

**S-009 Regional Technical Advisory Committee
Minutes of Annual Meeting, July 31 – August 1, 2012**

**University of Georgia Research and Education Garden Building
Griffin, GA**

Members present:

Florida (University of Florida) Kevin E. Kenworthy (kenworth@ufl.edu)
Georgia (University of Georgia) Paul L. Raymer (praymer@uga.edu)
Guam (University of Guam) Mari Marutani (marutani@uguam.uog.edu)
North Carolina (North Carolina State Univ) Tom Stalker (tom_stalker@ncsu.edu)
South Carolina (Clemson University) Emerson R. Shipe (eshipe@clemson.edu)
Tennessee (University of Tennessee) Fred Allen (allenf@utk.edu)
Southern Assoc. Agric. Exp. Sta. Directors Gerald Arkin (garkin@uga.edu)

USDA, ARS, PGRCU representatives present:

USDA-ARS-PGRCU, Griffin, GA Gary A. Pederson (gary.pederson@ars.usda.gov)
USDA-ARS-PGRCU, Griffin, GA Noelle Barkley (elle.barkley@ars.usda.gov)
USDA-ARS-PGRCU, Griffin, GA Roy N. Pittman (roy.pittman@ars.usda.gov)
USDA-ARS-PGRCU, Griffin, GA Ming Li Wang (mingli.wang@ars.usda.gov)
USDA-ARS-PGRCU, Griffin, GA Dave Pinnow (david.pinnow@ars.usda.gov)
USDA-ARS-PGRCU, Griffin, GA Lee Ann Chalkley (leeann.chalkley@ars.usda.gov)
USDA-ARS-PGRCU, Griffin, GA Merrelyn Spinks (merrelyn.spinks@ars.usda.gov)
USDA-ARS-PGRCU, Griffin, GA Phiffie Vankus (phiffie.vankus@ars.usda.gov)
USDA-ARS-PGRCU, Griffin, GA Libbie Hudson (libbie.hudson@ars.usda.gov)
USDA-ARS-PGRCU, Griffin, GA Kami Lindberg (kami.lindberg@ars.usda.gov)

S-009 employees present:

University of Georgia, Griffin, GA Jill Cunningham (jcunnin@uga.edu)
University of Georgia, Griffin, GA Donnie Hice (dhice@uga.edu)
University of Georgia, Griffin, GA Angie Lewis (alew71@uga.edu)
University of Georgia, Griffin, GA Jeremy Smith (zaydoc@uga.edu)

Day 1 (July 31, 2012)

1. The meeting was called to order at 1:00 pm. (Chair, Kevin Kenworthy)
2. Welcome message by Dr. Gerald Arkin, (Administrative Advisor, S-009 RTAC, and Assistant Dean of UGA Griffin Campus). He stated that S009 project is a successful multistate program, demonstrating a model of collaboration among curators, faculty and staff of states and interstates in the Land Grant system. He encouraged discussion of this program with administrators of each state to obtain further support.
3. Approval of the 2011 minutes. (Fred Allen/Tom Stalker)
4. Committee appointments (Kevin Kenworthy)
 - a. Paul Raymer and Mari Marutani to nominate an incoming officer.
 - b. Fred Allen and Emerson Shipe to propose the meeting site and dates for 2013 meeting.
5. Reports:

