MINUTES OF THE MEETING OF THE S-9 TECHNICAL ADVISORY COMMITTEE FOR PLANT GENETIC RESOURCES CONSERVATION AND UTILIZATION S-9 MULTISTATE RESEARCH PROJECT

A Cooperative Research Project Among:

THE STATE AGRICULTURAL EXPERIMENT STATIONS

OF THE SOUTHERN REGION

and the

U.S. DEPARTMENT OF AGRICULTURE AGENCIES:

AGRICULTURAL RESEARCH SERVICE

COOPERATIVE STATE RESEARCH, EDUCATION AND EXTENSION SERVICE

NATURAL RESOURCES CONSERVATION SERVICE

AUGUST 2-3, 2005

128 ELLINGTON PLANT SCIENCES BUILDING
UNIVERSITY OF TENNESSEE
KNOXVILLE, TN

SUBMITTED BY

EMERSON SHIPE, SECRETARY
FRED ALLEN, CHAIRMAN

Agenda

Tuesday, August 2, 2005 128 Ellington Plant Sciences Bldg, University of Tennessee Campus

Time Topic and Speaker

1:10 pm - Call to Order, Dr. Fred Allen, Chair S-9 RTAC

1:15 pm - Local Arrangements, Fred Allen, host

1:20 pm - Remarks by Administrative Advisor, Dr. Gerald Arkin

1:40 pm - Remarks by NPGS Staff, Dr. Peter Bretting

2:00 pm - Summary of the year at PGRCU, Griffin, GA, Dr. Gary Pederson

2:30 pm - Welcome to UT, and Agriculture Overview - Mr. Buddy Mitchell, Interim Vice President, Institute of Agriculture, University of Tennessee

3:00 pm - Break

3:15 pm - PGRCU Program Report, Vigna Curation, Dr. Graves Gillaspie

3:30 pm - PGRCU Program Report, Germination Program, Dr. Dave Pinnow

3:45 pm - PGRCU Program Report, Molecular Program, Dr. Noelle Barkley

4:00 pm - UT Forestry Products Center, Dr. Tim Rials, Director

4:30 pm - Use of plant genetic resources in TN's soybean breeding program, Dr. Vince Pantalone

4:50 pm - Adjourn, Vans will transport participants to hotel

6:00 pm - Vans will depart from hotel to transport participants to dinner

6:30 pm - Dinner @ Calhouns on the River

Wednesday morning August 3, 2005

8:15 am - Depart hotel for tour of East TN Research & Education Center (ETREC), Plant Sciences Unit, Knoxville, TN

8:30 am - Arrive ETREC

Tour will include corn (Dr. Dennis West) and soybean research (Mr. Richard Johnson & Fred Allen) involving plant genetic resources.

10:30 am - Depart ETREC

128 Ellington Plant Sciences Bldg.

11:00 am - RTAC business meeting and brief state reports

12:00 noon - Lunch on your own

1:00 pm – If needed --- Additional RTAC meeting time

2:00 pm - Adjourn

Attendees:

TAC Members:

Fred Allen, Chair (allenf@utk.edu)	University of Tennessee, TN
Thomas G. Isleib (tom_isleib@ncsu.edu) (for H. Thomas Stalker)	North Carolina State University, NC
Don LaBonte (dlabonte@agctr.lsu.edu)	Louisiana State University, LA
Tim Phillips (tphillip@uky.edu)	University of Kentucky, KY
Ken Quesenberry (clover@ifas.ufl.edu)	University of Florida, FL
Emerson Shipe (eshipe@clemson.edu)	Clemson University, SC
Clarence Watson (cwatson@MAFES.msstate.edu)	Mississippi State University, MS
Thomas Zimmerman (tzimmer@uvi.edu)	University of the Virgin Islands, VI.
Gerald F. Arkin, Administrative Advisor (garkin@uga.edu)	University of Georgia, GA

Griffin PGRCU Staff:

Gary Pederson, (gpederson@ars-grin.gov) Research Leader & Curator Annual Clovers, USDA, ARS

Noelle Barkley, (nbarkley@ars-grin.gov) Molecular Geneticist, USDA, ARS

Graves Gillaspie (ggillaspie@ars-grin.gov) Research Plant Pathologist/Vigna Curator, USDA, ARS

Melanie Newman, (mnewman@ars-grin.gov) Agronomist, Grass Curator, USDA, ARS

David Pinnow, (dpinnow@griffin.uga.edu) Plant Pathologist, USDA, ARS,

Other Attendees:

Peter Bretting, (pkb@ars.usda.gov), National Program Leader for Plant Germplasm And Genomes, USDA, ARS, Beltsville, MD

John Erpelding (mayje@ars-grin.gov) Sorghum Curator, USDA, ARS, TARS Mayaguez, PR

Buddy Mitchell, Interim Vice-President, Institute of Agriculture, University of Tennessee

Vince Pantalone (vpantalo@utk.edu), Dept. of Plant Sciences, University of Tennessee

Tim Rials, Director, Forestry Products Center, University of Tennessee

Call to Order
The Regional S-9 Technical Advisory Committee (TAC) was called to order at 1:10 PM on Tuesday, August 2, 2005 by chairperson Fred Allen in room 128 Ellington Plant Sciences Building on the University of Tennessee campus, Knoxville, TN.

Roll Call
Each person did a self-introduction including their organizational affiliation and their professional responsibilities. Representatives from some states were not present.

Welcome and Opening Remarks
Dr. Gerald Arkin welcomed the group and stated his responsibility as representative for S-9 to the Southern Agricultural Experiment Station Directors. He stated that the S9 project is an "off-the-top" SAES funded project in the southern region. He then encouraged each state committee member to communicate with his/her experiment station director about the importance of the S-9 project and how it serves each state in the region. He commented briefly on a report to be released soon by a national germplasm task force committee. The objective of the task force is to strengthen U.S. germplasm programs. Dr. Quesenberry and Dr. Bretting also commented briefly about the task force and the outcome of their deliberations. It is anticipated that a National Germplasm Coordinating Committee will be formed with membership from ESCOP, CSRES, and ARS. Dr. Arkin has been asked to be one of the committee members from the ESCOP group (state agricultural experiment station directors). It was suggested that a link to the task force report be added to the S-9 web page.

Fred Allen, 2005 host for the meeting, added his welcome to the group and covered local arrangement details.

Mr. Buddy Mitchell, Interim Vice-President, Institute of Agriculture, Univ. of Tennessee welcomed the group to campus and to Tennessee. He gave a brief overview of agriculture in Tennessee emphasizing the state's diverse geography and agricultural commodities. He highlighted the success of U.S. farmers by showing a graph depicting dramatic corn yield increases and relatively flat corn prices from 1900 through 2000. Other graphs illustrated the relatively small percentage of income that Americans spend on food and the increasing importance of agricultural research to allow farmers to compete in a global economy. He also discussed the importance of continued adequate funding for individual state research and extension priorities.

National Overview
Dr. Peter Bretting presented three written reports: (1) 2005 National Program Staff Report for Program 301 - "Plant, Microbial, and Insect Genetic Resources, Genomics, and Genetic Improvement", (2) June, 2005 Report from the National Germplasm Resources Laboratory and Plant Exchange Office and (3) The GRIN 2005 Report to Regional Technical Advisory Committees. Highlights of the report included:

- Retirements of Allan Stoner (Beltsville) , Loren Wiesner (Ft. Collins) , and Ed Percival (College Station)
- The NGRL supported fifteen plant explorations and one plant exchange expedition in 2004.

- Despite recent increases, budgets at some NPGS sites are still strained. The FY05 budget contained modest increases for plant genetic resource management in maize genetic enhancement. Future outlook is somewhat bleak since the budget for USDA-ARS is in the "discretionary dollars" category.
- Assessment for NP301's first five-year cycle (2000-2005) is underway. An accomplishment report will be developed which will serve as the basis for an assessment conducted by an external review panel. A report from the panel will be presented at the second NP 301 Customer-Stakeholder Workshop scheduled for November, 2005.

PGRCU Overview

Gary Pederson gave a presentation (**Appendix 1**) covering the activities and improvements of the Plant Genetic Resources Conservation Unit (PGRCU) at Griffin during the past year. He reviewed the mission of PGRCU as well as the progress that had been made in backing up the various plant collections since 1996. A total of 84,446 accessions are held at Griffin as of June, 2005. Dr. Pederson also reported on the domestic and foreign distributions of germplasm from the unit (24,102) during the past year. A total of 8,260 digital images (plant, flowers, leaves, seed, etc.) have been entered in the GRIN system for seven different crop species. Additionally, he reported on the status of funding, staffing, equipment purchases, facilities acquisitions, repairs and maintenance. A list of needs and priorities related to equipment and personnel were presented as requested by the S-9 Committee in 2004.

Vigna:

Graves Gillaspie made a presentation (**Appendix 2**) on the status of regeneration and distribution of Vigna species. He also described an extensive effort to provide digital images of flowers, seeds, leaves, and pods through the GRIN system and demonstrated how to access the images in the GRIN system.

Germination Lab:

Dave Pinnow described ongoing work in the germination laboratory (**Appendix 3**). Since 2001, over 27,000 germination tests have been conducted at Griffin. Germination test results for seed from new regenerations and seed in cold storage were presented for sorghum, pepper, peanut, Vigna, and watermelon.

Molecular Lab:

Noelle Barkley (Appendix 4) described the molecular procedure known as TILLING (target induced local lesions in genomes). She described several advantages of TILLING including cost benefits and ability to screen large numbers of individuals rapidly to assess natural genetic variation. Specific goals are: (1) to assess natural genetic variation in 100 mung bean accessions (within and between), identify SNPs, and design SNP markers; and (2) assess diversity in the peanut collection, develop SNP markers, and assay the collection for disease resistance...

Sorghum:

John Erpelding, located at Mayaguez, Puerto Rico reported on research efforts (**Appendix 5**) in (1) screening for ergot resistance, (2) screening for anthracnose resistance, (3) germplasm regeneration, (4) wild sorghum species regeneration, and (5) germplasm characterization. Digital imaging of panicles is being utilized to characterize accessions from Ethiopia.

University of Tennessee Programs
Tim Rials, director of the Univ. of Tennessee Forestry Products Center made a presentation describing the importance of the forestry industry in Tennessee. He reviewed some of the research projects his group is working on to enhance wood processing and development of new wood products in the U.S.

Vince Pantalone, soybean breeder, described the importance of plant introductions in his breeding program. His primary goals are improvement of seed yield and seed quality. Plant introductions have been utilized for modification of fatty acid levels and drought tolerance. Recent cultivar releases include '5002T' and '5601T'.

Wednesday, August 3, 2005
The group traveled a few miles south of campus on Hwy. 129 to the East Tennessee Research and Education Center, Plant Science Unit. Presentations were made by John Hodges, superintendent, Dennis West, grains breeder, Fred Allan, and Richard Johnson. Dr. Hodges gave an overview of the Plant Sciences Unit. Dr. West discussed his work in corn breeding and showed some progeny of hybridizations between corn and teosinte. Richard Johnson discussed his research with Dr. Allen on soybean leaf orientation/root morphology trait combinations as related to water use efficiency..

S-9 TAC Meeting Resumed
Chairman Fred Allen reconvened the group at 11:00 a.m., August 3, 2005 in room 128 Ellington Plant Sciences Building.

Committee Members Discussions

Tobacco Germplasm Collection
At the 2004 meeting the S9 TAC voted and recommended that the USDA take back the tobacco collection from NC State. The USDA-ARS representatives abstained from the vote. It was recommended that the Director of NC State Experiment Station take the action item to the next SAES directors meeting for their thoughts and action (especially the tobacco states). Apparently, there has been no action taken on this issue. There was considerable discussion as to what action the Committee might recommend. It was suggested that committee members from those states where tobacco is an important economic crop take the 2004 recommendation to their respective experiment station directors. It was pointed out that a considerable portion of the current tobacco germplasm collection is used for purposes other than variety development. This discussion has implications for other state-maintained germplasm collections as well including the wild Arachis spp. collection in Texas, a clover collection at the Univ. of Kentucky, and the tropical/subtropical forage collection (mainly legumes) in Florida.

Business Session
Tim Phillips was elected secretary and Emerson Shipe chair for the 2006 S-9 TAC meeting. Dr. Peter Bretting stated that a national meeting of regional germplasm committees is scheduled at Ames, Iowa on June 6-8, 2006. It will be hosted by the North Central Regional PI Station and organized by Candice Gardner, research leader. The likely agenda is a two day meeting with

one-half day allotted for a tour, national presentations, and individual regional committee meetings, respectively. A motion was made by Ken Quesenberry and seconded by Tom Zimmerman that the S-9 committee participate in and hold our annual meeting in conjunction with the national meeting at Ames. Motion passed. The incoming chair was urged to send out a reminder email to committee members early in 2006 providing the dates of the 2006 meeting.

The group thanked Dr. Allen for hosting the meeting, and the participating University of Tennessee faculty for their presentations.

Yearly reports from the S-9 TAC were distributed and each state representative present gave a brief summary. Reports should include yearly activities, impact and publications. Melanie Newman, grass curator at PGRCU, Griffin, gave a brief report on her work with warm season grasses. Gary Pederson requested guidance as to how to incorporate long state reports into the S-009 annual report on the National Information Management and Support System (NIMSS) website since it will not accommodate a long report. The Committee preferred to continue to put the longer, more complete state reports on the S-009 website and a shorter condensed version on NIMSS.

Meeting was adjourned 12:05 pm.

Appendix 1

DR. GARY PEDERSON

PLANT GENETIC RESOURCES: CURRENT STATUS

Plant Genetic Resources: Current Status

Gary A. Pederson

USDA, ARS, Plant Genetic Resources Conservation Unit

Griffin, GA

Outline

- PGRCU mission
- Current status of each crop
- Progress made
  - Distributions
  - Funding
  - Staffing
  - Equipment and facilities
- Needs

What is the mission of PGRCU?

