermediate water contents. We believe that these studies will lead to the elucidation of the mechanism of desiccation damage in seeds.

We are studying a number of species that range in their tolerance to desiccation. *Acer saccharinum*, *Aesculus hippocastanum* and *Zizania palustris* as well as some relatives in the citrus are most sensitive to desiccation. Recalcitrant seeds of lesser sensitivity to desiccation include *Coffea*, *Citrus*, and *Carica*. All of these genera are agronomically important to the US and a germplasm collection is either non-existent or exclusively in orchards.
RESULTS: Using the principle of optimum water levels, we have developed two methods to preserve recalcitrant seeds. In the first method, water content is adjusted to avoid both freezing and desiccation damage. Depending on species and maturity level, we achieve between 50 and 100% survival using this method. Efforts are underway to increase the cost-efficiency of this method and to determine the longevity of seeds stored under these conditions. A second method, called "vitrification," involves a slight and extremely rapid dehydration and then plunging embryos into liquid nitrogen at 2000°C/sec. This method is labor intensive and is recommended only in instances where the first method is not feasible.

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Note: Names in caps are present or former ARS employees, or were supported on NSSL funds.

PLANT GENETIC RESOURCES CONSERVATION UNIT
Griffin, Georgia

June 1996

Objectives: Manage seed and clonal genetic resources through effective, state-of-the art preservation and regeneration protocols; and document and distribute these holdings as required.

Status of Activities: Genetic resources representing over 1,200 new accessions were received, increasing the Unit holdings to in excess of 75,000 (plus an additional 18,000 currently held at the National Seed Storage Laboratory. New introductions represented a broad range of genera and species. Over 7,500 seed regenerations were accomplished at Griffin or through cooperators across various sites. In response to more approximately 800 requests, more than 31,000 distributions were made (approximately 90% were supplied to domestic users). Over 500 oligomers were distributed as molecular markers to profile ('type') accessions and map useful characteristics. In complement, an enhanced effort on database development of the Germplasm Resources Information Network (GRIN) occurred. More detail on these particular service activities can be obtained directly from the research leader, curators, and/or GRIN database manager.

Summary documentation regarding collections status are highlighted in the attached report prepared for Dr. Shands in May 1996.

Needs: Operational needs of the Unit also are documented and prioritized in the attached report.

Attachments:
May 1996 report on collections
May 1996 summary on erosion of funds
Summary of S-9 budget request for 1996

ANNUAL RESOURCES MANANAGEMENT PLAN

FYs 1988 - 1996

USDA, ARS, SAA

Plant Genetic Resources Conservation Unit

Griffin, Georgia

04/09/96

FISCAL YEAR	BASE FUNDS $	PERSONAL SERVICES $	PERSONAL SERVICES PERCENTAGE %	ALL OTHERS $	ALL OTHERS PERCENTAGE %
1988	1,391,886	403,101	28.96	988,785	71.04
1989	1,354,741	355,408	26.20	999,333	73.80
1990	1,409,873	480,375	34.07	929,498	65.93
1991	1,389,832	642,442	46.20	747,390	53.80
1992	1,493,596	824,647	55.10	668,949	44.90
1993	1,480,848	935,511	63.10	545,337	36.90
1994	1,477,165	869,766	58.90	607,399	41.10
1995	1,482,811	996,098	67.20	486,713	32.80
1996	1,363,048	962,848	70.60	400,200	29.40

flat

Δ salaries

ANNUAL RESOURCES MANAGEMENT PLAN
S-9 PROJECT - HATCH ACCOUNT

FYs 1988 - 1996

UNIVERSITY OF GEORGIA
PLANT GENETIC RESOURCES CONSERVATION UNIT

FISCAL YEAR	BASE FUNDS	PERSONAL SERVICES	%	ALL OTHER	%
1988	140,458	103,993	74%	36,465	26%
1989	177,613	141,148	80%	36,465	20%
1990	187,815	151,350	81%	36,465	19%
1991	201,836	165,371	82%	36,465	18%
1992	203,425	166,960	82%	36,465	18%
1993	200,315	160,874	81%	39,441	19%
1994	211,766	175,301	83%	36,465	17%
1995	220,860	184,395	84%	36,465	16%
1996	234,810	195,459	84%	39,351	16%

5/23/96

Trepovich
2 May 1996

PLANT GENETIC RESOURCES CONSERVATION UNIT
GRIFFIN, GEORGIA

STATUS REPORT
May 1996

The **Plant Genetic Resources Conservation Unit (PGRCU) at Griffin** currently maintains **approximately 75,000 accessions** representing over **1,500 species of 250 genera**. However, **nine species** (including sorghum, peanut, cowpea, mung bean, pepper, watermelon, okra, sesame, and sweet potato) represent **approximately 70%** of the holdings. In response to the following questions, a summary table has been prepared for easier review. Please note that in addition to the collections maintained at Griffin, there currently exists in excess of **18,000 accessions** (representing priority crops for Griffin) held at the National Seed Storage Laboratory (NSSL) that have not been incorporated into our holdings.

Question 1. For each of the major crops at your site, how many accessions are available for distribution?

Of the holdings presently maintained at Griffin, approximately 81.9% (over 61,000 accessions) are available for distribution.

Question 2. How many accessions are backed up at the National Seed Storage Laboratory?

Of the holdings presently maintained at Griffin, approximately 38.0% (over 28,000 accessions) are backed up at the NSSL. This total includes 35.9% backed up as required and 2.1% as critical back up.

Question 3. What is the plan for regeneration for those with inadequate seed supply?

The plans for regeneration are prepared and implemented by the individual curators. Because of the large backlog, incomplete accompanying data, inherent inefficiencies and difficulties in regenerating cross-pollinated (heterogeneous and heterozygous) accessions, and infrastructure and personnel constraints, many assumptions are made and planning is a challenge (see attached documentation provided by individual curators). Moreover, the 'easy' accessions have been regenerated and primarily more difficult materials remain for handling. At present, the curators strive for a completed regeneration cycle of approximately a decade, though this will vary from crop to crop based on resources available, and specific operational and logistical limitations.

Question 4. How many accessions do you plan to increase per year and how many years do you anticipate it will take to get caught up?

A simple answer to this question is not possible; moreover, it varies from crop to crop and by resource availability and curators' capabilities. Current and projected improvements in infrastructure and increased personnel for regeneration greatly impact the work done per year and the number of years needed to get to an appropriate regeneration schedule. However, as noted in the previous response, curators strive for a complete cycle of a decade or shorter. This schedule also assumes 'current' holdings at Griffin and does not reflect additional requirements made by increasing collection sizes in the future.

Question 5. What are the limitations to getting caught up on regenerations or doing it quicker?

Based on projections and potential, the PGRCU has established a preliminary plan to increase its capabilities for effective long-term regeneration, maintenance, and documentation for each crop collection. The plan, at present, assumes most work will be done at Griffin and Byron. However, the PGRCU will work in partnership with Mayaguez and Parlier as these sites are able to support regeneration activities.

* To be an effective site for long-term regeneration and conservation responsibilities (exclusive of research support for curation), Griffin will require the following:

- an annual working budget of approximately $3.3 million (currently $1.8 million). This funding would allow for the addition of approximately 15-20 individuals (@ $30,000 per employee) to adequately support regeneration, maintenance, and documentation activities.
- 60-80 additional acres of land to support controlled pollinations and isolation blocks needed for regeneration (cost undetermined).
- 500 pollination cages (@ $500 per cage). Ames does about 500.
- a farm operations building to house equipment and supplies (@ approximately $150,000)
- an air-conditioned, well-ventilated building and equipment for seed cleaning (@ approximately $150,000).
- back-up facilities for *in vitro* culture of sweet potato and peanut (@ approximately $150,000).
- additional greenhouse and screenhouse space (cost undetermined).