- a. 2012 Office of National Program Report for the U.S. National Plant Germplasm System:
 - i. Distribution of a report submitted by Dr. Peter Bretting *et al.* from Office of National Programs, National Program 301:Plant Genetic Resources, Genomics, and Genetic Improvement
 - ii. Oral summary report by Dr. Gary Pederson.
 - iii. Items in the report included:
 - Personnel changes (Noelle Barkley as peanut curator and Roy Pittman as Vigna curator at Griffin)
 - Budget increases proposed for NPGS in President's budget but location closures proposed for NPGS genebank in Palmer, AK, and others.
 - National Program (NP) 301 completed its five-year cycle. Program was reviewed and ARS leaders and researchers are developing individual Project Plans to start in 2013 according to NP 301 Action Plan.
 - NPGCC—to promote a better utilized NPGS, impacting ARS, NIFA and SAES. The NPGCC continues to work on the priority issues.
 - NGRAC—recently held an initial organizational teleconference. The NGRAC will formulate recommendations on policies and actions for the collection, maintenance and utilization of genetic resources, etc
 - iv. Closure of several ARS locations.
 - v. Recognition of the S-009 Multistate Project – Submission for the National Excellence in Multistate Research Award by Dr. Gary Pederson. Nominated by the Southern Directors and competing against other regional nominees for the national award. If awarded, the S-009 advisory committee will decide how to use the prize! Kudos to Gary for submission of the proposal (Kevin and committee members).
- b. Current Status and 2011 Summary of Plant Genetic Resources Conservation Unit (Gary Pederson)(Appendix 1)
 - i. PGRCU collection (as of 6/12): total accession (91,259), total available (80,142), and total back-up (88,669)
 - ii. Increase in back-up, seed germination test, and digital photos. Regeneration was also done at other institutions (e.g. 108 wild peanut spp. accessions at NC). Regeneration priority is based on the number of seed requests, longevity of stored seeds, and % germination.
 - iii. Increase in seed distribution to foreign countries. A concern expressed was that the U.S. should be able to receive seeds from those countries where we send seed. However, some countries will not send seeds to the U.S., although original seeds were sent or collected from those countries.
 - iv. Facility improvement and acquisition of surplus items from ARS sites closures – will visit and see during the tour on Day 2 of the meeting.
- c. PGRCU Plant Pathology and Germination Lab Development and Progress (Dave Pinnow) (Appendix 2)

- i. Presented a historical review of Pathology and Germination labs and his responsibilities. His current work involves disease screening, diagnosis, quarantine work, applied pathology research, and Molecular Lab research support.
- ii. Recent molecular research was detection and classification of Sweetpotato leaf curl virus (SPLCV) with colleagues, Dr. N. Barkley et al. Since 2002, the germination lab has made great progress. Germination tests have been completed for 81.6% of all accessions. Re-testing of accessions will start in 2013 (first year of next ARS 5-year Project Plan) in addition to keeping current with new regenerations.
- d. Evaluation of Plant Germplasm Collections by Biochemical Analysis (Ming Li Wang) (Appendix 3)
 - i. Presented his work at Molecular and Biochemical Genetics Lab., focusing on use of oil content and fatty acid analysis to characterize accessions. Major oilseed crops in collection were peanut (8,100 cultivated + 100 wild species accessions), castor bean (1,033 accessions), sesame (1,232 accessions), and minor oilseed plant species including hibiscus (329 = 222 *H. cannabinus* + 107 *H. sabdarifa* accessions), okra, watermelon, pepper, squash, and pumpkin.

6. Discussion

- a. Nicotiana collection (Tom Stalker)
 - i. There are little or no resources for conservation of Nicotiana germplasm.
 - ii. Possible places to maintain wild species and important germplasm at:
 - Pharmaceutical companies—medical groups may need them
 - Botanic Gardens – specimen collections
 - Possibly any USDA systems
- b. S-009 Project renewal in 2013 (Gary Pederson)
 - i. New project will start on September 2013 and need to work on preparation of Development Committee request. The committee and representatives of USDA-ARS, PGRCU will work on wording of new objectives on Day 2 of this meeting rather than discuss state reports. The meeting agenda of the Day 2 “State reports” was changed to “Discussion on objectives of the new S-009 Project.”
 - ii. Tentative schedule of development of the new project
 - Aug. 10, 2012 --- development of new objectives due
 - Aug. 31, 2012 --- prepare Development Committee request
 - Oct. 30, 2012 --- prepare first draft of new project
 - Nov. 2012 – Jan. 2013 --- Committee review and edit the project
 - Jan. 31, 2013 --- Final draft done
 - Feb. – May 2013 --- Enter project in NIMSS, request participation, peer review, and make corrections.
 - June 2013 --- Completion of the project plan; will be a 10-year project
 - iii. Gary will report on 10-year progress of the S-009 project at SAAESD meeting at Portsmouth, New Hampshire in September 2012.