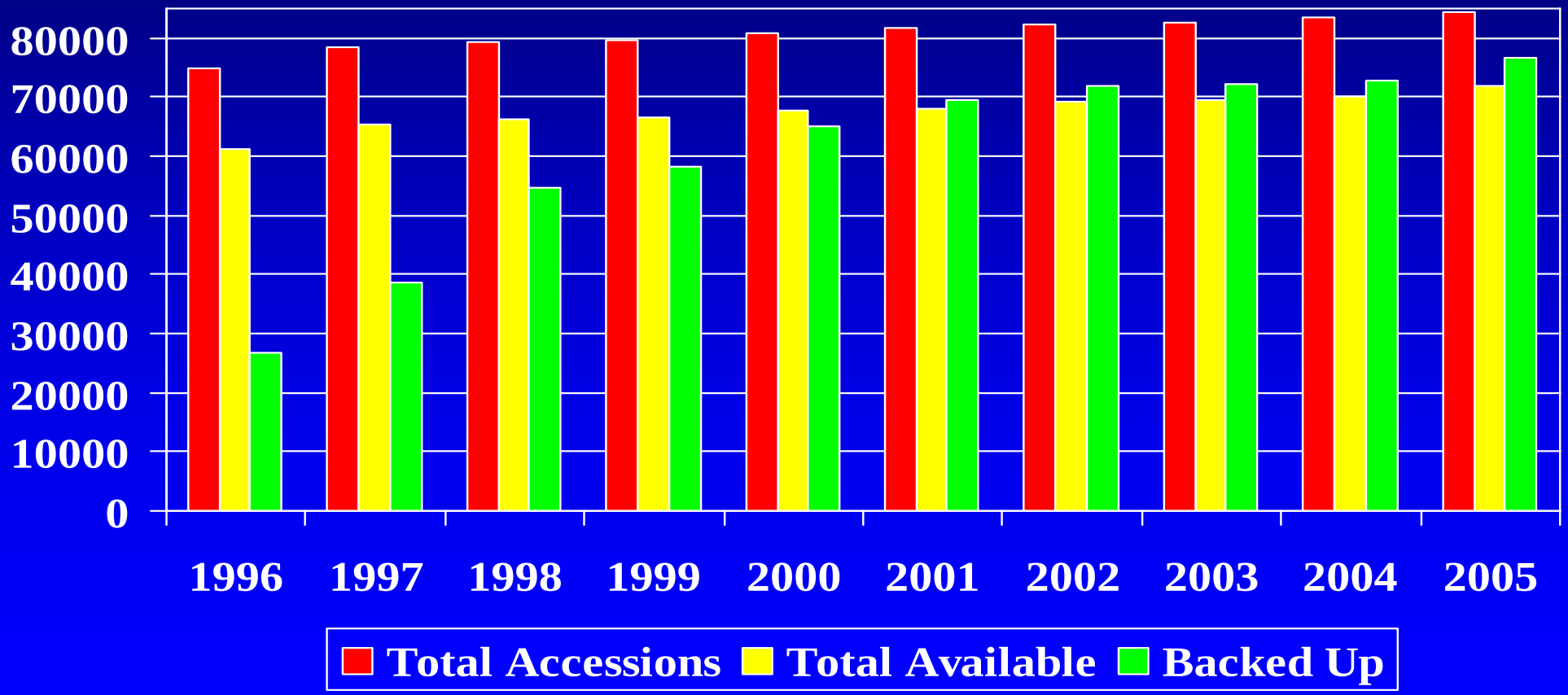
- Plant Genetic Resources Conservation Unit (PGRCU) exists to conserve plant genetic resources for users today and for future generations.
- Mission: “acquire, characterize, maintain, evaluate, document, and distribute plant genetic resources”.
- This is what users of the genetic resources maintained at Griffin expect from the Unit.

PGRCU Collection - June 2005

- Total Accessions
  - 84,446
- Total Available
  - 72,061 (85.3%)
- Backed Up
  - 76,775 (90.9%)

Acknowledgement: Merrelyn Spinks and Lee Ann Chalkley, PGRCU, compiled and summarized all numbers shown in this presentation. Pictures were taken by Tiffany Fields, Melanie Newman, and Rob Dean.

PGRCU Collection 1996 - 2005



Vigna

CURATOR	CROP	TOTAL ACCESSIONS	TOTAL AVAILABLE	NUMBER BACKED UP	ITEMS SHIPPED IN 2004
Graves Gillaspie	Cowpea	8,035	5,817	6,223	1,924
	Mung bean	4,202	3,832	4,101	192
	Other Vigna spp.	498	199	222	262

Vegetable Crops & Sweetpotato

CURATOR	CROP	TOTAL ACCESSIONS	TOTAL AVAILABLE	NUMBER BACKED UP	ITEMS SHIPPED IN 2004
Bob Jarret	Cucurbits	2,030	941	1,859	971
	Eggplant	971	898	969	827
	Okra	3,000	1,526	2,926	95
	Peppers	4,583	3,803	4,546	9,912
	Sweetpotato - tissue culture	753	714	724	378
	Other Ipomoea spp.	471	202	400	124
	Watermelon	1,871	1,712	1,752	2,317

Legumes and Misc. Crops

CURATOR	CROP	TOTAL ACCESSIONS	TOTAL AVAILABLE	NUMBER BACKED UP	ITEMS SHIPPED IN 2004
Brad Morris	Castor bean	373	267	357	92
	Kenaf & Roselle	338	293	309	84
	Legumes	3,513	2,667	2,746	684
	Miscellaneous	136	99	121	30
	Sesame	1,204	1,188	1,204	66

Warm-Season Grasses

CURATOR	CROP	TOTAL ACCESSIONS	TOTAL AVAILABLE	NUMBER BACKED UP	ITEMS SHIPPED IN 2004
Melanie Newman	Bamboo	98	98	3	66
	Grasses	6,719	5,925	5,984	480
	Pearl millet	1,089	1,056	1,072	440

Clover and Sorghum

CLOVER CURATOR/ SORGHUM COORDINATOR	CROP	TOTAL ACCESSIONS	TOTAL AVAILABLE	NUMBER BACKED UP	ITEMS SHIPPED IN 2004
Gary Pederson	Annual Clover	2,144	1,585	1,531	169
	Sorghum	32,305	30,546	30,972	3,226

Peanuts

CURATOR	CROP	TOTAL ACCESSIONS	TOTAL AVAILABLE	NUMBER BACKED UP	ITEMS SHIPPED IN 2004
Roy Pittman	Cultivated Peanuts	9,227	7,983	8,470	1,672
	Wild Peanuts	782	647	208	91

Digital photos

Crop	Images
Sorghum	5,274
Pepper	1,123
Peanuts	546
Pearl millet	444
Cowpea	382
Cucurbits	253
Watermelon	120
Total	**8,260 (9.8%)**

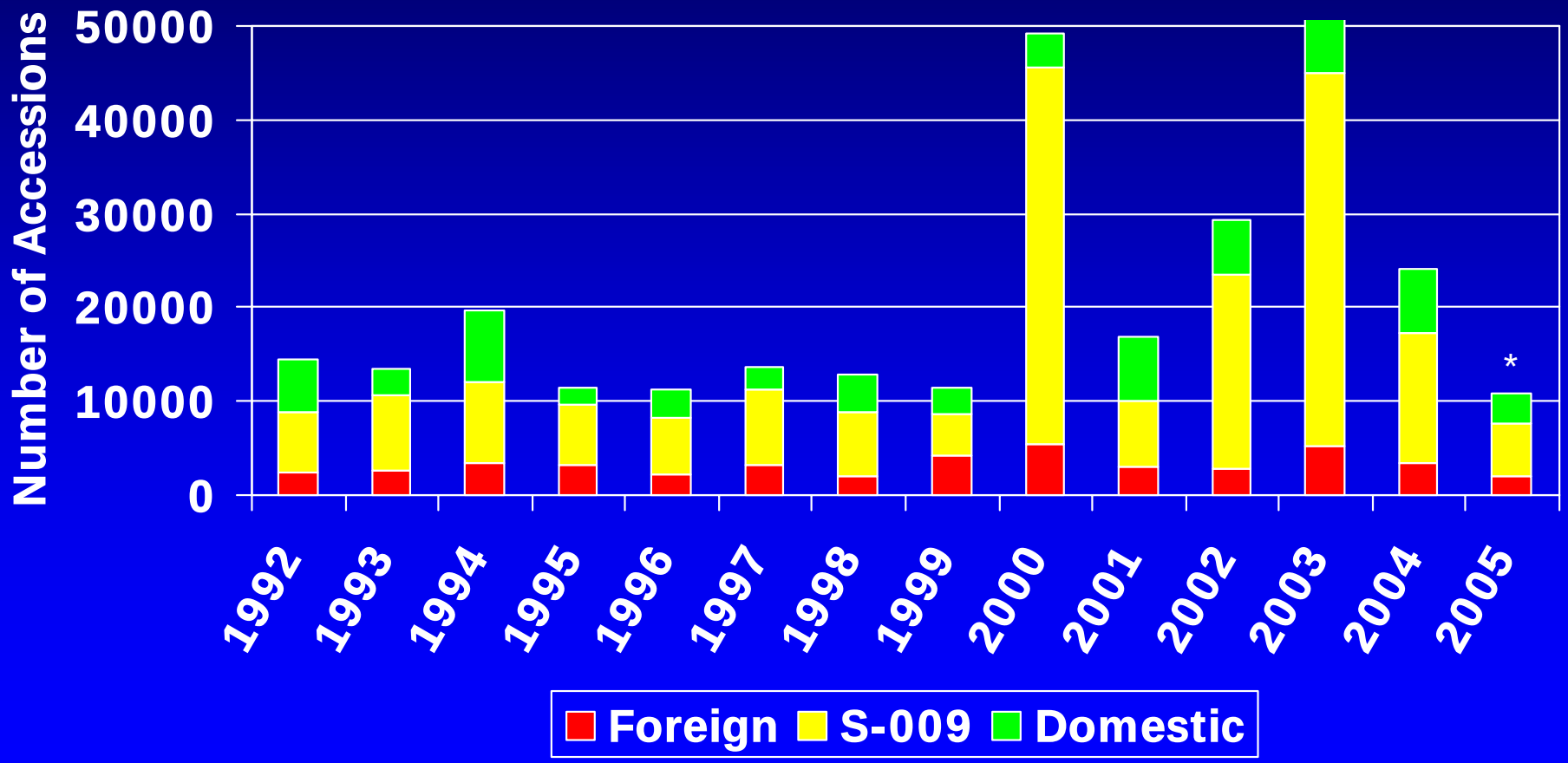
Requested for regeneration in CY2004

Crop	# accessions	Crop	# accessions
Cowpea	302	Castor bean	9
Sorghum	1,126	Grasses	933
Cucurbit	78	Kenaf	8
Clovers	213	Legumes	448
Guar	77	Misc. crops	35
Eggplant	57	Sesame	90
Peppers	132	Cult peanut	998
Watermelon	37	Okra	106

Distributions in CY2004

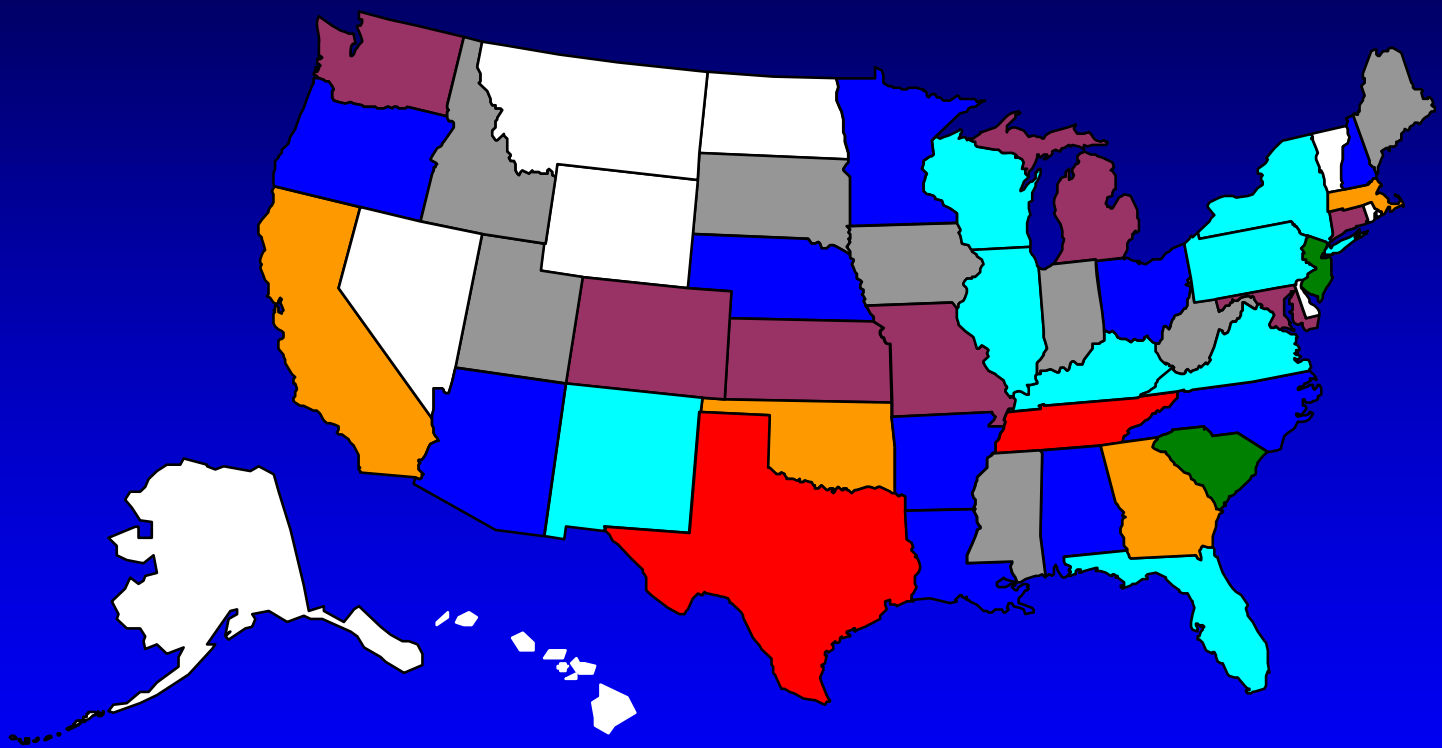
- Domestic = 20,646 items in 804 orders
  - S-9 region = 13,812 items
- Foreign = 3,456 items in 114 orders
- Total CY2004 distributions = 24,102 items

Distributions to S-009 Region



* As of July 25, 2005

Domestic Distributions in CY2004



Total number of accessions by state

2,500 to	5,000	500 to	749	50 to	99
1,000 to	2,499	250 to	499	1 to	49
750 to	999	100 to	249	0	

Foreign Distributions in CY2004

Argentina	Egypt	Israel	Puerto Rico	Thailand
Australia	Finland	Italy	Sierra Leone	Trinidad and Tobago
Austria	France	Japan	South Africa	United Kingdom
Belgium	Germany	Kuwait	South Korea	
Canada	Haiti	Netherlands	Spain	
China	Hungary	Niger	Sweden	
Denmark	India	Philippines	Taiwan	

Total PGRCU Funding

- ARS base funding
  - FY2005 = $2,181,198
- S-009 base funding
  - FY2005 = $398,373

PGRCU Funding

- ARS base funding increases
  - FY2001 = $349,370 (President and Congress)
  - FY2002 = $251,375 (Congress)
    - FY2002 money in President's budget reduction
- ARS temporary funding increases
  - FY2005 = $21,000 (deer fence for 17 acres at Westbrook Farm)

Staffing - ARS

- 26 ARS full-time employees
  - 25 permanent employees
  - 1 term employee (to be abolished when completed in 2005)
- Three resignations and positions terminated
  - Agric Sci Res technician term (vegetables)
  - Agric Sci Res technician (legumes)
  - Biol Sci Lab technician (seed storage)

Staffing - S-009

- Four permanent S-009 employees
- Three vacancies
  - Research Technician II (Byron)
  - Research Technician III (vegetables)
  - Research Technician III (legumes)
- 17 temporary full-time and part-time employees were hired during FY2005 to handle specific labor needs.