Summary of Core Collections

Among the major crop collections maintained at Griffin, only cultivated peanut has a core collection (798 entries) established by the relevant CGC. Core collections have been established for three smaller, annual *Trifolium* spp. (clover) collections by the Clover and Special Purpose Legume CGC. The *Vigna* curator has established a cowpea core collection of approximately 700 entries. A pepper core collection is planned for completion in late 1996.

Summary of Operations Manual

The PGRCU has a unit-wide operations manual highlighting curatorial and database activities. It is currently being updated with the last revision occurring in January 1994 (see attached document).

Key Points

A fundamental change in the U.S. National Plant Germplasm System (NPGS) occurred in the 1980s when the mission changed solely from plant introduction to both introduction and long-term conservation of crop genetic resources. Therefore, a tremendous backlog currently exists with regard to needs of regeneration, maintenance, and documentation at Griffin.

The numbers presented in this document do not accurately reflect the 'complete' story. In particular, quality issues are not reflected in the numbers. For example, though 81% of the holdings of the PGRCU are available for distribution, most crops have fragmentary information on seed viability (percent germination). Many regenerations were done with little regard to genetic integrity. Also, passport, characterization, and evaluation data are incomplete so we have no idea of redundancy or genetic representation of the collections. These needs are being addressed but the pace of progress is slow and much of the historical information may never be reconciled.

In summary, Griffin will make constrained progress with basal regeneration, maintenance, and documentation with current funding. Quality regeneration, maintenance, and documentation are resource-intensive activities. To provide the service needed for long-term conservation and use, significant increases/upgrades in personnel, operating funds, and infrastructure are needed. Griffin is responsible for a tremendously wide array of crops (1,500 species representing 250 genera) and collection sizes are excessive in some instances. Moreover, the challenges will increase in the future. If we are to be responsible, we need to project true costs of operation and establish priorities for long-term agricultural security based on the funding we are able to acquire.

PLANT GENETIC RESOURCES CONSERVATION UNIT
GRIFFIN, GEORGIA

MAY, 1996 SUMMARY

GROUP	CURATOR	SITE CROP	TOTAL ACCESSIONS	NUMBER AVAILABLE	NOT AVAILABLE	BACKED UP	CRITICAL BACKUP	CORE	NSSL ONLY[1]
Grasses & others	Lovell, Gil	Bamboo	70	70	0	50			
		Castorbean	357	272	85	325			672
		Hibiscus	361	225	134	46			380
		Miscellaneous	264	198	66	98			156
		Pearl millet	527	357	170	29			683
		Sesame	1,084	1,065	19	949			146
		Warm Season Grasses	7,171	6,154	1,017	1,243			2,429
		Sorghum	27,280	25,152	2,123	10,525			12,112
Legumes	Morris, Brad	Guar	350	347	3	259	84		951
		Legumes	2,906	2,148	757	515			94
		Trifolium	1,957	1,303	654	416		95[2]	46
		Winged bean	165	18	147	1	17		
Peanuts (8,804)	Pittman, Roy	Cultivated	8,224	7,379	845	6,064		798	60
		Wild	580	477	103	5			

[1]Figures in this column represent accessions held only at NSSL for which Griffin is the first priority site in the NPGS.

[2]Core includes three clover species: *T. alexandrinum, T. resupinatum, T. subterraneum*

PLANT GENETIC RESOURCES CONSERVATION UNIT
GRIFFIN, GEORGIA

MAY, 1996 SUMMARY

NSSL (350 used)

not an adequate quantity of seeds

GROUP	CURATOR	SITE CROP	TOTAL ACCESSIONS	NUMBER AVAILABLE	NOT AVAILABLE	BACKED UP	CRITICAL BACKUP	CORE	NSSL ONLY[1]
Vegetable Crops	Jarret, Bob	Citrullus	1,611	1,335	276	720			317
		Cucurbits	1,276	496	774	195			47
		Eggplant	864	841	22	501	242		40
		Gourds	458	259	199	121	103		12
		Ipomoea	1,053	725	328	4			34
		Luffa	159	129	29	52	60		1
		Okra	1,927	1,534	393	368	1,079		35
		Pepper	3,802	3,615	187	1,018			174
Vigna (12,391)	Gillaspie, Graves	Cowpea	7,603	4,625	2,978	2,657		700	247
		Mung bean	4,186	2,417	1,768	670			29
		Other Vigna spp.	602	137	465	56			1
Grand Total for Griffin crops			74,837	61,278	13,542	26,887	1,585	1,593	18,666
Percent (%)				81.9%	18.1%	35.9%	2.1%		

[1]Figures in this column represent accessions held only at NSSL for which Griffin is the first priority site in the NPGS.

Arachis Curation Project

Roy N. Pittman

I. Objectives

Curate the National Plant Germplasm System *Arachis* collection which is currently made up of 70 described species. Duties include the acquisition, maintenance, evaluation, and distribution of germplasm. In addition, germplasm is screened for the presence of pathogens and therapeutic procedures used to eliminate pathogens prior to release to the user public.

II. Status

A. Accomplishments

1. Descriptors for peanuts have been converted to the newly approved descriptors. A publication about the descriptors is available now.
2. Developed an in vitro conservation protocol for the rhizomatous peanuts.
3. Selection of a wild peanut increase site in Puerto Rico.
4. The core collection for cultivated peanuts has been regenerated and available for distribution.
5. Updated the inventory for the wild peanut germplasm with seeds available for distribution.
6. Regeneration of 850 cultivated peanuts at Griffin in the field.
7. Regeneration of cultivated peanuts from ICRISAT were processed through quarantine in the greenhouse.
8. Regeneration of 12 'Hirsuta' type peanuts at Puerto Rico.
9. Established a contact with the Oil Seeds Institute in China which coordinates the peanut program. In addition, contacts were made with the regional peanut programs in the three regions of productions.
10. Favorable information about storing peanuts at -20°C for both wild and cultivated.

B. Work in progress

1. 1250 accessions of cultivated peanuts have been planted this year for increase.
2. Accessions from the Spring 95 Brazil Peanut Collection have been started through an 'inhouse' quarantine. This is part of a standard procedure for all new germplasm.
3. Modifications to Rhizomatous procedure are being developed for long term maintenance.
4. Material from the 95 Williams collection has been started through in house quarantine to evaluated possible difference in testa color prior to assigning PI numbers.
5. An agreement in cooperation with the Plant Introduction Office has been established with Ecuadorian cooperators to increase material from the 95 Williams and Williams collection.
6. Inventory of the vegetative wild peanuts is in process and specie names being assigned based on Krapovickas and Gregory's Monograph and Valls.
7. Requested 10 -12 cultivated lines from South China Experiment Station.
8. Requested 20 -25 'Hirusta' types from visiting scientist from the Oil Seeds Institute in China.
9. Virus elimination from wild peanut germplasm continues.

III. Needs

1. Growth chambers for long term storage of in vitro cultures.
2. Wild peanut digger/sieve to aid in the harvest of plots--source Australia?
3. Cages for wild peanut increases to eliminate out crosses.

Pittman

Dr. Allan Stoner information request for Dr. Shands.