7. The meeting was adjourned at 4:50 pm until 8:00 am Aug. 1, 2012.

Day 2 (August 1, 2012)

1. The meeting re-convened at 8:00 am.
2. Tour of facilities
 - a. New 4 C cold room and building addition: Continue to have humidity problems that must be fixed before the cold room can be used.
 - b. Surplus items obtained from three ARS location closures included lab supplies, farm equipment, and vehicles.
 - c. New plot land—17 acre fenced area on Westbrook Farm near campus.
3. Discussion on objectives of the new S-009 Project
 - a. After a lengthy discussion, the group decided to propose four objectives in the new S-009 proposal.

Objective 1: Acquire and conserve genetic resources of crops and related wild species of importance to the Southern Region such as sorghum, peanut, watermelon, chili peppers, warm-season grasses, cowpea, clover, tropical/subtropical legumes, and others.

Objective 2: Conduct genetic characterizations and phenotypic evaluations of the conserved crops and related wild species for commercially important genetic and agronomic traits.

Objective 3: Incorporate characterization and evaluation information into the Germplasm Resources Information Network (GRIN) or other public databases.

Objective 4: Distribute genetic resources and associated information to researchers, educators, and plant breeders in the Southern Region and worldwide.
4. New officers for 2013
 - a. Chair – Mari Marutani
 - b. Secretary – Fred Allen (vote: 4 Yes, 1 No)
5. Location of the 2013 meeting
 - a. Gulf Coast Research and Education Center - Balm, Florida on July 30-31, 2013. (Fred Allen/Tom Stalker)
 - b. Kevin Kenworthy (UF) will organize the meeting and send detailed information later.
6. Other announcements
 - a. University of Florida – two plant breeding positions will be open (Kevin Kenworthy)
 - b. Clemson University – two plant breeding positions will be open (Emerson Shipe)
 - c. Members did a good job on submitting their state reports for the S-009 annual report (Gary Pederson)
7. Adjournment at 11:00 am (Fred Allen/Tom Stalker)

Submitted by Mari Marutani, S-009 Secretary

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

PGRCU Collection - June 2012

- Total Accessions
 - 91,259
- Total Available
 - 80,142 (87.8%)
- Backed Up
 - 88,669 (97.2%)

Acknowledgement: Merrelyn Spinks and Lee Ann Chalkley, PGRCU, compiled and summarized all numbers shown in this presentation.

PGRCU Collection 1996 - 2012

90000
80000
70000
60000
50000
40000
30000
20000
10000
0

Total Accessions

Total Available

Backed Up

Vigna

CURATOR	CROP	TOTAL ACCESSIONS	TOTAL AVAILABLE	NUMBER BACKED UP	ITEMS SHIPPED IN 2011
Roy Pittman	Cowpea	8,229	6,704	8,167	617
	Mung bean	4,232	3,850	4,232	976
	Other Vigna spp.	496	301	353	241

Vegetable Crops & Sweetpotato

CURATOR	CROP	TOTAL ACCESSIONS	TOTAL AVAILABLE	NUMBER BACKED UP	ITEMS SHIPPED IN 2011
Bob Jarret	Cucurbits	1,418	551	1,313	1,265
	Eggplant	1,020	915	1,006	987
	Okra	2,971	1,524	2,935	1,084
	Peppers	4,710	4,628	4,704	4,349
	Sweetpotato - tissue culture	753	728	670	89
	Other Ipomoea spp.	462	210	407	306
	Watermelon	1,908	1,563	1,876	3,375

Legumes and Misc. Crops

CURATOR	CROP	TOTAL ACCESSIONS	TOTAL AVAILABLE	NUMBER BACKED UP	ITEMS SHIPPED IN 2011
Brad Morris	Castor bean	374	168	373	188
	Hibiscus	340	283	338	538
	Legumes	3,082	2,284	2,996	293
	Guar, Winged Bean, Misc	711	540	625	156
	Sesame	1,216	1,178	1,216	1,355

Warm-Season Grasses

CURATOR	CROP	TOTAL ACCESSIONS	TOTAL AVAILABLE	NUMBER BACKED UP	ITEMS SHIPPED IN 2011
Melanie Harrison- Dunn	Bamboo	96	96	2	1
	Grasses	7,337	6,125	6,993	1,760
	Pearl millet	1,319	1,271	1,319	67