Staffing summary

- When vacant positions are filled, current staff will be 33 employees (26 ARS and 7 S-009)
  - including one term ARS position until 2005
- Additional 17 S-009 temporary labor positions

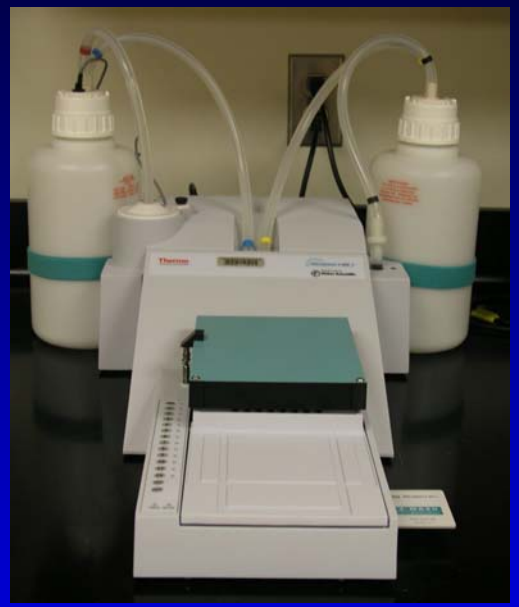
Equipment purchased

- Grass curation
  - greenhouse rolling benches
  - chipper/shredder for bamboo
- Farm operations
  - roto-tiller
  - roto-mower

Grass greenhouse benches

Equipment purchased

- Plant Pathology lab
  - ELISA plate washer
  - shaved ice machine
- Sweetpotato tissue culture lab
  - Ultra-pure deionized water system



Equipment purchased

- Molecular lab
  - Kodak gel camera system
  - DNA concentrator
  - ABI 9700 PCR
  - shaved ice machine
  - LiCor DNA analyzer to replace ABI 377 (cooperative with University of Georgia)

LiCor DNA analyzer

Facilities

- Field operations
  - Two more truck bodies used for pollination cage storage

Pollination cage storage

Facilities: Leases

- ARS leases with University of Georgia
  - Old PI building (germination and grass greenhouse)
  - Seed storage building (large 4C and -18C cold rooms)
  - S-9 building (Jarret's labs and sweetpotato tissue culture)
  - Redding building (molecular labs and offices)
  - Existing 11 acres and new machine shed on Westbrook Farm
  - Developing 17 acres on Westbrook Farm
- Existing ARS leases with University of Georgia
  - Land on Griffin campus where ARS buildings are located

Facility Repair and Maintenance

- Replaced greenhouse control panels and exhaust motors
- Replaced chiller pumps in greenhouse and headhouse
- Replaced drain line in seed processing bathroom
- Replaced floor tile and repainted interior of seed processing building


ARS greenhouses


ARS Seed processing

Other activities

- Unit Brainstorming Session (December 2004)
  - Emphasize quality not quantity of regeneration
  - Schedule curator talks at Unit meetings
  - Have everyone help on planting and harvesting
  - Convert storage space to seed threshing area
- Awards ceremony (June 2005)
  - Academy awards – red carpet, TV, presenters, envelopes, commercials

Planting 101 – Everyone help plant

Needs

- Reinstate money in President's budget reduction ($251,375)
- Technical support
  - Seed storage: seed processing
  - Greenhouse manager
  - Grass: labor to support grass tissue culture
  - Germination: labor for germination testing
  - Field crew: weeding, irrigation, harvesting
- Supplies
  - ARS policy of $25,000 per SY

Needs

- Equipment
  - 60 gallon tank sprayer with spray boom $ 3,000
  - Two growth chambers for tissue culture of sweetpotato and grasses $16,000
  - Regi-weeder I to reduce hand weeding $ 2,500
  - Real time PCR $30,000
  - Moveable storage shelves for 4C room $56,200
  - Autogen Prep DNA isolation system $74,900
  - Peanut plot combine $100,000

Needs

- National Greenhouse Initiative
  - Ames, Pullman, Griffin, and other locations are putting together a national initiative to support greenhouse construction and maintenance for genetic resources programs.
  - Currently surveying curators for needs to develop request by September 30th.
  - Request will be for FY08 budget year.

Plant Genetic Resources Conservation Unit

Appendix 2

DR. GRAVES GILLASPIE

VIGNA CURATION IN GRIFFIN, GEORGIA

Vigna Curation in Griffin, GA

Knoxville, Tennessee
August 2, 2005

A. Graves Gillaspie
Plant Genetic Resources Conservation Unit
Griffin, Georgia

REGENERATION ACTIVITIES

- **Greenhouse increase for winter of 04-05 included 31 cowpea lines which had low seed counts and would not flower in the field in Griffin and 8 mung bean lines.**
- **Seed was obtained from 29 lines of cowpea and 8 mung bean lines.**

REGENERATION ACTIVITIES

- **200 Vigna lines were planted in the greenhouse in April, checked for viruses, and transplanted into the field or the greenhouse during the summer.**

REGENERATION ACTIVITIES

- **52 lines were grown at Isabela, Puerto Rico.**
- **Virus spread was of some concern in Puerto Rico in this field because of viruses introduced in the seed**


VIGNA GERMPLASM ITEM
DISTRIBUTIONS BY CATEGORY
FROM 01/01/2004 - 12/31/2004

Distributions to Cooperators by Categories

Category	Count
USDA, ARS	386
U.S. commercial company	10
U.S. individual no affiliation	44
U.S. state agency or university	882
U.S. non-profit organization	179
Foreign commercial company	379
Foreign genebank/genetic resources unit	191
Foreign individual no affiliation	1
Foreign non-commercial organization	305
Total	2,377

Distributions by Crop Groups

Category	Count
Cowpeas (V. *unguiculata*)	1,923
Mung (V. *radiata* & V. *mungo)*	192
Other *Vigna* spp.	262
Total	2,377

Other Order Categories

Category	Count
Backup at NSSL	183
Germination	247
Observation	693
Replenishment	413
Total	1,536

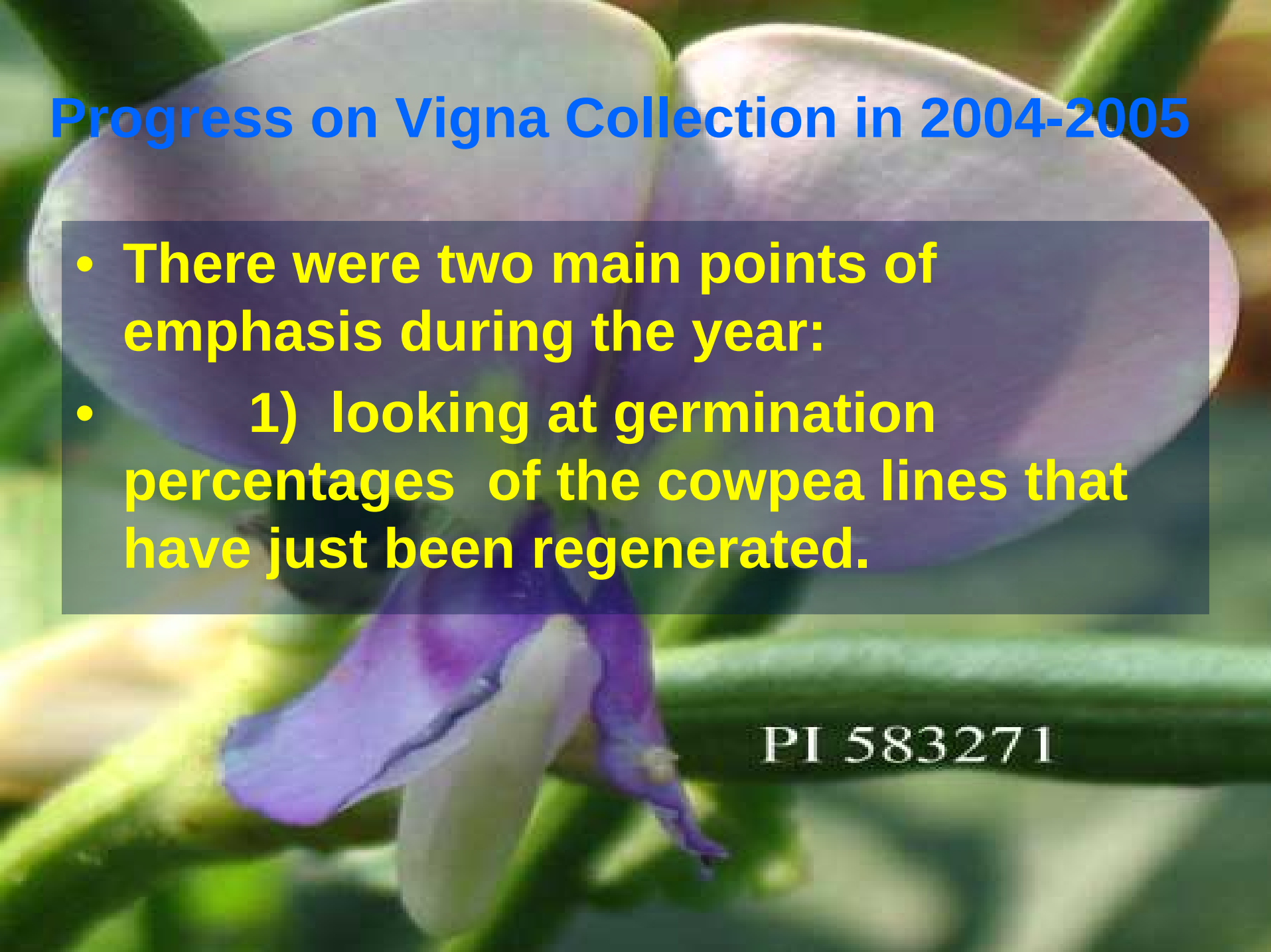
PLANS FOR YEAR 2005

- **Continue work to scan in images of seeds and to take digital images of leaves, flowers, and pods of all Vignas in regeneration and those in the cowpea and mungbean core so that these descriptors can be recorded in GRIN**

PI 580883

Progress on Vigna Collection in 2004-2005

- There were two main points of emphasis during the year:
- 1) looking at germination percentages of the cowpea lines that have just been regenerated.



Progress on Vigna Collection in 2005

- There were two main points of emphasis during the year:
- 2) taking digital images of flowers, seeds, leaves, and pods. During the year there were images made of flowers of cowpea core (313) and others (247) and seed images of core (281) and others (396).

PI 220849


Seeing these images
PI 221731

Web address to GRIN

- www.ars-grin.gov/npgs/

National Plant Germplasm System, GRIN - USDA, ARS - Netscape

File Edit View Go Bookmarks Tools Window Help

http://www.ars-grin.gov/npgs/

Home Netscape Search

New Tab | National Plant Germplasm System, GRIN - ...

National Plant Germplasm System

United States Department of Agriculture
Agricultural Research Service

NPGS is a cooperative effort by public (State and Federal) and private organizations to preserve the genetic diversity of plants.

The world's food supply is based on intensive agriculture, which relies on genetic uniformity. But this uniformity increases crop vulnerability to pests and stresses.

Scientists must have access to genetic diversity to help bring forth new varieties that can resist pests, diseases, and environmental stresses. The NPGS aids the scientists and the need for genetic diversity by:

- acquiring crop germplasm

National Plant Germplasm System

United States Department of Agriculture
Agricultural Research Service

Search GRIN

Accession Area Queries

Crop Science Registration

Plant Variety Protection

Taxonomic Queries

Research Crops and Descriptor/Evaluation Data Queries

This web server is maintained by the Database Management Unit (DBMU) of the National Germplasm Resources Laboratory (NGRL), Plant Sciences Institute (PSI), Beltsville Agricultural Research Center

Accession Area Queries

There are more than 450,000 accessions (distinct varieties of plants) in the GRIN database. These accessions represent more than 10,000 species of plants. Se
the Helps and Hints page if you are having trouble getting your results.

Text search query NEW

Standard text search engine query of all the fields of the accession.

☐ Include historical and unavailable accessions in the text query search.

Submit Text Query

Simple queries

Use this option for a quick look-up of a cultivar name, PI number, collector number or other identifier. Append the '*' character for a wildcard search (e.g. Red
all cultivars beginning with Red). You can also add a genus name to your wildcard searches to further refine the results (e.g. Red*::triticum)

Accession identifier:

☐ Include historical and unavailable accessions in the simple query search.

Submit Simple Query

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Accession identifier: PI 579016

☐ Include historical and unavailable accessions in the simple query search.

Submit Simple Query

Query Results for:

Search string: 579016
Restricted to active and available accessions
Limit to first 1000 records

PI 579016

Vigna unguiculata subsp. unguiculata FABACEAE (black-eyed-pea, crowder-pea)

Institute identifier: TVu 213.
Maintained by the Southern Regional PI Station. NPGS received: Oct-1987. Inventory volume: 203. Improvement status: Cultivated material. Form received: Se
Accession backed up at second site.

Accession names and identifiers

TVu 213
Type: INSTITUTE. Group: IITA. Comment: International Institute of Tropical Agriculture. Comment: IITA, Ibadan
UCR 2829
Type: DONOR.
Grif 1852
Type: OTHER. Group: GRIF. Comment: S-9 Research Numbers. Comment: S-9

Availability

Material is available for distribution. The normal amount distributed is 50 seeds.

Source History

- Type: Donated. Date: Oct-1987. From: Nigeria.
  Cooperators:
  1. Ng, N., International Institute of Tropical Agriculture.

Observations

Vouchers for accession

- Type: Computer image. Taken by: Gillaspie, G., USDA, ARS. On: 10/2003.
  Flower Image. 
- Type: Computer image. Taken by: Gillaspie, G., USDA, ARS. On: 2003.
  Seed Image. 

PI 579016 - Flower Image

EXIT

EXIT

USDA - ARS - GRIN

Source History

- Type: Donated. Date: Oct-1987. From: Nigeria.
  Cooperators:
  1. Ng, N., International Institute of Tropical Agriculture.

Observations

Vouchers for accession

- Type: Computer image. Taken by: Gillaspie, G., USDA, ARS. On: 10/2003.
  Flower Image. 
- Type: Computer image. Taken by: Gillaspie, G., USDA, ARS. On: 2003.
  Seed Image. 

PI 579016 - Seed Image

EXIT

- **If your goal is to just view images loaded to a descriptor with codes of POD, SEED, FLOWER, or LEAF, go to the GRIN web site and navigate to the Research Crop/Descriptor Query page**

National Plant Germplasm System

United States Department of Agriculture
Agricultural Research Service

Search GRIN

Accession Area Queries

Crop Science Registration

Plant Variety Protection

Taxonomic Queries

Research Crops and Descriptor/Evaluation Data Queries

This web server is maintained by the Database Management Unit (DBMU) of the National Germplasm Resources Laboratory (NGRL), Plant Sciences Institute (PSI), Beltsville Agricultural Research Center

Evaluation/characterization Data Queries

Enter a **species name** (e.g. ***Pisum, Zea mays***) Go
or **Select a Crop** from the list below:

NEW This page has been changed, what used to be the Query on multiple descriptors is available as the long form query on the crop page. Both the long and s
forms allow queries on multiple descriptors.