I. 1. For each of the major crops at your site, how many accessions are not available for distribution?

i. Cultivated peanuts--7,379 available; 845 not available.

ii. Wild peanuts----------477 available; 103 not available.

Wild peanuts are in the process of being inventoried and identity verification. After the local inventory of the greenhouses, the inventory will be updated for vegetative materials.

2. How many accessions are not backuped at NSSL?

i. Cultivated peanuts not backed up at NSSL--1315.

ii. Wild peanuts not backed up at NSSL or elsewhere--472 out of 477 seed producing accessions. In addition, another 300-500 vegetative types are not backed up at present.

3. What is the plan for regeneration for those with inadequate seed supply?

i. Cultivated peanuts after a 1200 accession increase this year will be about caught up with seed regeneration of the material needing increased based on low seed counts and poor germination. New material from India has been increased in the greenhouse and will need increasing in the field in 1997. In addition, new material identified during shipping processors as 'not available' will need to be increased. This is expected to be about 500 accessions, maybe. The cultivated with a short growing season can be increased in Griffin while long season accession will have to be increased elsewhere such as Puerto Rico or south Florida.

ii. Wild peanuts will have to be increased in Puerto Rico or south Florida. In addition, steps will have to be taken to eliminate out crossing due to bees or other insects. Accessions of wild peanuts will need to be caged.

4. How many accessions do you plan to increase per year and how may years do you anticipate it will take to get caught up?

i. Cultivated peanuts after 1996 should be caught up with increases except for normal increases because of age, low germination, or new introductions. I do not think we can ever 'get caught up' because of this. One should plan for between 300 - 1000 accessions per year for cultivated peanuts.

ii. Wild peanuts probably need the whole collection increased in order to have enough material

available here and at NSSL. This would be about 500 accessions of which 5 are presently backed up at NSSL. Fifty accessions a year would be a big task requiring a great amount of labor and equipment. This would require 10 years based on information available today.

5. Limitations for getting caught up on regenerations or doing it quicker include:
   i. Cultivated peanuts--need for a very long season grow out location. This is critical for those accessions which require 180 days or more to mature seed. This is not available in Georgia!
   ii. Wild peanuts--
      a. Again, a location with a very long growing season.
      b. Cages to control pollination from insects.
      c. A small plot digger and sieve for the small seed wild peanuts. No such piece of equipment is available for small plots. This would have to be designed from the ground up to meet the necessary specifications. It have to dig soil and sieve soil about 6 inches deep and move through the plot. A 3 to 4 foot wide digger/sieve would be best. In addition, it would need to be easily cleaned between accessions.
      d. Additional help will be needed to increase 50 accessions a year. This would be critical if no power equipment is available to dig and sieve the pods. Digging and sieving by hand might require 2-3 or more hours per plot.
   iii. Both require a acid soil. A sandy soil is best for both to aid in separating the soil from the pods during digging.

II. Core collections
   1. Cultivated peanuts have a core collection. The information about the core has been available since 1993.
   2. Because of the small number of wild peanuts no core collection has been developed on advice from the CGC.

PLANT PATHOLOGY AND VIGNA CURATION PROJECTS

A. Graves Gillaspie

I. Objectives

Develop and apply new technologies for detection, diagnosis, and elimination of pathogens on introduced plant germplasm. Curate the National Plant Germplasm System *Vigna* germplasm collection including acquisition, maintenance, evaluation, and distribution. Screen introduced germplasm for the presence of pathogens and conduct therapeutic procedures to eliminate such pathogens prior to the release of the germplasm.

II. Status

A. Accomplishments

1. Virus elimination from 80 lines of cowpeas from Botswana, Kenya, and elsewhere.

2. Regeneration of 50 lines of Bamberra groundnut in the screenhouse.

3. Regeneration of 36 cowpea accessions and 102 accessions of mung beans in the field at Griffin. Found that Bamberra groundnut could be regenerated in the field at Griffin if the plants were started in the greenhouse and transplanted to the field in May.

4. Core collection established for cowpeas consisting of 700 accessions.

5. Cowpea collection has been bar-coded and backup samples have been sent to the National Seed Storage Lab (NSSL) for many accessions. Additional mung bean accessions have been cleaned, counted, and weighed, but more remain to be processed.

B. Work in progress

1. Regeneration of 157 lines of cowpeas from Botswana in the field at Griffin

2. Greenhouse virus elimination and regeneration of *Vigna* lines in the greenhouse, especially for those photoperiod sensitive lines that will not flower under field conditions at Griffin.

3. Count and weigh remaining mung bean accessions, bar code all of the mung bean inventories, and pull samples for NSSL backup.

4. Characterization and study of epidemiology of viruses isolated from cowpea and other legumes in regeneration plots at Griffin.

5. Work on nucleic acid-based virus-detection methology, especially PCR-based tests, to increase sensitivity and specificity.

III. Needs

A. Technical support for laboratory work in molecular biological virus-detection approaches.

B. Grow lights in greenhouse to improve conditions for winter regeneration and research.

Gillespie

Updated Information on Vigna Germplasm Collection
April 1996 Version

SITE CROP	TOTAL	NUMBER AVAILABLE	NOT AVAILABLE	TOTAL INV. RECORDS	INV. WITH COUNTS	BACKED UP	CORE
cowpea	7,603	4,625	2,978	8,758	8,553	2,657	700
mung	4,186	2,417	1,768	6,208	2,510	670	
other	602	137	465	712	470	56	
cowpea core	700	681	19	989	987	202*	

*This number does not include core accessions which might have been shipped in the last three backup orders which have not been processed by NSSL.

- Plan for regeneration:

A. 1996

1. Field - 157 lines of virus-free Botswana cowpeas to be regenerated in Griffin after regeneration was not successful in St. Croix because of soil pH and hurricanes.

2. Greenhouse - remaining cowpea lines from 1989 and 1990 UCR growouts through virus elimination procedures; lines from Botswana and Kenya as well as a few lines from the 1994 field regeneration plot that failed to flower because of photoperiod problems. (82 lines)

B. 1997 and beyond

1. Field (cowpea) - Approximately the same number of lines as for 1996 above depending upon amount of support and field space; emphasis initially on obtaining adequate amounts of those lines in the cowpea core for distribution and normal backup at NSSL. After the core is in good shape, will concentrate on regeneration of the IITA lines that were introduced recently at the request of the CGC and that were not handled at UCR. This number is currently at about 2,000 lines.

2. Field (mung bean) - After the mung bean lines are counted and weighed and a core collection is established, the approach will be as above for cowpeas. But the number regenerated will depend on number of cowpeas regenerated - that is that the number of lines total that can be handled with the FY 96 level of support will continue to be about 150 per year.

3. Greenhouse (cowpeas and mung beans)- Emphasis on obtaining adequate seed amounts for distribution of those lines that fail to set seed in Georgia and any lines that are acquired that originate in a location in which exotic viruses may be a problem. Total number handled in this way depends upon space available as well as support.

- Regeneration summary:

With the current level of support, regeneration will stay at about 150 lines per year in the field in Georgia and 50-80 per year in the greenhouse. This means a minimum of 10 years to meet the requests of the CGC. The germplasm within the cowpea core and the future mung bean core can be made current within two years. Personnel and field space continue to be limiting. Field space at Byron is available, but travel between plots and Griffin a problem with current personnel level. Maintaining a current, usable, low redundancy core of each group is the best answer to the regeneration problem.