Clover and Sorghum

CURATOR	CROP	TOTAL ACCESSIONS	TOTAL AVAILABLE	NUMBER BACKED UP	ITEMS SHIPPED IN 2011
Gary Pederson	Annual Clover	2,240	1,853	2,218	613
	Sorghum	37,641	36,405	36,785	12,999

Peanuts

CURATOR	CROP	TOTAL ACCESSIONS	TOTAL AVAILABLE	NUMBER BACKED UP	ITEMS SHIPPED IN 2011
Noelle Barkley	Cultivated Peanuts	9,316	8,146	9,059	850
	Wild Peanuts	608	409	395	49

Number (and %) of accessions that are unavailable

Crop	2011	2012	Crop	2011	2012
Cowpea	1,524 (19%)	1,525 (18%)	Hibiscus	49 (14%)	57 (17%)
Mung bean	382 (9%)	382 (9%)	Legumes	816 (26%)	796 (26%)
Cucurbits	848 (60%)	867 (61%)	Sesame	30 (2%)	38 (3%)
Eggplant	104 (10%)	105 (10%)	Grasses	1,277 (17%)	1,212 (16%)
Okra	1,429 (48%)	1,447 (49%)	Pearl millet	47 (4%)	48 (4%)
Peppers	90 (2%)	82 (2%)	Annual clover	395 (18%)	387 (17%)
Sweetpotato (TC)	42 (5%)	25 (3%)	Sorghum	1,200 (3%)	1,236 (3%)
Watermelon	299 (16%)	345 (18%)	Cultivated peanuts	1,235 (13%)	1,170 (12%)
Castor bean	206 (55%)	206 (55%)	Wild peanuts	201 (33%)	199 (33%)
			TOTAL	11,150 (12%)	11,117 (12%)

Digital photos

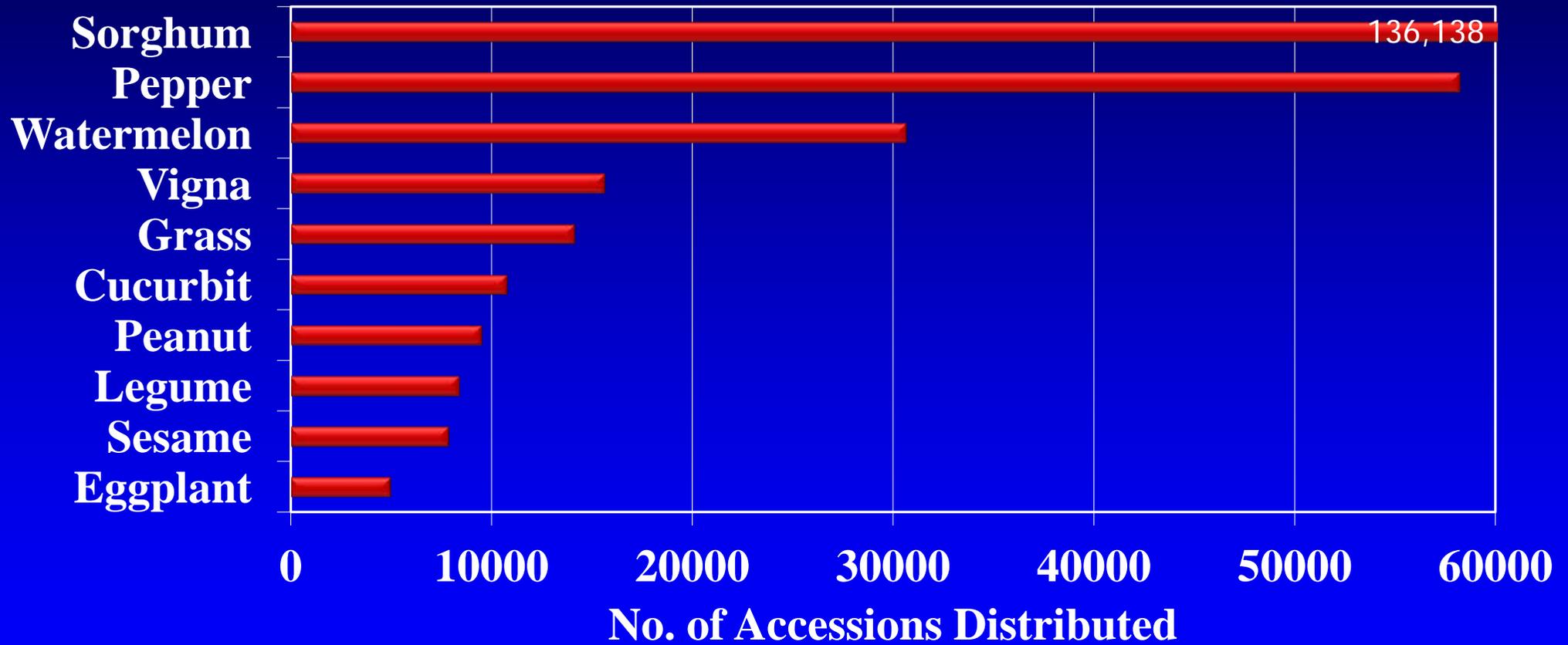
Crop	Images
Sorghum	8,995
Cowpea	2,208
Watermelon	1,812
Pepper	1,790
Grass	1,093
Cucurbit	827
Peanut	549
Pearl millet	450
Other crops	447
Total (+1,569)	18,394 (20.2%)