ALFALFA	Query on multiple descriptors (see Note)
ALLIUM	Query on multiple descriptors (see Note)
ALLIUM-WILD	Query on multiple descriptors (see Note)
AMARANTH	Query on multiple descriptors (see Note)
APIUM	Query on multiple descriptors (see Note)
APPLE	Query on multiple descriptors (see Note)
ASTRAGALUS	Query on multiple descriptors (see Note)
BAMBARA-GROUNDNUT	Query on multiple descriptors (see Note)
BARLEY	Query on multiple descriptors (see Note)
BARLEY-GENETICS	Query on multiple descriptors (see Note)
BRASSICA	Query on multiple descriptors (see Note)
BREADFRUIT	Query on multiple descriptors (see Note)
CANTALOUPE	Query on multiple descriptors (see Note)
CARAMBOLA	Query on multiple descriptors (see Note)
CASTOR	Query on multiple descriptors (see Note)
CHERRY	Query on multiple descriptors (see Note)

SPINACH	Query on multiple descriptors (see Note)
SQUASH	Query on multiple descriptors (see Note)
STRAWBERRY	Query on multiple descriptors (see Note)
SUGARBEET	Query on multiple descriptors (see Note)
SUGARBEET-RAPD	Query on multiple descriptors (see Note)
SUGARCANE	Query on multiple descriptors (see Note)
SUNFLOWER	Query on multiple descriptors (see Note)
SWEET-CLOVER	Query on multiple descriptors (see Note)
SWEETPOTATO	Query on multiple descriptors (see Note)
TOBACCO	Query on multiple descriptors (see Note)
TOMATO	Query on multiple descriptors (see Note)
TREFOIL	Query on multiple descriptors (see Note)
TRIGONELLA	Query on multiple descriptors (see Note)
TRITICALE	Query on multiple descriptors (see Note)
VACCINIUM	Query on multiple descriptors (see Note)
VETCH	Query on multiple descriptors (see Note)
VIGNA	Query on multiple descriptors (see Note)
W6-LEGUMES	Query on multiple descriptors (see Note)
W6-MISC	Query on multiple descriptors (see Note)
WALNUT	Query on multiple descriptors (see Note)
WATERMELON	Query on multiple descriptors (see Note)
WHEAT	Query on multiple descriptors (see Note)
WHEAT-GENETICS	Query on multiple descriptors (see Note)

VIGNA

Comment: Contains characteristic data on Vigna spp. accessions (except for Vigna subterranea). For additional information, contact Graves Gillaspie at the Pla
Genetic Resources Conservation Unit in Griffin, GA 30223-1797, Phone: (770) 412-4777.

List of Descriptors List Species in crop

Descriptor Report with frequency of observations

Query

- using short form
- using long form

Narrative keyword searches.
Crop Science Registration searches (if available for this crop) are restricted to CSR materials and are quicker than searches by genus. Searches by genus include CSR materia
well but are probably slower.

- search all Vigna descriptions

Back to crop list

Cite as: USDA, ARS, National Genetic Resources Program. *Germplasm Resources Information Network - (GRIN)*. [Online Database] National Germplasm
Resources Laboratory, Beltsville, Maryland. Available: http://www.ars-grin.gov/cgi-bin/npgs/html/crop.pl?188 (03 February 2005)

Please send comments to the Database Management Unit at: dbmu@ars-grin.gov

Descriptors for VIGNA:

Category: DISEASE

1. Bacterial Canker (CANKER)
   Resistance to bacterial canker (Xanthomonas vignicola)
   Code values.

2. Blackeye Cowpea Mosaic Virus (BLCMV)
   Resistance to blackeye cowpea mosaic virus
   Code values.

3. Cowpea Aphid-Borne Mosaic Viru (CAMV)
   Resistance to cowpea aphid-borne mosaic virus
   Code values.

4. Cowpea Chlorotic Mosaic Virus (CCMV)
   Resistance to cowpea chlorotic mosaic virus
   Code values.

5. Cowpea Mosaic Virus (CPMV)
   Resistance to cowpea mosaic virus
   Code values.

6. Cucumber Mosaic Virus (CMV)
   Resistance to cucumber mosaic virus
   Code values.

Category: PRODUCTION

1. Seed Production (SEEDPROD)
   Seed production or yield
   Code values.

2. Seed Weight (SEEDWEIGHT)
   Seed weight in grams/100 seeds at 25% moisture
   Observed values.

Category: Uncategorized Descriptors

1. Core Subset (CORE)
   A flag to indicate the accession is part of the core subset
   Code values.

2. Image (IMAGE)
   Image present in GRIN database
   Code values.

Codes for Image of VIGNA

Code	Definition	Number of Accessions
FLOWER	Image of flowers	324
LEAF	Image of leaf	1
POD	Image of pods	6
SEED	Image of seed	160

| USDA | ARS | GRIN | NPGS | New Search |

Cite as: USDA, ARS, National Genetic Resources Program. *Germplasm Resources Information Network - (GRIN)*. [Online Database] National Germplasm Resources Laboratory, Beltsville, Maryland. Available: http://www.ars-grin.gov/cgi-bin/npgs/html/codes.pl?188029 (03 February 2005)

Please send comments to the Database Management Unit at: dbmu@ars-grin.gov

Accessions with code FLOWER

1. PI 632757 TVu 11987
2. PI 632758 TVu 13724
3. PI 632759 TVu 13725
4. PI 632760 TVu 13726
5. PI 632761 TVu 13728
6. PI 632762 TVu 13729
7. PI 632762 TVu 13729
8. PI 632763 TVu 13731
9. PI 632764 TVu 13734
10. PI 632765 TVu 13735
11. PI 632766 TVu 13737
12. PI 632767 TVu 13738
13. PI 632768 TVu 13739
14. PI 632769 TVu 13741
15. PI 632770 TVu 13742
16. PI 632771 TVu 13743
17. PI 632772 TVu 13744
18. PI 632773 TVu 13745
19. PI 632774 TVu 13746
20. PI 632776 TVu 13759
21. PI 632777 TVu 13761
22. PI 632778 TVu 13764
23. PI 632779 TVu 13765
24. PI 632780 TVu 13771
25. PI 632781 TVu 13773

PI 632757

Vigna unguiculata subsp. unguiculata FABACEAE (black-eyed-pea, crowder-pea)

Institute identifier: TVu 11987.
Maintained by the Southern Regional PI Station. NPGS received: 28-Sep-1992. Inventory volume: 212. Improvement status: Uncertain improvement status. I
received: Seed. Accession backed up at second site.

Accession names and identifiers

TVu 11987
Type: INSTITUTE. Group: IITA. Comment: International Institute of Tropical Agriculture. Comment: IITA, Ibadan
Grif 12076
Type: SITE. Group: GRIF. Comment: S-9 Research Numbers. Comment: S-9
TB79-924
Type: OTHER. Comment: IITA, Ibadan

Availability

Material is available for distribution. The normal amount distributed is 50 seeds.

Source History

- Type: Collected. From: Sudan.
- Type: Donated. Date: 28-Sep-1992. From: Nigeria.

laterial is available for distribution. The normal amount distributed is 50 seeds.

ource History

- Type: Collected. From: Sudan.

- Type: Donated. Date: 28-Sep-1992. From: Nigeria.
  Cooperators:
  1. Ng, N., International Institute of Tropical Agriculture.

Observations

ouchers for accession

- Type: Computer image. Taken by: Gillaspie, G., USDA, ARS. On: 10/2003.

  Flower Image. 

te as: USDA, ARS, National Genetic Resources Program. *Germplasm Resources Information Network - (GRIN)*. [Online Database] National Germplasm esources Laboratory, Beltsville, Maryland. Available: http://www.ars-grin.gov/cgi-bin/npgs/html/acchtml.pl?1058988 (03 February 2005)

lease send comments to the Database Management Unit at: dbmu@ars-grin.gov

PI 632757 - Flower Image

EXIT

EXIT

USDA - ARS - GRIN

- **If your goal is to look at all the variation within *Vigna* then you can do the following on GRIN:**

National Plant Germplasm System, GRIN - USDA, ARS - Netscape

File Edit View Go Bookmarks Tools Window Help

http://www.ars-grin.gov/npgs/

Home

New Tab | National Plant Germplasm System, GRIN - ...

National Plant Germplasm System

United States Department of Agriculture
Agricultural Research Service

| Home | Collections | Search GRIN | Request Germplasm | pcGRIN | Crop Germplasm Committees | Repository Home Pages | FAQs | Links |

NPGS is a cooperative effort by public (State and Federal) and private organizations to preserve the genetic diversity of plants.

The world's food supply is based on intensive agriculture, which relies on genetic uniformity. But this uniformity increases crop vulnerability to pests and stresses.

Scientists must have access to genetic diversity to help bring forth new varieties that can resist pests, diseases, and environmental stresses. The NPGS aids the scientists and the need for genetic diversity by:

Transferring data from www.ars-grin.gov...

Search GRIN - National Plant Germplasm System - USDA, ARS - Netscape

File Edit View Go Bookmarks Tools Window Help

http://www.ars-grin.gov/npgs/searchgrin.html

Home

New Tab | Search GRIN - National Plant Germplasm Sy...

National Plant Germplasm System

United States Department of Agriculture
Agricultural Research Service

Search GRIN

Accession Area Queries

Multi-Database Query (test)

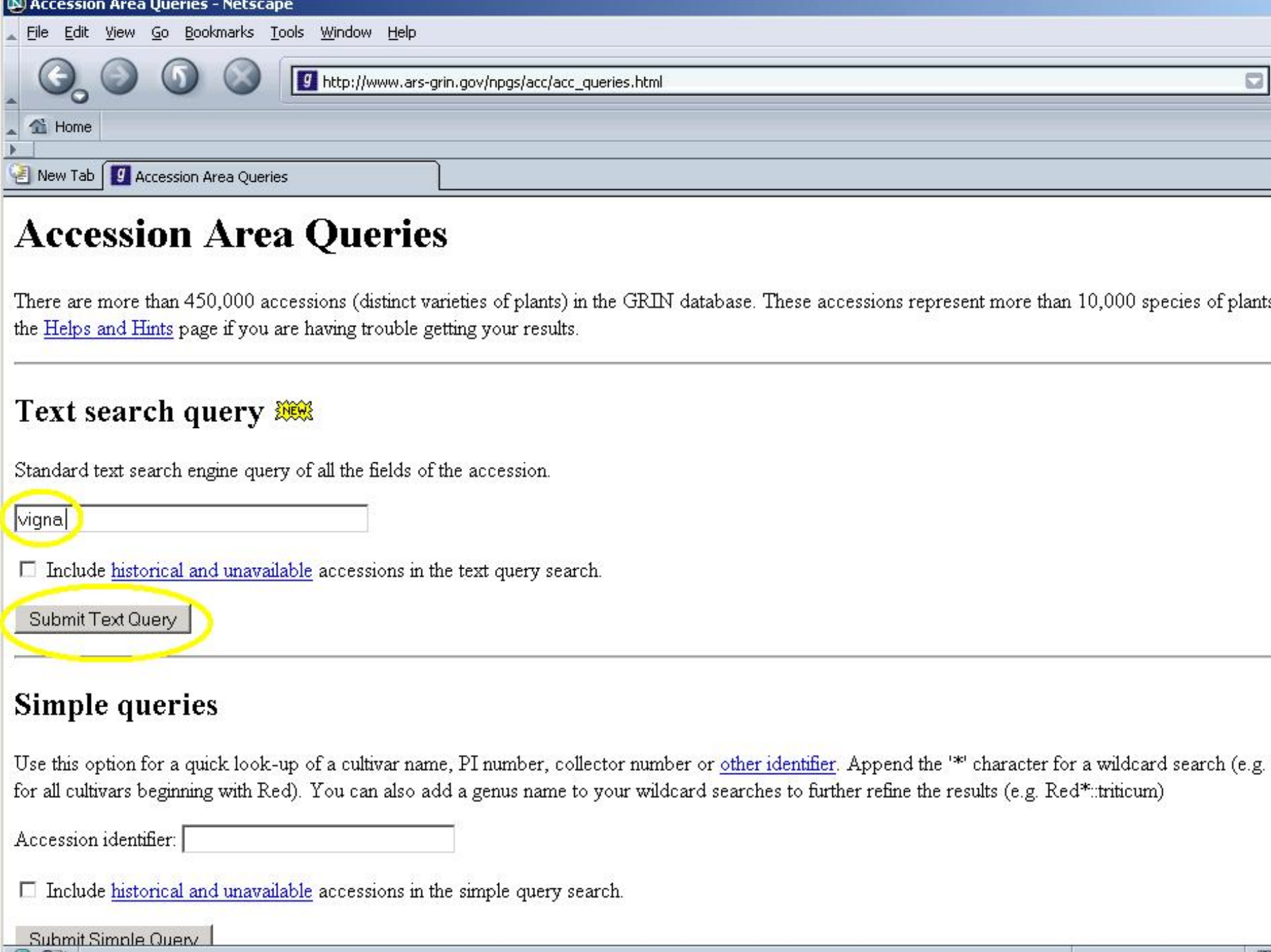
Crop Science Registration

Plant Variety Protection

Taxonomic Queries

Research Crops and Descriptor/Evaluation Data Queries

This web server is maintained by the Database Management Unit (DBMU) of the National Germplasm Resources Laboratory (NGRL).



Accession Area Queries

There are more than 450,000 accessions (distinct varieties of plants) in the GRIN database. These accessions represent more than 10,000 species of plants the Helps and Hints page if you are having trouble getting your results.

Text search query NEW

Standard text search engine query of all the fields of the accession.

vigna

☐ Include historical and unavailable accessions in the text query search.

Submit Text Query

Simple queries

Use this option for a quick look-up of a cultivar name, PI number, collector number or other identifier. Append the '*' character for a wildcard search (e.g. for all cultivars beginning with Red). You can also add a genus name to your wildcard searches to further refine the results (e.g. Red*::triticum)

Accession identifier:

☐ Include historical and unavailable accessions in the simple query search.

Submit Simple Query

Search NPGS/GRIN Accessions

vigna Search!