CLOVER AND SPECIAL-PURPOSE LEGUME CURATORIAL ACTIVITIES

Brad Morris

I. Objectives

Curate the National Plant Germplasm System's clover and special-purpose legume germplasm collection which consists of 5378 accessions of approximately 424 horticultural, agronomic, ornamental, medicinal, and industrial species. The mission and objectives include acquisition, maintenance, characterization, evaluation, documentation, and distribution of germplasm. In addition, low viable seed are cultured *in vitro* for rescuing germplasm.

II. Status

A. Accomplishments

1. The seed database including seed cleaning, weights and counts is high priority. Sixty-four percent of the clover collection is complete.
2. A total of 30 pollination cages were designed, built and utilized for regenerating cross-pollinated clovers and one lespedeza species.
3. Established a contract with a beekeeper to provide and maintain honeybees used in regenerating cross-pollinated species.
4. Regeneration of 100 accessions from several important legume species including *Cyamopsis, Desmodium, Lablab, Indigofera* and *Stylosanthes*.
5. Developed an *in vitro* protocol for low viable seed rescue.

B. Work in progress

1. The seed database work continues.
2. Twenty-seven cross-pollinated clovers were transplanted on April 1. Currently, all but two accessions have flowered. Honeybee hives have been placed in about one-half of these with the others scheduled at 20% flowering.
3. Two hundred accessions of important legumes have been planted for regeneration. This includes several *in vitro* accessions with low seed viability.
4. The African clover species are being grown in Beeville, Texas for a possible regeneration site.

C. Future

1. Complete the seed database work in 2 years.
2. Regenerate 100-200 cross and self-pollinated clovers next year. This will largely depend on progress in the seed database work.

April 23, 1996

To: Steve Kresovich

From: Brad Morris

Subject: STATUS OF CLOVER AND SPECIAL-PURPOSE LEGUMES CURATION PROJECT

Trifolium

During the last 5 years, 2969 annual clover accessions were distributed. About 416 accessions need to be backed up at NSSL and 654 accessions need to be regenerated. Plans include regenerating 125 Trifolium accessions per year at Griffin with an anticipated completion date of six years. However, this completion date could be reduced in half with the use of a winter regeneration site such as Puerto Rico. The specific items needed are 100 pollination cages, storage area for these cages, and at least 4 people from the farm crew at critical times such as planting, placing cages in the field, and harvesting. Core collections exist for Trifolium alexandrinum, T. resupinatum, and T. subterranean. These core collections are designated in GRIN. At present, no other Trifolium core collections are proposed or being developed. The operation manual for the Trifolium species is current. Approximately 1500 accessions need to be counted and weighed.

Cyamopsis

Within the past 5 years, 1133 Cyamopsis accessions were distributed. 259 accessions need to be backed up at NSSL. The critical regenerations were completed in 1995. A core collection does not exist for Cyamopsis and is not proposed. The operation manual for the Cyamopsis species is in place and has been revised. Counts and weights are completed.

Legumes

During the past 8 years, 6430 special-purpose legume accessions were distributed. 515 accessions need to be backed up at NSSL. About 757 accessions need to be regenerated and 3500 accessions need to be counted and weighted. Current plans include regenerating 125 legumes at Griffin with an expected completion in 7 years. However with the use of a winter and perennial grow-out site such as Puerto Rico, the regeneration time could be cut to 3 years. Items needed include 100 pollination cages, storage area, and at least 4 people from the farm crew at planting, placing cages in the field, and harvesting. A core collection is in the process of being developed for Aeschynomene. There are

not any other core collections proposed for the special-purpose legumes. The operation manual for the special-purpose legumes has been revised.

Psophocarpus

158 accessions have been distributed within the past 5 years. 203 accessions need to be backed up at NSSL and 147 accessions need regenerating. Plans are to regenerate Psophocarpus in five years. However, we will need to utilize a perennial nursery in an area such as Puerto Rico. Four people from the farm crew will be needed to help plant and harvest seeds. There are not any core collections being proposed or developed for Psophocarpus. The operations manual is current. Counts and weights are completed.

Activity Report to the Technical Advisory Committee
S-9 Regional Project
June 4, 1996

Gil Lovell
Grass Curator

FORAGE AND TURF GRASS COLLECTION

A complex group of 7,171 PI's composed of 106 genera and 537 species. There are 1,017 PI's not available for distribution because of low seed quantity and 5,928 are not backed-up at NSSL.

Regeneration 1995- 235 PI's 1996- 253 PI's

Part of the grass regeneration (165 clones) for 1996 is material that has been maintained in the greenhouse over the years for various reasons. However, now a need exists for space for the maintenance of new turf grass accessions. We will be carrying out detailed observations on the flowering and seed set characteristics of the individual accessions. It is expected that enough seed will be harvested for a larger regeneration in the near future. With some of the species we will be documenting the need for better regenerations at more southern/tropical sites.

CASTOR (*Ricinus communis)* COLLECTION

There are 357 PI's in this collection; 85 are not available for distribution of which 32 are not backed-up at NSSL.

Regeneration 1995- 7 PI's 1996- 10 PI's

SESAME (*Sesamum indicum & S. radiatum*) COLLECTION

There are 1,079 PI's in this collection with *S. indicum* totaling 1,074. Only 12 PI's are unavailable because of low seed quantity. However, 303 PI's need regeneration to provide back-up samples to NSSL.

Regeneration 1995- 7 PI's 1996- 13 PI's

MISCELLANEOUS COLLECTION

This collection totals 264 PI's of 24 genera and 34 species. There are 66 unavailable for distribution and 166 not backed up at NSSL.

Regeneration 1995- 8 PI's 1996- 17 PI's

SORGHUM AND PEARL MILLET COLLECTIONS

These collections are regenerated at the Tropical Agriculture Research Station, Mayaguez, P.R. and St. Croix, V.I. under the supervision and planning of Dr. Jeff Dahlberg, Sorghum Curator.

KENAF (*Hibiscus cannabinus)* & Roselle (*H. sabdariffa*) COLLECTIONS

These fiber crop species are under review for probable transfer to the Cotton Germplasm unit at College Station, Texas. There are 164 PI's of Kenaf and 49 PI's of Roselle. These species are subject to short-day responses, cross-pollination, and are very sensitive to frost.

Lovell

4-24-96

Response to Allan Stoner's request of 3-26-95 for updated information on the status of regeneration backlogs, etc.

I. Status of availability for distribution -

1. Castor (Ricinus communis), of 357 PI's 85 are not available.
2. Hibiscus (H. cannabinus, H. sabdariffa, & H. spp.), of 361PI's 134 are not available.
3. Miscellaneous, of 264 PI's 66 are not available.
4. Pearl Millet (Pennisetum glaucum) of 527 PI's 357 are not available.
5. Sesame (Sesamum indicum), of 1,084 PI's 19 are not available.
6. Forage & Turf Grasses, of 7,171 PI's 1,017 are not available.
7. Sorghum (Sorghum bicolor), of 27,280 PI's 2,123 are not available.

Number of accessions not duplicated (backed up) at NSSL -

1. Castor - 32
2. Hibiscus - 315
3. Miscellaneous - 164
4. Pearl Millet - 498
5. Sesame - 135
6. Grasses - 5,928
7. Sorghum - 16,755

Regeneration schedule -

1. Castor - the 85 unavailable PI's can be regenerated in four seasons (1996-99) and these regenerations would provide backup samples for the 32 PI's not currently duplicated at NSSL.