Germination Testing

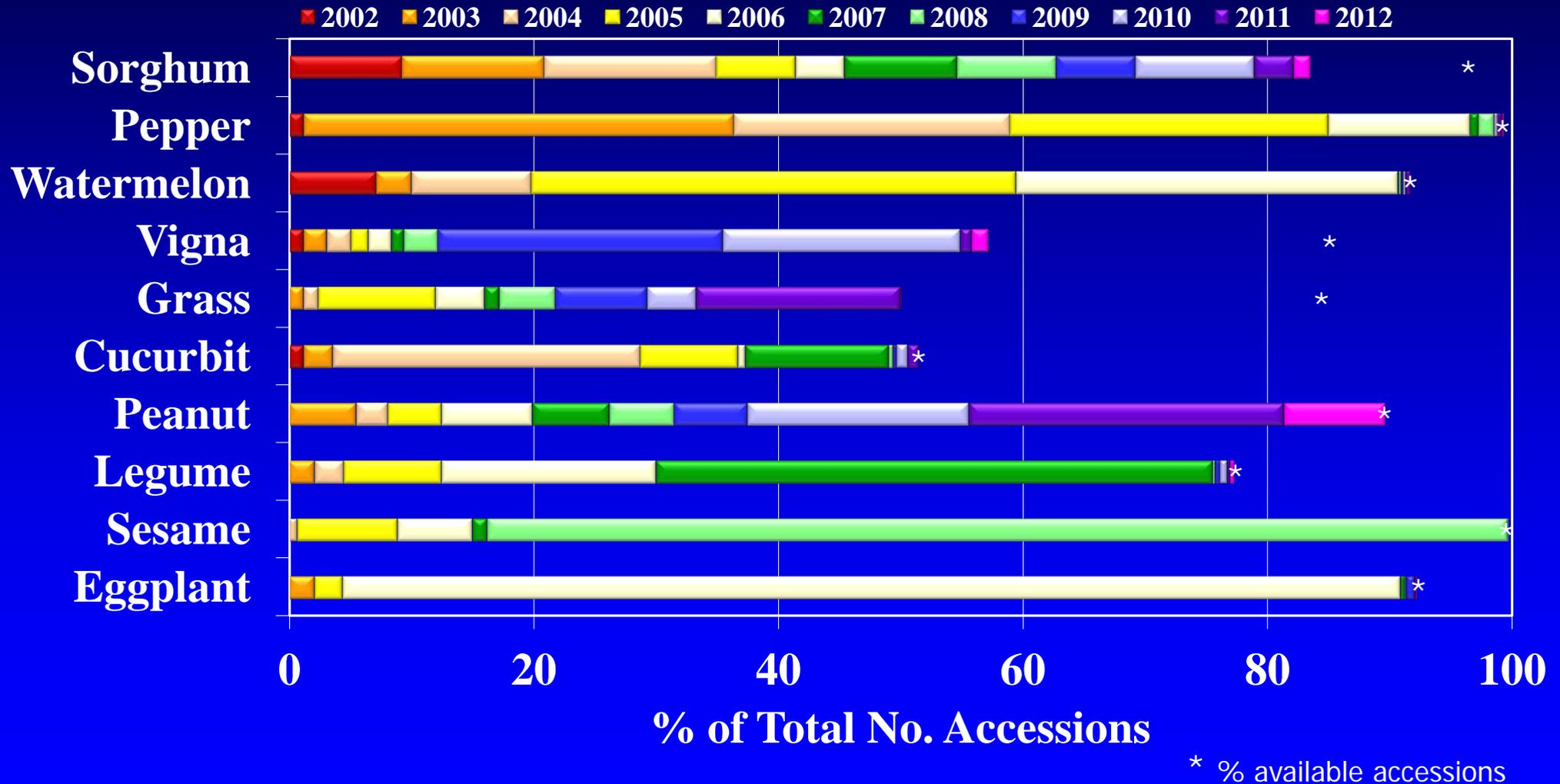
(Accessions with seed only, tested since 2002)