Sort by: Rank ☐ Reverse Sort

Search only accession with status:

☑ Active ☐ Inactive

Results for **vigna** 1 to 15 of 9984 results. Run time: 0.127 seconds | Search time: 0.052 seconds

Page: 1 2 3 4 5 6 7 8 9 10 666 Next 15

1 PI 313545 - Vigna unguiculata subsp. unguiculata - VIGNA - Mexico -- rank: **1000**

PI 313545 Vigna unguiculata subsp. unguiculata FABACEAE (black-eyed-pea, crowder-pea) Unverified name: VIGNA. Collected in: Mexico Maintained by the Southern Regional ... backed up at second site. Accession names and identifiers VIGNA Type: UNVERIFIED. ACM-RGGC Type: OTHER. Availability Material ...

http://www.ars-grin.gov/cgi-bin/npgs/html/acchtml.pl?1234071 - 2066 bytes -

2 PI 313544 - Vigna unguiculata subsp. unguiculata - DE CASTILLA VIGNA - Mexico -- rank: **1000**

PI 313544 Vigna unguiculata subsp. unguiculata FABACEAE (black-eyed-pea, crowder-pea) Unverified name: DE CASTILLA VIGNA. Collected in: Mexico Maintained by the Southern Regional ... at second site. Accession names and identifiers DE CASTILLA VIGNA Type: UNVERIFIED. X-9081 Type: OTHER. Availability Material ...

http://www.ars-grin.gov/cgi-bin/npgs/html/acchtml.pl?1234070 - 2659 bytes -

3 PI 291385 - Vigna unguiculata - No.277 - China -- rank: **980**

PI 291385 Vigna unguiculata (L.) Walp. FABACEAE Other or unclassified name: No.277. Collected in: China Maintained by ... Site Old Name ---------- ---------- ------ ---------- Re-Ident 22-Feb-1993 S9 Vigna unguiculata subsp. cylindrica Re-Ident 11-May-1994 S9 Vigna unguiculata subsp. sesquipedalis Source History Type: Collected. From ...

http://www.ars-grin.gov/cgi-bin/npgs/html/acchtml.pl?1220571 - 2240 bytes -

PI 313545

Vigna unguiculata subsp. unguiculata FABACEAE (black-eyed-pea, crowder-pea)

Unverified name: VIGNA.
Collected in: Mexico
Maintained by the Southern Regional PI Station. NPGS received: 11-Apr-1966. PI assigned: 1966. Inventory volume: 174. Form received: Seed. Accession backed up at second site.

Accession names and identifiers

VIGNA
Type: UNVERIFIED.
ACM-RGGC
Type: OTHER.

Availability

Material is available for distribution. The normal amount distributed is 50 seeds.
Request this germplasm

Source History

- Type: Collected. Date: 1957. From: Mexico.
  Locality: Coatepec, Mexico. Mantequilla.

United States Department of Agriculture
Agricultural Research Service, Beltsville Area
Germplasm Resources Information Network (GRIN)

GRIN Taxonomy for Plants

Data from GRIN Taxonomy

Taxon: *Vigna unguiculata* (L.) Walp. subsp. *unguiculata*

Genus: *Vigna* subgenus: *Vigna* section: *Catiang*
Family: *Fabaceae* (alt. *Leguminosae*) subfamily: *Faboideae* tribe: *Phaseoleae* subtribe: *Phaseolinae*. Also placed in: *Papilionaceae*
Nomen number: 300675
Comment: or *V. unguiculata* Unguiculata Group
Name verified on: 06-Dec-1996 by Systematic Botany Laboratory. **Last updated:** 11-Mar-2004
Species priority site is: Southern Regional PI Station (S9).
Accessions: 6836 in NPGS. Get list of **available** ☑ and **unavailable** ☐ accessions. Or get list by country.

See other conspecific taxa:

- ***Vigna unguiculata*** (1183 accessions)
- ***Vigna unguiculata* subsp. *baoulensis*** (no accessions)

- ***Dolichos unguiculatus*** L. (basionym)
  (previously associated with 2 accessions)
- ***Phaseolus unguiculatus*** (L.) Piper
- ***Vigna sinensis*** (L.) Savi ex Hassk.
  (previously associated with 608 accessions)

Check other databases for *Vigna unguiculata* (L.) Walp. subsp. *unguiculata*:

- **ILDIS:** International Legume Database & Information Service
- **Mansfeld:** Mansfeld's World Database of Agricultural and Horticultural Crops

Images and other information:

- **GRIN Images** of germplasm accessions
- Google Images Note: Be advised that their identity may be inaccurate. Proper identification of a plant may require specialized taxonomic knowledge or comparison with properly documented herbarium material.

Jump to BeanGenes Database

Abbreviations & symbols in GRIN Taxonomy

Cite as:

File Edit View Go Bookmarks Tools Window Help

http://www.ars-grin.gov/cgi-bin/npgs/html/tax_imag.pl?300675

New Tab | GRIN Accessions for Taxon

United States Department of Agriculture
Agricultural Research Service, Beltsville Area
Germplasm Resources Information Network (GRIN)

- *Popup window*

GRIN Taxonomy for Plants

National Plant Germplasm System (USDA/ARS)

images of

Vigna unguiculata subsp. unguiculata

Get new report excluding: **live plant images** ○ **herbarium vouchers** ○

Sort by: **accession names** ○ **accession numbers** ○

Availability status: !! - available for distribution ?? - contact germplasm maintenance site ** - historical record only

Follow links below for full accession data and information on germplasm maintenance sites.

Sample entry: PI 255616 Napoleon (!!)

1. DLEG 890264 DLEG 890264 (!!) 
2. Grif 12161 TVu 13803 (??) 
3. Grif 12205 TVu 13853 (??) 
4. Grif 14281 Grif 14281 (!!) 

Transferring data from www.ars-grin.gov...

6. PI 166146 TVu 2291 (!!) 
7. PI 179125 KARNIKARA (!!) 
8. PI 194208 R 53 (!!) 
9. PI 197056 FRIJOL DE CASTILLA (!!) 
10. PI 312204 FRIJOL NEGRO DE CASTILLA (??) 
11. PI 313544 DE CASTILLA VIGNA (!!) 
12. PI 441917 Feijao de Corda (!!) 
13. PI 441919 Feijao de Corda (!!) 
14. PI 441925 527 (!!) 
15. PI 447445 TVu 3684 (!!) 
16. PI 447480 TVu 3723 (!!) 
17. PI 447483 TVu 3726 (!!) 
18. PI 447484 TVu 3727 (!!) 
19. PI 447485 TVu 3728 (??) 

File Edit View Go Bookmarks Tools Window Help

http://www.ars-grin.gov/cgi-bin/npgs/html/dispimage.pl?112314

New Tab | Image for: PI 441917

PI 441917 - Flower Image

EXIT

EXIT

Done

- *Popup window*


VIGNA COLLECTION AS OF
01/25/2005
PI 165529

Species	Total at Griffin	Backed up at NSSL	Percent (%) backed up	Total at NSSL only
aconitifolia	56	56	100.0	
adenantha	7	5	71.4	
angularis	299	46	15.4	1
angularis var. nipponensis	2	1	50.0	
caracalla	7	7	100.0	
glabrescens	1	1	100.0	
lasiocarpa	1	1	100.0	
linearis var. latifolia	2	2	100.0	
longifolia	1	1	100.0	
luteola	14	12	85.7	
marina	1	1	100.0	
membranacea	2	1	50.0	

Species	Total at Griffin	Backed up at NSSL	Percent (%) backed up	Total at NSSL only
minima	1	1	100.0	
mungo var. mungo	302	290	96.0	1
oblongifolia	6	5	83.3	
oblongifolia var. oblongifolia	8	6	75.0	
oblongifolia var. parviflora	3	3	100.0	
peduncularis	1	1	100.0	
radiata	750	734	97.9	29
radiata var. radiata	3,148	3,076	97.7	
radiata var. sublobata	1	1	100.0	
schimperi	2	1	50.0	
sp.	25	18	72.0	
speciosa	1	0	0.0	

Species	Total at Griffin	Backed up at NSSL	Percent (%) backed up	Total at NSSL only
subterranea	104	76	73.1	
trilobata	2	2	100.0	
umbellata	41	38	92.7	
unguiculata	949	942	99.3	244
unguiculata subsp. cylindrica	14	14	100.0	
unguiculata subsp. dekindtiana	41	38	92.7	
unguiculata subsp. pubescens	9	9	100.0	
unguiculata subsp. sesquipedalis	194	181	93.4	
unguiculata subsp. stenophylla	5	5	100.0	
unguiculata subsp. unguiculata	6,823	5,033	73.8	2
vexillata	15	13	86.7	
Totals	12,838	10,621	82.7	277

Crop	Year[1]	Total Accessions	Available	Not Available	Backed Up	NSSL Only
Cowpea	2005	8,035	5,734	2,301	6,222	246[2]
Mung bean	2005	4,201	3,832	369	4,101	30[2]
Other Vigna spp.	2005	498	199	299	222	1
Bambara Groundnut	2005	104	64	40	76	0
Totals	2005	12,838	9,829	3,099	10,621	277

[1]Totals as of 1/10/2005
[2]PVPO accessions included (twelve V. unguiculata and one V. radiata)


VIGNA Descriptors
PI 581163P

Descriptor Query Name	Descriptor Name	Total accessions evaluated
APHID	Aphid	965
BLCMV	Blackeye Cowpea Mosaic Virus	2
CAMV	Cowpea Aphid-Borne Mosaic Virus	299
CANKER	Bacterial Canker	155
CCMV	Cowpea Chlorotic Mosaic Virus	339
CMV	Cucumber Mosaic Virus	342
CORE	Core Subset	1130
CPMV	Cowpea Mosaic Virus	991
DRYPODCOL	Dry Pod Color	3207
FLOWERCOL	Flower Color	3314
FUSARIUM	Fusarium Wilt	158
IMAGE	Image present	482
LEAFSHAPE	Leaf Shape	482
MATURITY	Plant Maturity	3165
PLANTHABIT	Plant Habit	5533
PLANTHGT	Plant Height	5363

Descriptor Query Name	Descriptor Name	Total accessions evaluated
PODLENGTH	Pod Length	5546
PODPLACE	Pod Placement	3398
PODPOS	Pod Position	3388
PODSPEDUNC	Pods Per Peduncle	3308
SDCOATCOL	Primary Seed Coat Color	5047
SDPATCOLOR	Seed Pattern Color	1260
SDPATTERN	Mature Seed Pattern	3056
SEEDPROD	Seed Production	2691
SEEDSHAPE	Seed Shape	3141
SEEDSIZE	Seed Size	2391
SEEDTEXT	Seed Texture	351
SEEDWEIGHT	Seed Weight	10174

Bambara Groundnut Descriptors

Descriptor Query Name	Descriptor Name	Total accessions evaluated
DRYPODCOL	Dry Pod Color	0
EYEPATTERN	Eye Pattern	0
EYEPIGCOL	Eye Pigment Color	0
FLOWERDATE	Flower Date	0
FLWRDATE50	Flower date 50%	0
PLANTHGT	Plant Height	0
PLANTSPRD	Plant Spread	0
PLANTTYPE	Plant Type	0
PODLENGTH	Pod Length	0
PODSHAPE	Pod Shape	0
PODSPLANT	Pods Per Plant	0
SEEDLENGTH	Seed Length	0
SEEDSHAPE	Seed Shape	0
SEEDSPOD	Seeds Per Pod	0
SEEDWEIGHT	Seed Weight	64
SEEDWIDTH	Seed Width	0
TESTACOVCO	Testa Cover Color	0
TESTAGRCOL	Testa Ground Color	0
TESTAPATT	Testa Pattern	0


PI 227829
PI 115674
7
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PI 257463


PI 183251
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PI 292891
7
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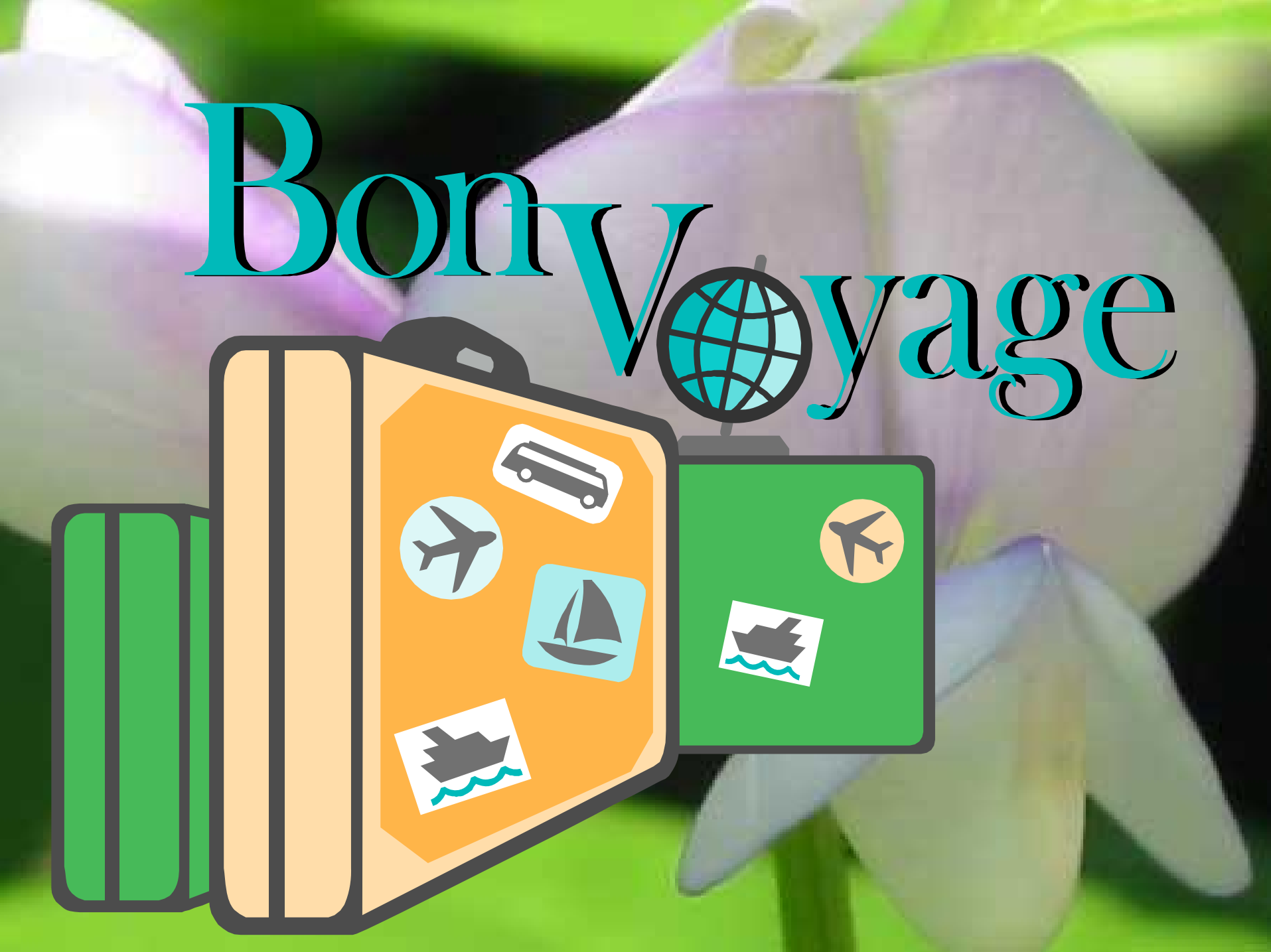
10