2. Hibiscus - of the 134 PI"s not available 43 in the minor species are currently being regenerated by Dr. Doug Wilson (ARS retired). The remaining 91 PI's are in the Kenaf and Roselle which are pending transfer to the Cotton Germplasm Unit, College Station, TX. They can be regenerated in Mexico in one year for the cost of $1,800. These regenerations would not cover the remaining 181 PI's requiring backup samples at NSSL. However, they could be regenerated (in Mexico) in one or two additional seasons at the cost of $108.00 per PI plus shipping costs.

3. Miscellaneous - regeneration priority will be placed on the 66 PI's not available for distribution; these can regenerated in three years (1996-98) if we continue to have the extra labor as allotted us for the 1996 season. The remaining 32 PI's needing backup at NSSL would require an additional 2 years (1999-2000).

4. Pearl Millet - regeneration priority will be placed on the 357 PI's not available for distribution and secondary priority on 141 available but not backed up at NSSL. If TARS labor force is not reduced we can expect to regenerate both groups in 4 seasons (1996-99).

5. Sesame - a total of ll6 PI's need regeneration to meet needs of availability and backup samples. These can be regenerated in 4 years (1996-99) if we continue to have the extra labor as allotted us for the 1996 season.

6. Grasses - regeneration of 1,017 PI's will be given priority and can be accomplished in 3 years (1996-98) if we continue to have the extra labor as allotted us for the 1996 season. As we complete a detailed inventory (including seed counts) over the next 12 months we expect to be able to submit many more backup samples to NSSL. However, we fully expect to find other PI's requiring regeneration besides the 1,017 currently shown as unavailable. This crop will require a detailed review at end of the l997 growing season.

7. Sorghum - of the 2,123 PI's listed as unavailable, 125 are being harvested at TARS and the new balance will be 1,998. Since these PI's include numerous problem accessions, we need to allow a minimum of 3 years (1996-98) to regenerate them at TARS. An ongoing inventory is expected to provide many more backup samples. However, we also expect to identify more PI's with low seed quantity which will require regeneration at TARS for several years beyond 1998.

For the four crops (castor, miscellaneous, sesame,grasses) grown at Griffin and satellite locations in Georgia we can expect to regenerate a maximum of 500 PI's per year. Any reduction in field labor will be reflected in lower regeneration numbers. To insure high quality seed production and descriptor data for sorghum and pearl millet regenerated at TARS I suggest a maximum of 1,000 PI's of sorghum and 100-150 PI's per season.

As reflected in statements above, more man-hours than were available in FY's 94 & 95 is required to meet a continued maximum level of regeneration for the next 5 years. In any one year as many hours are needed for seed cleaning, counting, and packaging as is needed for planting, field maintenance, and seed harvesting.

II. Core Collections

No core collections have been established for the 7 crop groups discussed above. The Sorghum Curator, Dr. Jeff Dahlberg, is developing a core collection for the sorghum germplasm.

Gil

Gil Lovell
Germplasm Curator.

60-100 requests per yr.

Vegetable Crops Germplasm Maintenance (A Synopsis)

Sweetpotato (*Ipomoea batatas*) and related species
- Collection is about 600 PIs (clonal) + 250 PIs (seed).
- Fifteen (15) additional PIs were received in 95 and are in vitro.
- We are collaborating with CIP in their efforts to identify a global core collection of sweetpotato and with NSSL and CIP in locating funds to support research relative to technique development for cryopreservation of sweetpotato.
- Increase of seed of related species may be conducted in Mayaguez or other appropriate sites, in the future.

Watermelon (*Citrullus lanatus*)
- Seventy pollination cages were purchased in late 95.
- Watermelon seed increase is being carried out in Byron, GA.
- Eighty PIs with few original seed remaining were preincreased in the greenhouse in 95-96.
- A plant collecting trip to S. Africa was organized and carried out in April 96.
- 130 additional pollination cages have been requested for 97.

Squash (*Cucurbita* spp.)
- Fifty PIs of squash are being increased via collaborative arrangements with private sector breeders and SAES scientists.
- Ten PIs are being increased locally in isolation blocks.
- Future seed increase sites might include Mayaguez, Miami or Parlier, CA.

Pepper (*Capsicum* spp.)
- Forty PIs were increased in Griffin in 95 and 40 are being increased in 96.
- Four hundred PIs are being increased in New Mexico through a cooperative agreement with NMSU (Paul Bosland).
- A core collection of pepper is under development based on morphological and descriptor data.

Eggplant (*Solanum melongena*)
- Two-hundred and forty accessions of eggplant were increased in 1995.
- No eggplant PIs are scheduled for increase in 96.

Okra (*Abelmoschus* spp.)
- No okra was increased in 95 and none is scheduled for increase in 96.
- Okra will be increased either in Byron, GA or Griffin in the future, pending the availability of additional labor.

Luffa (*Luffa* spp.)
- Luffa species were increased in 95 through a cooperative agreement with NCSU (Todd Wehner). Characterization data were collected during the growing season.
- The cooperative agreement with NCSU has been extended through 96.
- Trellises will be constructed in Griffin, GA and Byron, GA to facilitate local seed increase of this crop.

Vegetable Crops Germplasm Maintenance-

Today and Tommorow

I. Objectives

Griffin maintains approximately 13,000 accessions of vegetable crops including; pepper (Capsicum spp.), watermelon (Citrullus spp.), squash (Cucurbita spp.), okra (Abelmoschus spp.), luffu gourds (Luffa spp.), eggplant (Solanum spp.), sweetpotato (Ipomoea spp.) and several miscellaneous genera including Momordica, Lagenaria, etc. The curator of these plant materials is responsible for their maintenance, increase and distribution. In addition, the curator, in cooperation with the various CGCs, is responsible for facilitating/coordinating/conducting germplasm characterization and the acquisition of additional germplasm.

II. Status of Individual Collections

A. Watermelon (Citrullus spp.)

1. Work in Progress. Seventy screen cages for controlled pollination of watermelon were purchased in 1995 with funds provided by the Area Office. Cages have been constructed in Byron, GA and the 96 watermelon seed increase will be accomplished at that location. Apiary services have been contracted locally. Eighty watermelon PIs were pre-increased in the greenhouse in the Fall-Winter of 95 for further increase in the field in the summer of 97. Recently, contacts were established with the Plant Genetic Resources Unit (PGRU) in the Republic of South Africa and a plant exploration trip was organized and conducted in April 96. Participants included J. McCreight (USDA/ARS) and T. Wehner (NCSU). Emphasis was placed on collection of Citrullus and Cucurbita and 104 accessions were acquired.

2. Future Needs. We anticipate a need to regenerate seed of approximately 200 to 300 PIs/year of watermelon. In order to accomplish this, additional pollination cages (170) will be required. Additional funding will also be required for procurement of apiary services, addition field support and supplies.

B. Squash (Cucurbita spp.)

1. Work in Progress. Griffin has a backlog of Cucurbita accessions requiring regeneration. In order to speed up the regeneration of these materials arrangements have been made with various commercial seed companies including PetoSeed, Asgrow Seed, Pioneer Seed, Harris Moran Seed and cucurbit specialists at various SAES including Clemson University, Auburn University, UC Davis and the University of Florida to regenerate one to several Cucurbita moschata PIs at no expense to the Griffin PGRU. An additional 12 PIs of C. moschata will be increased in Griffin and Byron in isolation blocks.