Crop	Accessions	%	Crop	Accessions	%
Sorghum	31,241	83.0	Clover	1,940	86.6
Peanut	8,345	89.6	Okra	1,756	59.1
Cowpea	7,023	85.3	Watermelon	1,754	91.9
Pepper	4,672	99.2	Pearl millet	1,297	98.3
Mung bean	3,928	92.8	Sesame	1,211	99.6
Grass	3,705	53.5	Eggplant	939	92.0
Legume	2,377	77.1	Cucurbit	685	48.3
			TOTAL	73,274	81.6

Germination Priority Based on Distributions 2002 - 2012



Germinations 2002 - 2012



Accessions in -18 C storage

(Accessions with seeds only, seed splitting initiated in 2001)

Crop	Accessions	%	Crop	Accessions	%
Sorghum	27,451	72.9	Watermelon	1,908	100.0
Grasses	6,957	98.9	Cucurbits	1,412	99.6
Peanuts	6,171	66.3	Sesame	1,216	100.0
Peppers	4,704	99.9	Eggplant	1,018	99.8
Mung bean	4,074	96.3	Cowpea	838	10.2
Legumes	3,079	99.9	Gourds	482	98.6
Okra	2,971	100.0	Ipomoea spp.	456	99.3
Clover	2,205	98.4	TOTAL	67,241	74.9

Requested for regeneration in CY2012

Crop	# accessions	Crop	# accessions
Cowpea	128	Grasses	196
Sorghum	1,361	Legumes	145
Cucurbit	18	Wingbean	38
Clovers	54	Eggplant	12
Solanum sp.	21	Cult peanut	828
Peppers	64	Wild peanut	72
Sesame	13	Hibiscus	21
Ipomoea sp.	2	Castor bean	10
Watermelon	6	Misc crops	6

Regenerations by others in CY2012

- 95 sorghum and 1 Ipomoea sp. accessions
 - R. Goenaga, USDA, ARS, Puerto Rico
- 1,659 sorghum, 50 cowpea, 18 legume, & 17 wingbean accessions
 - A. Quiles, USDA, ARS, St. Croix
- 343 peanut accessions
 - 34 accessions, J. McKinney, Univ. Florida, Citra, FL
 - 114 accessions, C. Chen, USDA, ARS, Dawson, GA
 - 42 accessions, K. Chamberlin, USDA, ARS, Stillwater, OK
 - 46 accessions, C. Holbrook, USDA
 - 107 accessions, T. Isleib, North Carolina State Univ., Raleigh, NC
- 108 wild peanut accessions
 - T. Stalker, North Carolina State Univ., Raleigh, NC
- 2 watermelon accessions
 - T. Wehner, North Carolina State Univ., Raleigh, NC