PI 147076
7
8
9
10

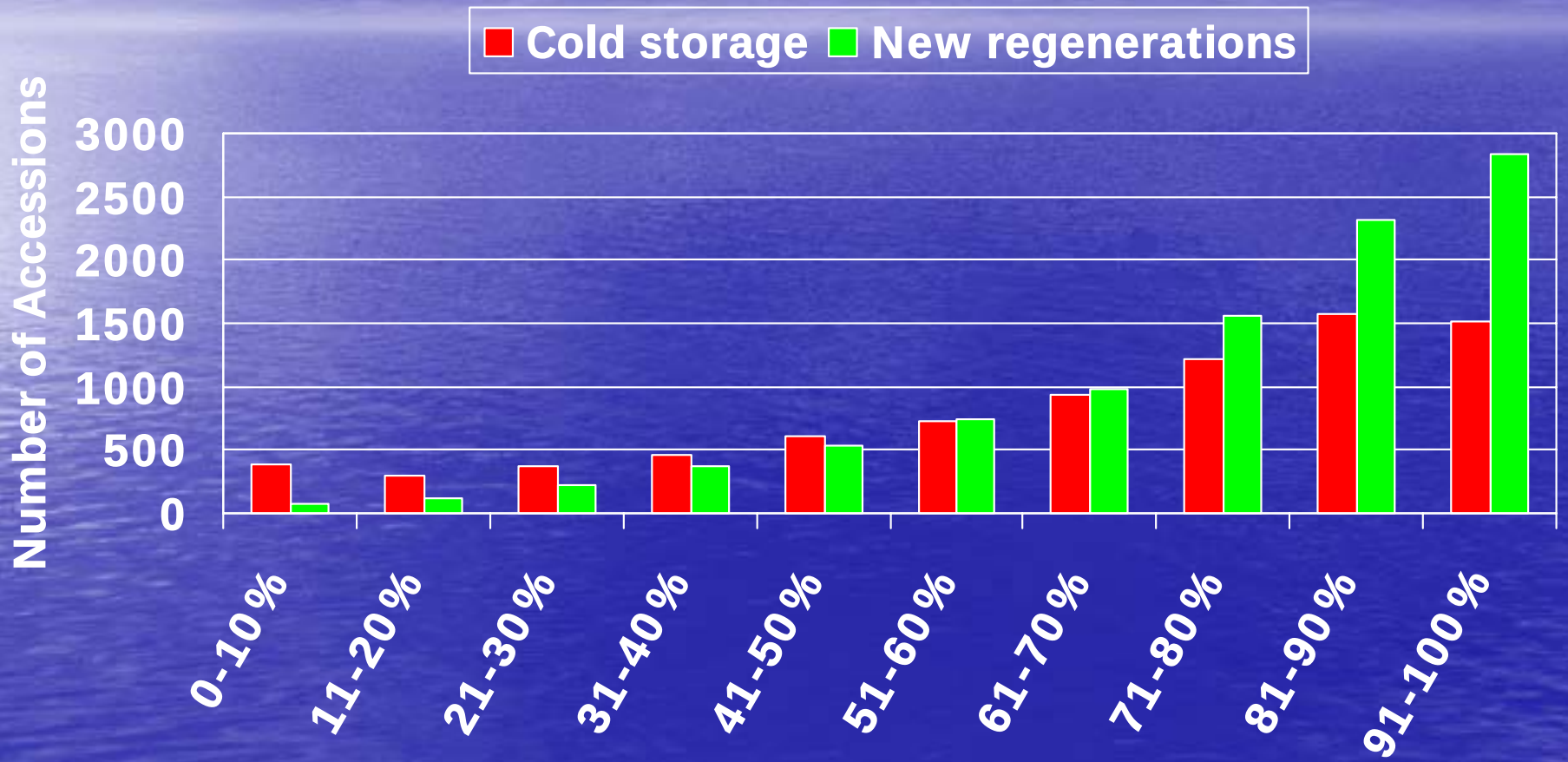

Bon Voyage

Appendix 3

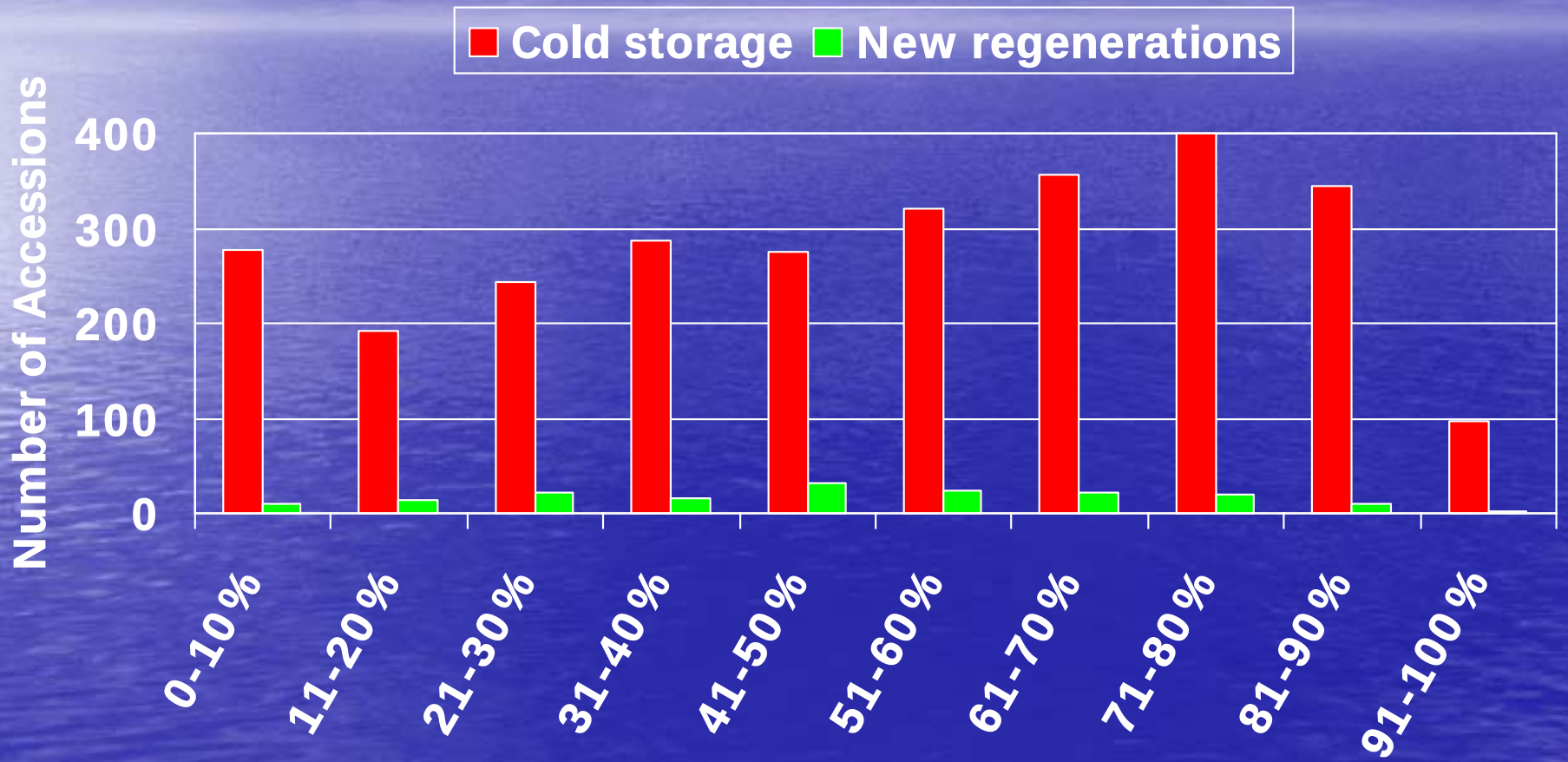
MR. DAVID PINNOW

PLANT GENETIC RESOURCES:
GERMINATION LAB

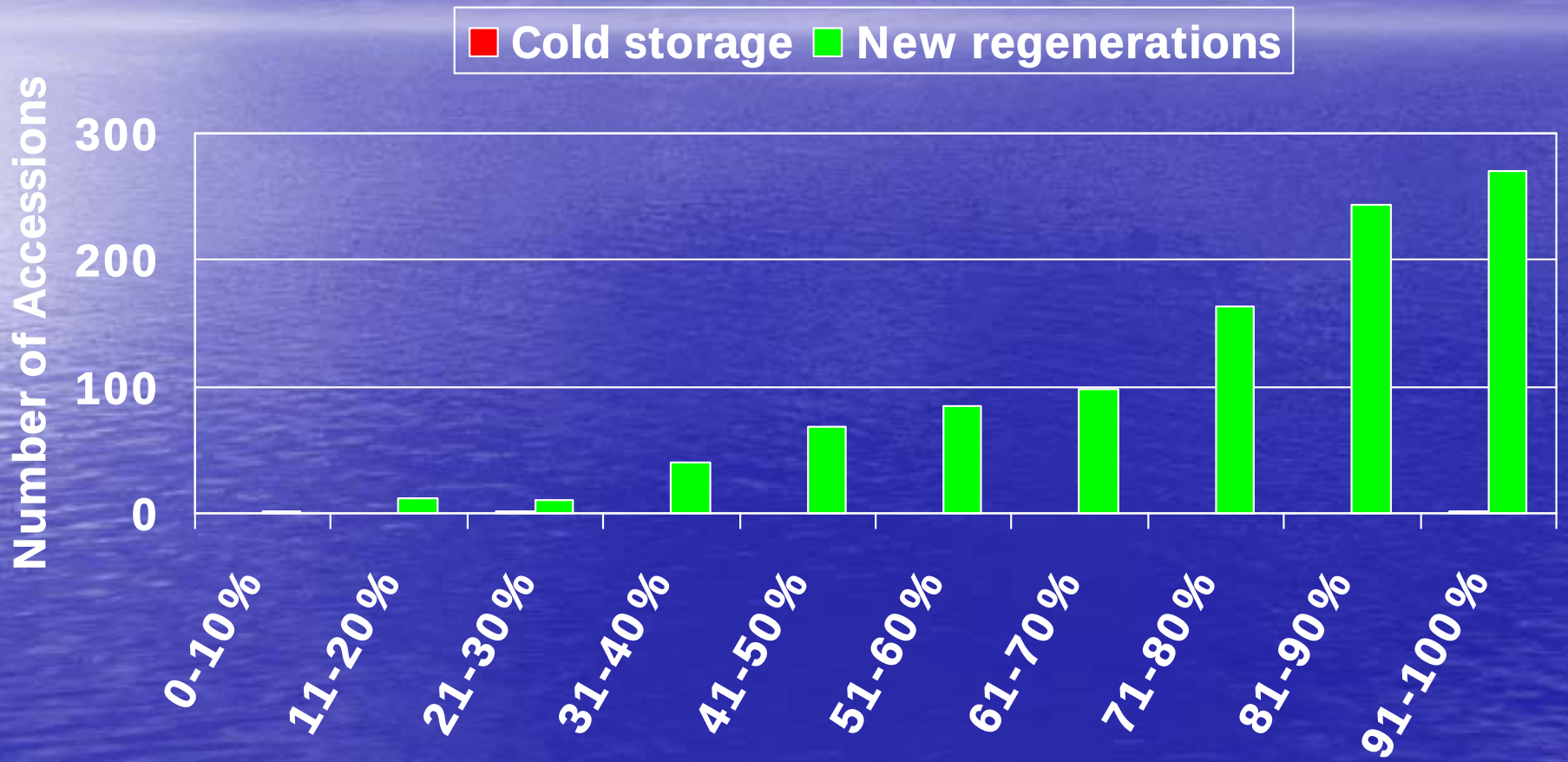
Sorghum germination



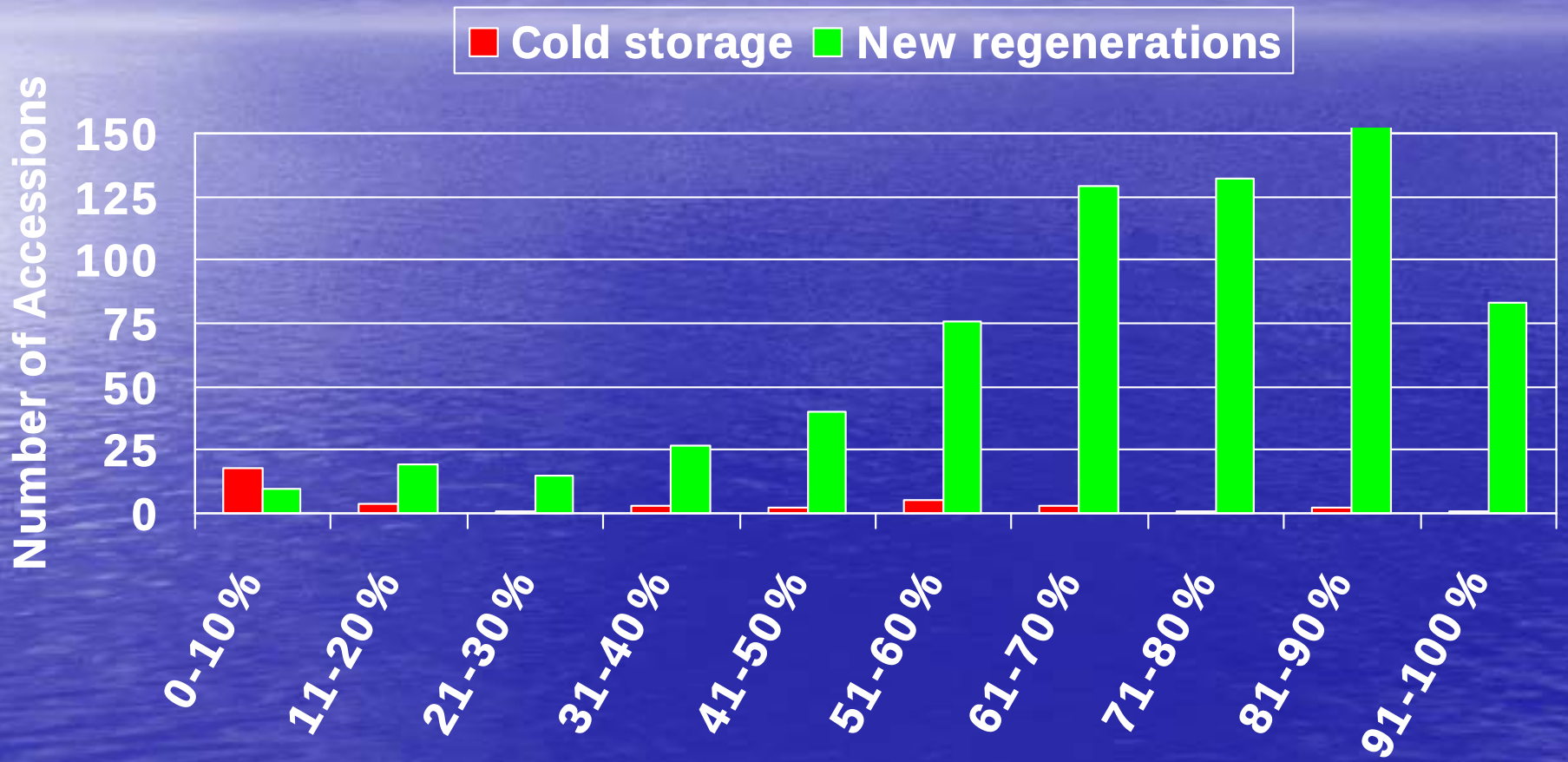
Pepper germination



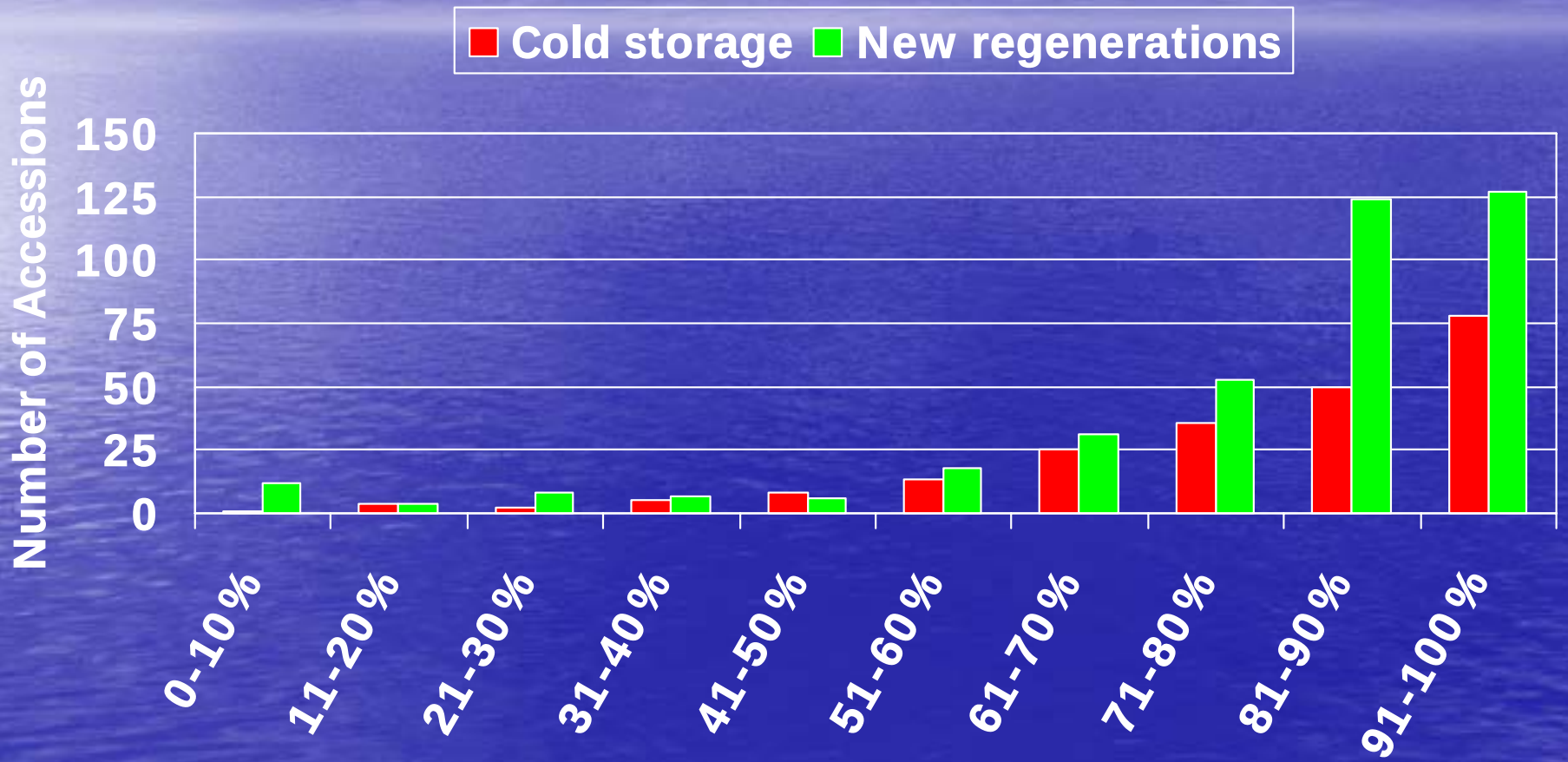
Peanut germination



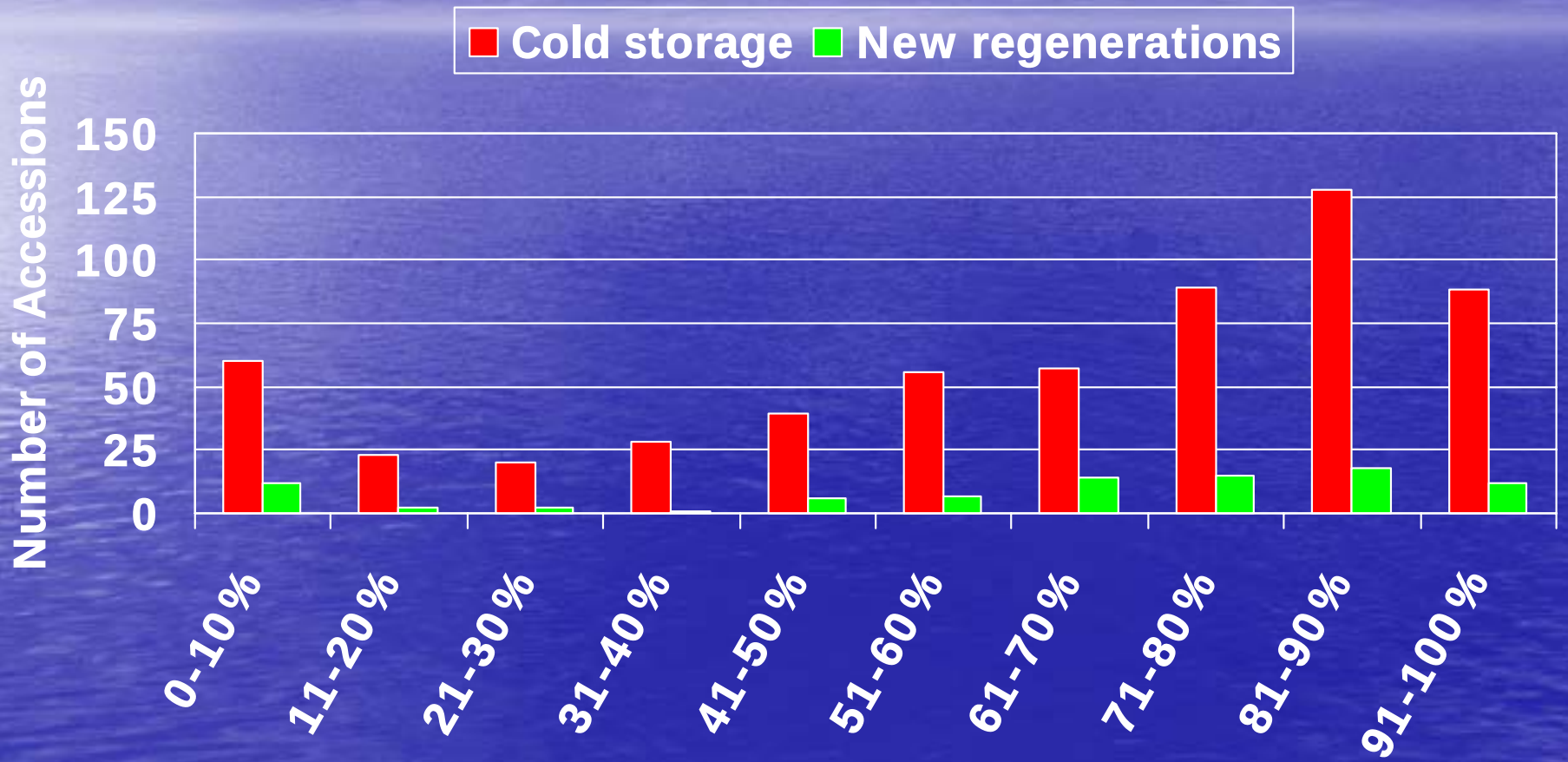
Vigna germination



Watermelon germination



Cucurbit germination

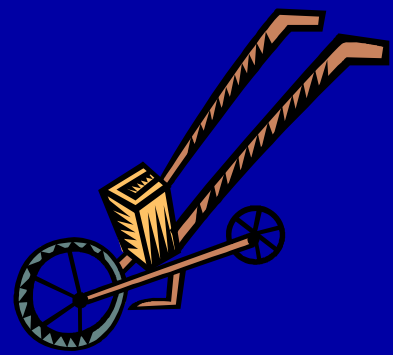


Appendix 4

DR. NOELLE BARKLEY

TILLING
MOLECULAR LAB

TILLING: No Plow, Blood, Sweat or Tears Required



Noelle Barkley, PhD
Molecular Geneticist
USDA-ARS PGRCU

INTRODUCTION

- Forward Genetics: begin with a trait and search for the gene
  - Slow, cumbersome process
  - Many mutations are undetectable as a phenotype
  - Rare phenotypes and mutations are missed

- Reverse Genetics: begin with sequence of gene and search for the function; function determined through mutation
  - Several reverse genetics techniques have been used over the years (Antisense RNA suppression, T-DNA tagging)
    - Rely on creation of transgenic plants
    - Often unstable
  - TILLING
    - Broadly applicable and nontransgenic

Claire McCallum
invented TILLING as a graduate
student

Definitions

- TILLING= target induced local lesions in genomes