2. Future Needs. We intend to continue the practice of

increasing Curcurbita accessions in isolation blocks at various locations in the SE. Seed increase, in collaboration with the private sector and SAES scientists, will also be continued and expanded. Additional funding would permit expansion of regeneration activities to additional locations including Mayaguez, PR, and Parlier, CA

C. Luffa (Luffa spp.)

1. Work in Progress. A Griffin-North Carolina State University (NCSU) Specific Cooperative Agreement (SCA) was established to facilitate regeneration of seed of this crop. Seed will be increased, cleaned, packaged and returned to Griffin for maintenance and distribution. During the seed increase plants and fruits will be scored for morphological descriptors.

2. Future Needs. Construction of trellises in Griffin or Byron in isolation blocks would facilitate more rapid regeneration of the luffa germplasm. In addition, funds for the continuation of the SCA with NCSU will be required.

D. Pepper (Capsicum spp.)

1. Work in Progress. Pepper seed increase has been conducted primarily in collaboration with Dr. Paul Bosland (New Mexico State University, Las Cruces, New Mexico) since 1990, and this practice is being continued. Approximately 400 PIs were increased in 95 and an additional 400 PIs are scheduled for increase in 96. Seed from the 95 increase has been cleaned, inventoried and added to the S-9 for maintenance and distribution. Forty PIs of pepper were increased in Griffin in 1995 and 40 PIs are scheduled for increase in 96. In addition, 60 suspected duplicate accessions will be grown in the field in 96 for visual observation.

2. Future Needs. Much pepper germplasm remains to be regenerated. Funding will be required for the continuation of seed increase activities in collaboration with NMSU and the purchase of additional cages for control pollination seed increase in Griffin/Byron.

E. Eggplant (Solanum spp.)

1. Work in Progress. Two hundred+ accessions of eggplant, originally from Thailand, were increased in Griffin in 1995. Characterization data were obtained and entered in GRIN. No eggplant is scheduled for increase in 96.

2. Future Needs. Although it is generally assumed that outcrossing occurs at a very low frequency in eggplant, seed purity would likely be improved by using controlled pollination techniques. Funds are required for the purchase of 100 pollination cages.

F. Okra (Abelmoschus spp.)

1. Work in Progress. No okra germplasm was increased in 95 nor is any scheduled for increase in 96. Increase of this crop and its related species is labor intensive.

2. Future Needs. Effectively management of the okra germplasm collection will require substantial additional field support and acreage.

G. Sweetpotato (Ipomoea spp.)

1. Work in Progress. The sweetpotato germplasm collection continues to be maintained in vitro. Fifteen PIs of sweetpotato were received in 95 and these have been added to the in vitro collection. Approximately 1500 propagules have recently been provided to UGA-Athens in support of an SCA initiated to characterize the collection for root quality characteristics. There is a continued interest in the identification of a global core collection of sweetpotato. The curator is working closely with personnel at CIP (Lima, Peru) as they attempt to identify criteria for inclusion of material in a core collection. The curator continues to collaborate with personnel at NSSL in the development of cryopreservation techniques for sweetpotato. A plant exploration proposal was prepared by D. LaBonte and R. Jarret and submitted to the PEO. Sweetpotato germplasm with reported resistance to the sweetpotato weevil has been introduced from CIP.

2. Future Needs.

The technician currently responsible for routine maintenance of the in vitro collection has acquired additional duties related to the seed increase of other vegetable crops germplasm. Employment of a full-time technician for reculture activities is essential in order to maintain the security of the collection. Funding may be required to support the increase of Ipomoea spp. at another location such as Mayaguez, PR.

III. Summary

The acquisition of pollination cages and additional field space in Byron, GA has significantly improved the quality and quantity of seed regeneration of watermelon. However, additional pollination cages are required. Other vine crops will continue to be increased in isolation blocks locally and in collaboration with private and public sector breeders. Pepper seed regeneration will continue to be most effectively accomplished through the existing Griffin-Las Cruces SCA, and increased regeneration in Griffin. Additional pollination cages are also required for increase of pepper and eggplant germplasm in Griffin. Increase of okra germplasm will require a substantial increase in field support personnel. Additional funding may be required to support the increase of sweetpotato-related species germplasm at a more appropriate (photoperiod) location. Plasticulture with drip

irrigation has been adopted as a standard cultural practice.

Vamot

Watermelon (*Citrullus* spp.)

2,000 PIs total
1,335 PIs available
  276 PIs are unavailable due to low seed stocks
  720 PIs are backed up at NSSL

Many accessions in this collection have previously been increased by open pollination. Hence, although most PIs are available for distribution, there is reluctance by the community to utilize seed stocks increased in this manner. Open-pollinated seed will not be immediately discarded. However, future seed increases will be derived from control-pollinated original seed stocks.

Eighty (70) cages have been purchased for controlled pollination seed increase of *Citrullus lanatus* germplasm. We estimate a need to increase a minimum of 250 watermelon PIs/year to put the collection on 10 year regeneration cycle. Limitations for increased seed regeneration at this time include; adequate cages, funding for apiary services, and personnel. The location will require an additional 180 cages for increase in 1997. Cages cost about $500/ea, for a total of approx. $90,000 for 180 cages.. Watermelon increase is currently being conducted in Byron, GA and adequate field space is available in Byron for expansion of watermelon regeneration. However, funding will be required to expand the irrigation system (estimated cost of $30,000). The location is currently paying $35/cage for apiary services for watermelon seed increase. In order to increase the current level of activity (80 PIs/year) to 250 PIs/year in 1997 will require an additional $6,300/year. A full-time temporary employee is stationed in Byron to assist with seed increase activities at that location. We anticipate that one full-time employee stationed in Byron will not be sufficient to perform routine maintenance of the watermelon seed increase plots if regeneration activity is increased. An additional seasonal employee (1 full-time seasonal/4 months) will be required.

No core collection is currently available for watermelon. However, the curator is in the process of selecting a core collection for this crop. Many of the accessions in this collection are poorly characterized and it is expected that the core collection will require frequent revision as additional characterization data become available.

A request for support to characterize this collection using molecular markers, in support of a core collection, has been submitted.

Pepper (*Capsicum* spp.)

3,802 PIs total (excluding NSSL)
3,615 PIs available
  187 PIs not available due to low seed supplies
1,018 PIs backed up at NSSL

Pepper seed increase has been, and is being, accomplished via a Specific Cooperative Agreement with New Mexico State University (Dr. Paul Bosland). In addition 50 to 100 PIs (or other inventory)/year are being increased in Griffin. We anticipate continuation of the pepper seed increase in New Mexico and an expansion of regeneration activities in Griffin in 1997. Expansion of regeneration activities in Griffin will require the purchase of 200 pollination cages at a cost of $150/cage for a total of $30,000. Additional seasonal labor (1 full-time temporary for 4 months) at an anticipated cost of $5,000 will be required for routine field work and to assist with harvest and seed extraction.

Dr. Paul Bosland (NMSU), in collaboration with a graduate student, the NMSU Statistics Department and the curator, are in the process of selecting a pepper core collection based on phenetic analysis of morphological, passport, other descriptor data and molecular markers. This core collection should be defined before the end of the calendar year.

Seed of many of the "hot" peppers that are increased in Las Cruces (or in Griffin) are difficult to clean, as exposure to the dust from the dried fruit during the cleaning process posses a health hazard. Improved ventilation in the seed cleaning area is required for the cleaning of pepper seed. The cost of ventilation equipment and its installation has been estimated at $20,000.

Squash (*Cucurbita* spp.)