  - involves inducing a random mutation (chemically) and screening for the change in a gene of interest against a reference
  - Detecting induced mutations; creating an allelic series (series of genotypes associated with a range of phenotypes)
- ECOTILLING= natural variation in population
  - No chemical mutagensis involved
  - Strategy for discovering DNA polymorphisms

TILLING/ECOTILLING DATA

- SNPs (single nucleotide polymorphism), small indels, microsatellite variation detectable

- SNPs in genes can lead to silent mutations, changes in the amino acid, or cause truncated proteins
  - Humans are 99.9% identical; majority of our differences are from SNPs (1 per 1200 bases)
  - Finding a SNP in an entire genome is like finding a needle in a haystack

SNPs

- Uses and Benefits of SNPs
  - Abundant in genomes
  - Molecular markers
    - Help to identify genes
    - Marker assisted selection
  - Fingerprinting
  - Diversity studies
  - SNPs found to be linked to susceptibility of disease
    - ApoE4 variant confers increased risk of Alzheimer's disease

TILLING PROCEDURE

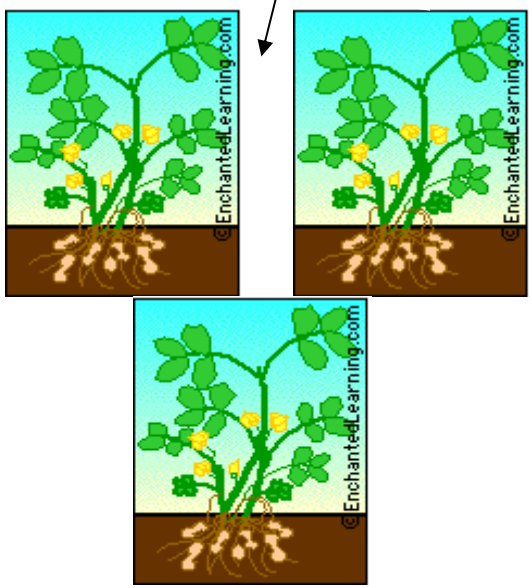
High throughput TILLING Protocol

Basic Steps:

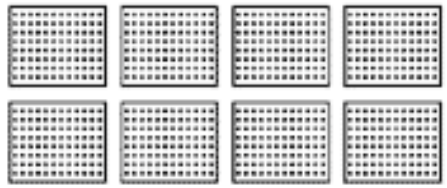
DNA extraction
Pooling Samples
PCR and heteroduplex formation
Heteroduplex digestion
Sample Purification
Gel electrophoresis (Li-Cor)
Gel analysis and data entry