1,276 PIs total
  496 PIs available
  774 unavailable due to low seed stocks
  195 PIs are backed up at NSSL

Most of the *Cucurbita* collection requires regeneration. About 10% of the collection has been previously increased via open-pollination w/o isolation, and these stocks will also require re-regeneration from original seed.

No significant effort has been made to regenerate this collection in recent years. Land area for *Cucurbita* regeneration is available in Byron, GA although funding will be required for additional capital improvements at that site in the form of expansion of the existing irrigation system. Plants are too large for caged seed increase so additional personnel will be required for bagging of flowers in the PM and performing pollinations the following AM. Due to the large amount of labor required for increase of this crop, we intend to increase this crop, to the extent possible, by the use of controlled open-pollination techniques in isolation at remote locations, and in cooperation with the private sector and SAES scientist support.

The curator has made arrangements with plant breeders at various commercial seed companies and scientists at various SAESs who have agreed to increase 2 to 8 PIs/each of squash via controlled pollinations (sib mating), for a total of 30 PIs year in 1997. This number may be larger or smaller in 1997. Due to the backlog of material to be increased, a minimum of 75-100 PIs/year should be increased. It is recommended that additional PIs be increased in Mayaguez, Puerto Rico and Parlier, CA to the extent possible. Additional funding may be required at those locations to support those activities.

No core collection currently exists although the curator is in the process of selecting a core collection for *Cucurbita moschata*.

Eggplant (*Solanum melongena*)

864 PIs total
841 PIs available
22 PIs are not available due to low seed stocks
501 PIs are backed up at NSSL

Land and personnel for increase of eggplant are available in Griffin, GA and/or Byron, GA. Recommend that 100 cages be purchased for controlled pollination seed increase of this crop. Cages can also be used for increase of pepper at these sites (see above). The estimated cost of 100 cages is $15,000. Additional seasonal labor will be required at harvest and during seed cleaning, counting and bagging. We estimate this cost at $5,000 for 1 full-time temporary employee for 4 months.

Okra (*Abelmoschus* spp.)

1,927 PIs total
1.534 PIs are available
393 PIs are unavailable due to low seed stocks
1,400 PIs are backed up

Land for regeneration of the okra (*Abelmoschus* spp.) collection is available in Byron, GA. Funding will be necessary for improvements to the existing drip irrigation system (estimated cost $30,000).

Additional seasonal labor will be required for increase of okra. Increase of okra requires bagging of flowers or branches, prior to anthesis, and tagging. We anticipate a need for 5 full-time temporary (4 month) field workers at a cost of $5,000/employee or a total of $25,000, in order to increase 200 PIs of this crop/year (10 year turn-around). The cost of pollination bags or other equipment is negligible.

No core collection is currently available.

Date sent: **Tue, 23 Apr 96 09:15:26 EST**
From: **Bob Jarrett <BJARRET@GAES.GRIFFIN.PEACHNET.EDU>**
To: **Steve Kresovich <skresov@GAES.GRIFFIN.PEACHNET.EDU>**

A few additional points to add to the report:

We have increased most of the Ipomoea spp. that can be increased here. Many of the remaining species have photoperiod or other environmental requirements that we can't provide. Mayaguez (or Porto Rico in general) is the logical place to do that. Increase is fairly intensive because things have to be trellised and either isolated or caged with bees. Some species are shrubs with a juvenille period.
The in vitro collection (walk-in growth chamber) should be on an emergency generator (as should the seed storage rooms).
If we are going to actually scale up regeneration then we should be thinking about new orsignificantly modified seed cleaning facilities.
These latter points have been discussed before.

SEED STORAGE/DATABASE MAINTENANCE

May 1995 - June 1996

Merrelyn Spinks, Lee Ann Chalkley, Verlene Byous, Lebus Kilgore, Paulette Kitchens

Objective: To coordinate and conduct seed storage/database maintenance and acquisition/distribution for Unit germplasm activities.

- Backup - A total of 6,486 accessions has been sent for backup at the NSSL since May 1, 1995. Almost 4,900 of these had adequate samples for a normal backup. Backup has been completed on seven crops (Castorbean, Eggplant, Gourds, Guar, Luffa, Okra, Wingbean) sending samples with either adequate or limited (enough for at least two regenerations) seed numbers.

- Hundred seed weights and counts - More than 7,300 additional weights and counts were completed on inventory samples in the collection. Since June 1995, 27,927 inventory records have been added to the GRIN.

- Move to -18°C storage - Original seed samples (2,132 bags) of the seven crops listed above have been rebagged and heat sealed in foil bags, labeled with bar codes and moved to the -18°C walk-in freezer.

- Bar codes - In addition to the original seed samples which were bar coded, the entire collection of increase cowpeas (7,819) has been bar coded and rebagged. The entire collection of Castorbeans has also been completed. A total of 11,255 samples has been rebagged and bar coded since September 1995.

- Inventory action records - A project begun in June 1995 was completed in April 1996 to verify and update all inventory action records in the GRIN for the PGRCU material. Each inventory record was checked against the old card file system to make additions, updates, or deletions to 162,187 inventory action records.

-

Totals	June 1995	May 1996
Accessions	77,437	76,742
Inventory records	86,399	114,326
Orders	729	806
Order Items	30,058	31,189

- Renovation of old Cold Storage facility - A two compartment walk-in freezer combination is being manufactured for installation in the late summer. One compartment will be dual temperature with dehumidification, and the other compartment will be -18°C. Demolition of the existing cold rooms will begin the first of August with completion of the project scheduled for the end of September.

- Local Area Network - Matching lottery funds were obtained to purchase the equipment for the local area network. Fiber optic cable between eight buildings of the Unit has been installed, and all equipment has been received except the server. Interior wiring, fiber optic termination, and subsequent hook up of equipment should be completed during the summer.

- Operations Manual - The PGRCU Operations Manual was completely revised the first of May 1996.

PLANT PATHOLOGY AND TISSUE CULTURE SERVICES

Mark S. Hopkins, David L. Pinnow, and Stephanie L. Dunn

I. General Statement:

Pathology/Tissue Culture services objective is to assist the curators with their specific needs pertaining to disease diagnosis and therapy, embryo rescue of seeds with low or no germination, and genetic conservation of germplasm through tissue culture techniques.

II. Status:

A. Peanut

1. Peanut stripe potyvirus testing of seed being distributed to countries not known to have the disease.
2. Clean-up of the wild and hybrid collection by shoot tip culture and heat therapy or meristem culture.
3. Embryo rescue of old seeds (>15 years) or low germination seeds via embryo axis culture.
4. Visual and/or serological examination of quarantined material for possible viral infection.
5. Genetic conservation of the rhizomatous peanut collection, currently --% in culture.
6. Serological detection of virus infected plant samples from field increases.

B. Cowpea

1. Assist curator in clean-up of germplasm by testing for six seed borne viruses in seedlings to ensure only virus free plants are grown for seed increase.
2. Assist in the serological detection of peanut stunt virus in cowpea seedlings.
3. Assist in serological detection of virus infected plant samples from field increases.

C. Sweetpotato

1. Indexing of sweetpotato clones for sweetpotato feathery mottle virus and sweetpotato virus disease complex via grafting onto indicator plants.
2. Implementing a reverse transcription polymerase chain reaction protocol for the detection of virus disease in sweetpotato in order to increase both sensitivity and speed of detection and to free-up greenhouse space.

D. Summer Legumes

1. Visual and/or serological screening of seedlings for field increases and subsequent field screening for viral diseases.
2. Embryo rescue of accessions with low germination.