Overview of TILLING/ECOTILLING

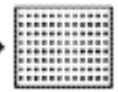
Treat a population of plants with EMS



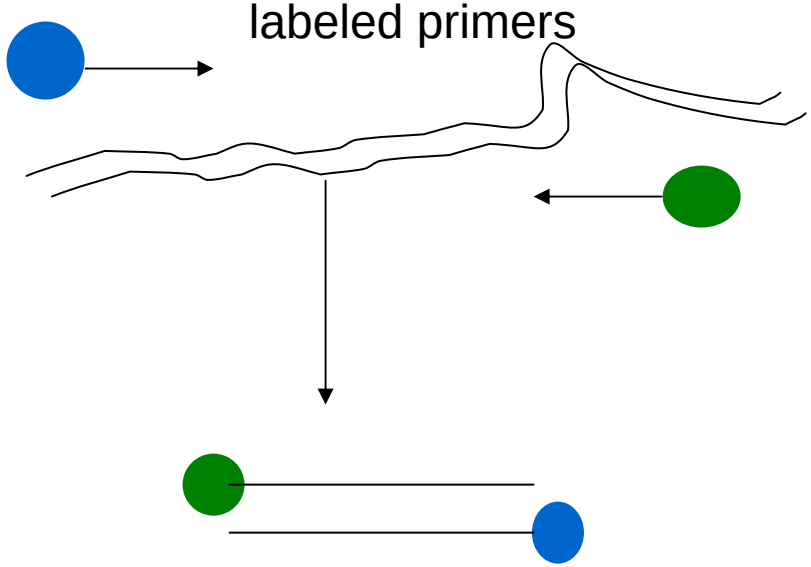
Extract DNA



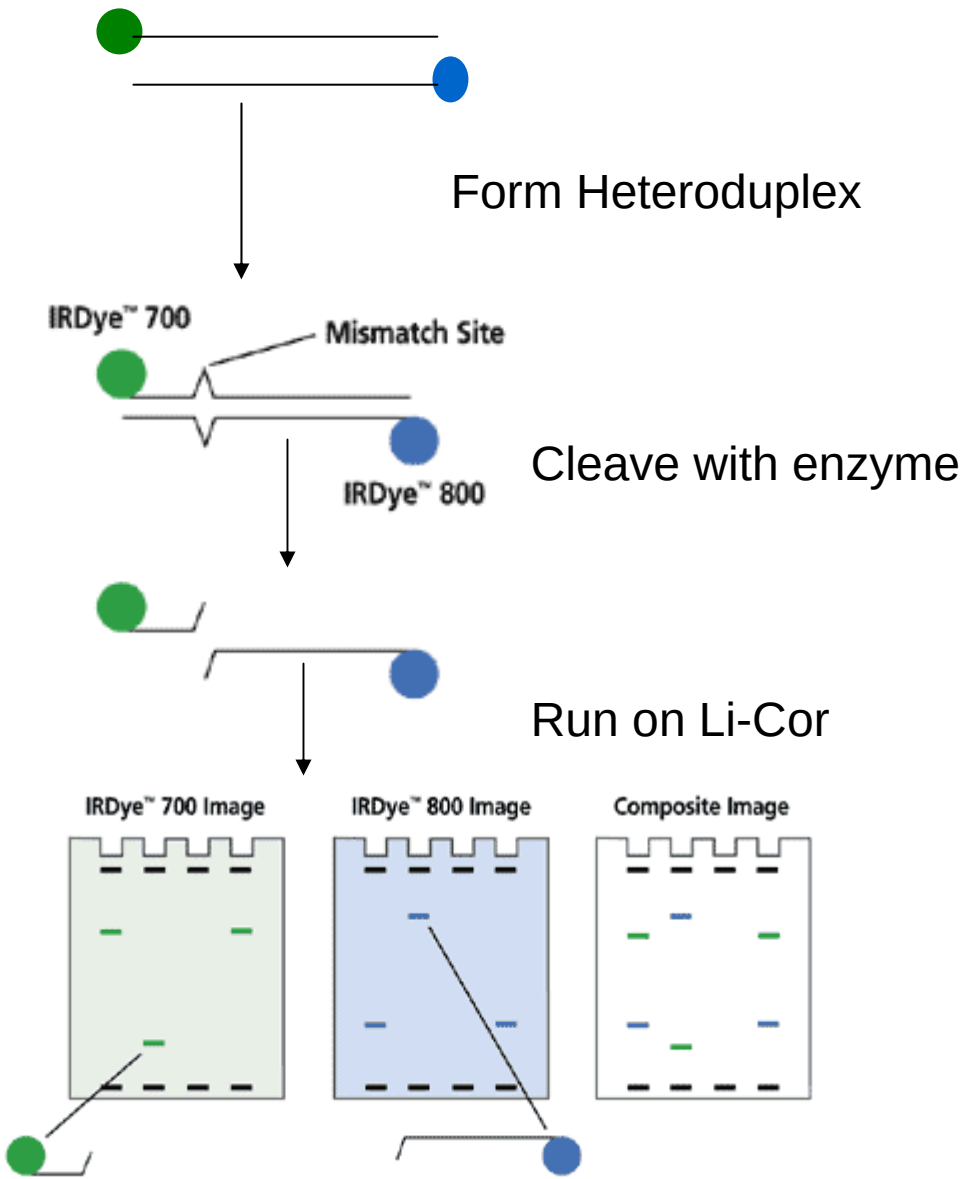
Pool DNA



PCR with 2 labeled primers



Overview of TILLING



PUBLISHED TILLING/ECOTILLING EXPERIMENTS

TILLING EXPERIMENTS

- *Lotus japonicus* TILLING in SYMRK gene (required for formation of root symbiosis); 5472 bp
  - Compared mutated to wild type; Tracked how many of the induced mutations affect symbiosis=no root nodules formed upon inoculation
- Waxy gene (maize, rice, wheat); Breads, pastas, glue, adhesives
  - Worked on in maize for > 80 years; Wheat 25 years
  - TILLING of waxy produced 246 new alleles which is more than the last 80 years of work
- Arabidopsis used Ecotilling to discover 55 alleles in 5 genes

BENEFITS OF TILLING

Benefits of TILLING/ECOTILLING

- Technique works in many different organisms unlike other reverse genetic approaches
- TILLING not affected by
  - Genome size
  - Reproductive system
  - Generation time
- TILLING also working in polyploids
  - PGRCU has many polyploid crops

Benefits of TILLING/ECOTILLING

- Advantages
  - Screen through large numbers of individuals (up to 768 individuals in 1 plate) rapidly to assess natural genetic variation
  - Saves money by limiting the amount of sequencing required
    - Know approximate position of detected variation
  - Fingerprinting
  - Diversity of a particular crop
  - Develop SNP markers
  - No transgenics

Cost of TILLING

Detecting Genetic Variation

- Sequencing 96 well plate ~ $ 658.00
  - No pooling; all individuals
  - No way to eliminate individuals that have identical sequences
  - Cost does not include TAQ, Kits to clean up samples, primers or DNA extraction
- Molecular markers (SSRs) cost ~$ 218 per plate
  - Does not include dye labeled primers, DNA extraction or TAQ

TILLING/ECOTILLING COSTS

- 1-96 well plate with 8 individuals/well (768 total) $ 34
  - Cost does not include labeled primers
- Sequencing 768 individuals would cost $5264

PGRCU TILLING PROJECTS

PGRCU TILLING PROJECTS

- ECOTILLING in Mung Bean
  - Small genome
  - Diploid
  - Sequence data already available to design labeled primers
  - Goal: assess natural genetic variation in ~100 Mung Bean accessions (5 plants/accession); identify variation within an accession and between accessions; identify SNPs and indels; design SNP markers

PGRCU ECOTILLING PROJECTS

- ECOTILLING in Peanuts
  - Previous studies of molecular markers displayed a low level of genetic variation in cultivated peanuts (SSRs, AFLPs)
    - Cultivated peanuts have phenotypic variation
  - No published data on SNPs in peanut
  - Epitope in allergens, desaturase gene, disease resistance genes
  - Goal: assess diversity in the collection; develop SNP markers; assay disease resistance

Summary

- ECOTILLING Benefits for PGRCU
  - Process more samples than molecular markers or sequencing
    - Costs less than markers and sequencing
  - Assess diversity b/w and within accessions
    - Help curators with regeneration
    - Develop SNP markers for breeding
    - Screen for disease resistance
  - Works well in polyploids

Thank You

Appendix 5

DR. JOHN ERPELDING

SORGHUM GERMPLASM REPORT 2005

Sorghum Germplasm Report 2005

Dr. John Erpelding
USDA-ARS Tropical Agriculture Research Station
Mayaguez, Puerto Rico

Sorghum Ergot Research

1. Sorghum Core Collection.
The sorghum core collection was screened in Puerto Rico in collaboration with Dr. Louis Prom. Nearly 2,400 sorghum accessions were evaluated in a single growing season and with this large number of accessions we were not able to conduct a replicated experiment. The accessions (~1,500) that showed tolerance to the disease were evaluated the following year in a non-replicated experiment. Approximately 90% of the accessions showed a similar response to ergot over the two years indicating that large scale evaluations could result in the successful identification of ergot tolerant germplasm for additional characterization.

Some important information from this study was that the country of origin could be used to identify sources of tolerance. Additionally, sorghum racial classification, which also related to country of origin, was associated with tolerance and would be useful for germplasm selection. The minor races tended to show higher levels of tolerance compared to the susceptible major races. For example, the durras tended to be susceptible, but the durra-kafirs were more tolerant.

In addition, ergot inoculations of sorghum accessions from the core collection were conducted before flowering and at the start of flowering. Significantly higher levels of infection were observed when inoculations were conducted at the start of flowering. These results would suggest that uniformity in flowering time within a field is important as higher levels of infection could occur for later flowering plants as disease pressure increases.

2. Evaluation of sterile hybrids.
Sterile hybrids were generated from tolerant sorghum accessions and evaluated for ergot resistance. The sterile hybrids were highly susceptible to ergot indicating that factors enhancing self-fertilization are responsible for tolerance.

3. Development of a screening procedure to evaluate resistance to ergot.
Sorghum hybrid seed production relies on the use of male sterile lines. A bulk emasculation procedure was used to generate sterility in order to screen sorghum germplasm for resistance to ergot. Sterile panicles were highly susceptible indicating that mechanisms influencing self-fertilization were important factors contributing to ergot tolerance. The procedure provides a more rapid and economical approach to screen

sorghum germplasm compared to the generation of sterile hybrids. IS8525 was observed to be susceptible using this procedure.

4. Development of segregating populations to evaluate ergot tolerance.
Crosses were conducted between highly tolerant and highly susceptible sorghum germplasm lines. The segregating populations generated from these crosses were screened for ergot tolerance in Puerto Rico and Texas. The ergot tolerant phenotype was more frequently recovered indicating that mechanisms enhancing tolerance could be easily incorporated into breeding lines. These results would indicate that sorghum hybrids could be developed with tolerance to ergot; therefore, ergot would be less of a problem for sorghum producers.

Sorghum Anthracnose Research

1. Sudan working collection.
A subset of sorghum germplasm from Sudan comprising the working collection was evaluated for resistance to anthracnose in Puerto Rico and Texas. The response to anthracnose infection varied between locations for some of the accessions suggesting the occurrence of different pathotypes of the disease. Results would indicate that sorghum germplasm from Sudan is a potential source of anthracnose resistant for sorghum improvement. In addition, germplasm lines from the Sudan collection were selected to establish a set of differential lines that could be used to evaluate pathotypes of the disease.

2. Ethiopian collection.
A subset of sorghum accessions from Ethiopia was screened for anthracnose resistance during the wet and dry growing seasons in Puerto Rico. Results would indicate that Ethiopia is a potential source of anthracnose resistant germplasm. Additionally, the response to anthracnose was generally uniform over seasons suggesting large scale disease evaluations could be conducted for the Ethiopian sorghum collection throughout the year. This is of importance since the Ethiopian collection consists of over 8,000 sorghum accessions and large scale evaluations would be essential to assess the diversity for anthracnose resistance in the collection.

3. Mozambique collection
The sorghum germplasm collection from Mozambique was evaluated for anthracnose resistance over multiple growing seasons. The majority of the germplasm lines were resistant. Variation between growing seasons was observed indicating that the sorghum collection from Mozambique could also be a source of tolerance (minor gene resistance) that would have be useful for the development of resistant hybrids in locations were disease pressure in high.

4. Mali working collection.
The sorghum working collection from Mali was screened for anthracnose resistance in Puerto Rico and Texas. The evaluation in Puerto Rico was conducted over two growing seasons. The majority of the accessions in the collection were resistant at both locations

suggesting Mali could be a good source of anthracnose resistant. A subset of the Malian accessions was evaluated in Georgia and resistant germplasm was identified that would provide a source of anthracnose resistance to multiple pathotypes of the disease.

5. Mali regional collections.
Mali is composed of eight regions with sorghum commonly grown in five of the regions. Sorghum germplasm has been identified from each of these five regions and screened for anthracnose resistance. One region (Kayes) located in the western part of Mali was a graduate student's MS thesis project. The Kayes regional collection was screened over three growing seasons and nearly 50% of the collection was resistant to anthracnose. Results of this evaluation indicated that climatic conditions in the country of origin and the region where the germplasm was collected provide important information for the identification of resistant germplasm. This indicates that passport information would be highly useful in the selection of sorghum germplasm to identify additional sources of anthracnose resistance. These results have been confirmed by screening sorghum collections from other African countries. Anthracnose evaluations for regions where climatic conditions are not favorable for the disease, such as Algeria and Somalia, have resulted in a high level of anthracnose susceptibility for the sorghum accessions. Other regions where climatic conditions are favorable for high disease pressure, such as Gambia, Mozambique, and Rwanda, the majority of the germplasm accessions were observed to be resistant to the disease. This information is not only important for the identification of anthracnose resistant germplasm, but similar results may be observed for other sorghum diseases that could greatly enhance the identification and selection of resistant germplasm.

6. Anthracnose population development.
As germplasm collections from specific countries are screened and stable sources of anthracnose resistance are identified, germplasm lines are being selected for population development. Critical to the development of these populations was the identification of an anthracnose susceptible parent. One accession from the Malian collection was identified and evaluated under multiple growing seasons and at several locations to confirm susceptibility. This germplasm line has been crossed to anthracnose resistant accessions from Ethiopia, Mozambique, and Rwanda and populations are in the process of being generated.

The anthracnose evaluation of the Kayes region of Mali resulted in the identification of 120 accessions resistant to the disease. From these resistant accessions, 72 were selected and crosses have been conducted for population development. One of the resistant accessions was determined to have a dominant gene for anthracnose resistance and 25 of the 72 resistant accessions were crossed to this line to determine whether different genes are controlling resistance in the Malian germplasm collection. This is the most comprehensive disease evaluation that has been conducted on the collection. Dr. Robert Klein will be collaborating on the mapping of the anthracnose resistant genes for these populations.

Dr. Louis Prom has been screening anthracnose isolates on a subset of sorghum lines to determine pathotype variation. Crosses have been conducted with these lines in order to determine the genes for resistance in the host plant that are associated with the pathotypes of the disease.

7. In collaboration with Dr. Ming Li Wang, 96 sorghum accessions were randomly selected for molecular marker analysis and disease evaluation. Using the marker data, Dr. Wang showed that accessions clustered by country of origin. The disease response to anthracnose and rust also showed an association with country of origin with Mali being a good source for anthracnose resistant germplasm. Populations are being generated to evaluate resistance to rust and anthracnose.

Germplasm Regeneration

1. Emergency seed increases
Seed quality or quantity is low on approximately 1,200 sorghum accessions and emergency seed increases are being conducted to rescue these accessions. Approximately 600 sorghum accessions have been increased in Puerto Rico. For these accessions, seed samples are germinated in the laboratory. Germinating seeds are planted in the greenhouse to produce healthy seedlings prior to transplanting to the field. The 250 accessions being increased this year are not available for distribution; thus, seed increases are of high priority to prevent the loss of this germplasm. A considerable amount of resources are devoted to these seed increases resulting in a high rate of success.

2. Collection maintenance
Germination data has been obtained for the majority of the accessions in the sorghum collection. This information along with information on seed quantities was used to identify sorghum accessions requiring regeneration. Approximately 10,000 accessions required regeneration and seed increases are being conducted at the Germplasm Introduction and Research Unit in St. Croix, USVI. Over 8,000 sorghum accessions have been regenerated at the research unit since 2001. For the 2004 and 2005 growing season, 3,255 accessions were increased. Since 2002, average germination rate of regenerated seed has been 74%. Over 2,750 sorghum panicles have been photographed and more than 106,000 descriptor notes taken from accessions regenerated at St. Croix and incorporated into the GRIN database.

3. Quarantine seed increases
Approximately 1,000 sorghum accessions have been added to the collection. Seed increases have been conducted for 835 sorghum accessions in 2004 and 2005.

Wild Sorghum Species Regeneration

Approximately 300 accessions from the wild sorghum species collection require regeneration. In 2003, a seed increase protocol was developed for evaluation and 10 accessions were regenerated. The overall success rate was good. In 2004, a seed

increase was conducted for 25 wild sorghum accessions. To prevent further losses in seed quality, extensive regeneration of this collection is necessary. Regeneration of the wild species is labor intensive as the samples are processed by hand; therefore, we anticipate the process will require five years to complete.

The wild species are also being crossed with cultivated sorghum to generate populations for use in the sorghum genomics initiative. Several wild sorghum accessions have been successfully crossed with cultivated sorghum. These populations will be highly useful for genetic mapping and for evolution studies. The crosses between the wild species and cultivated sorghum will also help define the gene pools.

Germplasm Characterization

Over 2,900 sorghum accessions from the Ethiopian germplasm collection were phenotypically characterized including digital imaging of panicles.

Phenotypic data has been obtained for the sorghum germplasm collections from Gambia, Chad, Algeria, Mauritania, Rwanda, Somalia, and Mozambique. These collections are also being evaluated for disease resistance in replicated experiments over two years. In collaboration with Dr. Louis Prom, several of these collections are being evaluated for disease resistance in Texas and Mexico. Also, there is an effort to collect more comprehensive information including molecular marker data for these collections.