E. Grasses and Miscellaneous

1. Embryo rescue of accessions with low germination.
2. Efforts are under way for the genetic conservation of bamboo via tissue culture.

APPLIED GENETIC ANALYSIS
Griffin, Georgia

June 1996

Objective: To apply genetic analysis technologies to improve plant genetic resources conservation and utilization.

Status of Activities: Various genetic analysis techniques for genotyping, *i.e.*, RFLPs, RAPDs, AFLPs, SSRs, and DNA sequencing are being applied to establish genetic identity, relatedness, and structure of accessions held in *ex situ* plant genetic resources repositories in the U.S. (work focused on holdings from Griffin, Mayaguez, Ames, Miami, and Geneva). At present, over 300 SSRs primer pairs are available for use in the crops such as sorghum, peanut, maize, seashore paspalum, watermelon, sweet potato, pepper, mango, apple, and grape. Efforts also have focused on training scientists for the use of appropriate molecular genetic screening technologies and protocols. We also have supported scientists attempting to identify, quantify, and partition variation among races of pathogens and insects. Based on our experiences to date, we have improved efficiency, simplified protocols, increased the level of automation, decreased the unit cost of each assay, and applied rigorous statistical interpretations of the data. The genetic analysis research and applications are conducted in collaboration (with associated financial support or support-in-kind) with Pioneer Hi-Bred International, Perkin-Elmer/Applied Biosystems Division, Linkage Genetics, and Sequana Therapeutics.

Louisiana State University
Agricultural Center
Louisiana Agricultural Experiment Station

Appendix No. 6
S-9 TAC 1996

Department of Horticulture
137 Julian C. Miller Hall
Baton Rouge, LA 70803-2120
(504) 388-2158
Fax. (504) 388-1068

June 6, 1996

H. Thomas Stalker
NCSU - Dept. of Crop Sci.
P.O. Box 7629
Raleigh, NC 27695-7629

Dear Dr. Stalker:

I understand you are now the S-9 Regional Technical Advisory Committee representative from North Carolina. We took the liberty of appointing you as the secretary for our 1997 committee meeting. We had a number of members rotating off and our state representative attendance was down this year so we had few choices among attending committee members. Responsibilities are limited to drafting meeting minutes and serving as the chair in 1998. The only chair responsibility is moderating the actual meeting. S-9 staff are responsible for the meeting arrangements. We would appreciate it if you could serve in this capacity. We look forward to having you on our TAC.

Please notify me if this is not acceptable to you.

Sincerely,

Don R. La Bonte
Assoc. Prof.

cc:
B. Rhodes, S-9 1997 Chair
D. Coffey

Louisiana State University
Agricultural Center
Louisiana Agricultural Experiment Station

Department of Horticulture
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June 6, 1996

Peter Bretting, Research Leader/Coordinator
Plant Introduction Station
Iowa State University
Ames, Iowa 50011

Dear Dr. Bretting:

The S-9 Regional Technical Advisory Committee accepts your invitation to meet in Ames in 1998. We prefer the first or second week in June for the meeting. The only time we cannot meet is the second week in July. The committee responded favorably to a short symposium. We recommend a meeting limited to three days or less.

Sincerely,

Don R. La Bonte, Chair
S-9 RTAC

cc:
S. Kresovich, SRPIS
B. Rhodes, S-9 1997 Chair

Appendix No. 7
S-9 TAC 1996

United States
Department of
Agriculture

Agricultural
Research
Service

South
Atlantic
Area

Genetic Resources Unit
University of Georgia
Griffin, Georgia
30223-1797

October 1, 1996

SUBJECT: Curators' Fiscal Year 97 Budget

TO: S-9 Committee Members

FROM: Stephen Kresovich
Regional Coordinator

Several members of the S-9 Regional Committee expressed an interest in the curators' individual budgets at the 1996 annual meeting.

Based on planning with curators, I have set up individual accounts for each curator. Attached is a tentative budget for this fiscal year beginning October 1, 1996. If you have questions or comments, please contact me at (770) 228-7254.

Attachment

sk:am

CURATORS' ALLOTMENT FOR FY 97 (Tentatively)

DISCRETIONARY FUNDS

09/24/96

	FINANCIAL PLAN	GILLASPIE CODE GG	JARRET CODE JJ	LOVELL CODE LL	MORRIS CODE MM	PITTMAN CODE PP	KRESOVICH CODE KK
ACCOUNT: 601-6607-050:							
2100 - Travel	16,000.00	1,712.00	3,000.00	1,000.00	1,000.00	3,000.00	6,288.00
2600 - Supplies & Materials	36,209.00	3,874.36	10,000.00	3,000.00	3,000.00	10,000.00	6,334.64
TOTAL 050	52,209.00	5,586.36	13,000.00	4,000.00	4,000.00	13,000.00	12,622.64
ACCOUNT: 601-6607-910:							
2600 - Supplies & Materials	61,777.00	2,563.75	12,000.00	6,000.00	6,000.00	12,000.00	23,213.25
TOTAL 910 AND 050:	113,986.00	8,150.11	25,000.00	10,000.00	10,000.00	25,000.00	35,835.89

* FY 97 - Allocation 00 - $1,427,795 - Kresovich

* FY 97 - Allocation 00 - $151,709 - Gillaspie

* As of this date, I do not have a subobject class breakdown per CRIS. I only have the overall breakdown for Account 050. ARMPS shows that Gillaspie has 10.70 percent of the total of Account 050. The figures for Gillaspie is based on that percentage per subobject class.

* Gillaspie's has a 4.15 percentage for Account 910.

* These figures are tentatively until I receive a CRIS breakdown of subobject class.

* I did not focus on Subobject Class 2500, it involves: SCA, transfers, maintenance agreements, task orders, repairs and maintenance, etc. At the end of the first quarter, it would be safer to analyze the situation closer (January 1997).

* I RECOMMEND each curator is allotted their funds quarterly. This allows for better analysis and planning. These amounts could decrease or increase; it depends on whether the actual salaries and other fixed cost are the same as the FY 97 ARMPS.

* Please note the attached sheet, from The ARS Resources Management System (ARMS), as amended June 1992, "Discretionary Funds".

* Kresovich's fund includes allotments for Hopkins, Strickland, Spinks,

North Central Regional Plant Introduction Station

http://www.ars.usda.gov/ars/MidWest/tmcs/ncrpis.html

The North Central Regional Plant Introduction Station (NCRPIS), founded in 1948, is one of four plant introduction stations in the United States. It is a joint venture among the USDA-ARS, Agricultural Experiment Stations of the 12 North Central States, and Iowa State University. The NCRPIS employs about 30 permanent, full-time USDA-ARS and ISU staff and as many as 20 to 65 part-time seasonal employees. The Research Leader/Coordinator and Research Scientists have offices and laboratories in Agronomy Hall on the ISU campus. Most of the staff is housed at the NCRPIS farm which is located about two miles southwest of the campus. The farm has offices, greenhouses, laboratories, seed storage rooms, support facilities and 120 acres of land for seed regeneration and research.

- Personnel
- National Plant Germplasm System
- Function of the Station
- Plant Germplasm Resource Management
- Acquisition of Germplasm
- Maintenance of Germplasm
- Regeneration of Germplasm
- Distribution of Germplasm
- Where to request seed
- Characterization of Germplasm
- Germplasm Enhancement
- Evaluation of Germplasm
- Utilization of Germplasm
- Research at the Station
- Selected Germplasm Maintained at the Station
- Bees used for pollinating germplasm
- Annual Reports

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