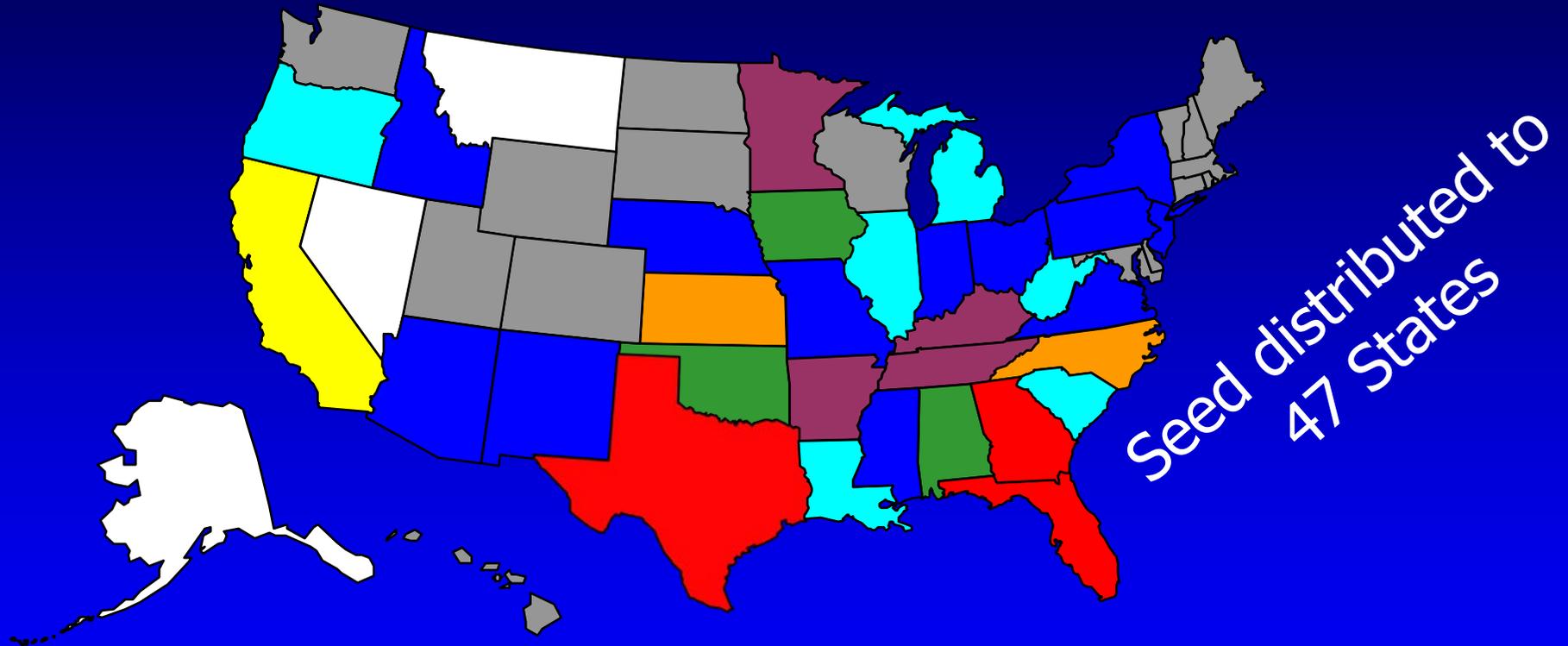
Distributions in CY2011

- Domestic = 23,698 items in 739 orders
 - S-9 region = 18,233 items
- Foreign = 8,814 items in 207 orders
- Total CY2011 distributions = 32,512 items

Distributions



Domestic Distributions in CY2011



Total number of accessions by state



Distributions outside of 50 U.S. states in CY2011

Argentina	China	Italy	Poland	Ukraine
Australia	Czech Rep	Jamaica	Portugal	United Kingdom
Austria	Egypt	Japan	Puerto Rico	Uruguay
Barbados	Finland	Jorden	Singapore	Vietnam
Belarus	France	Kenya	South Africa	U.S. Virgin Islands
Bolivia	Germany	Mexico	South Korea	
Brazil	Hungary	Netherlands	Spain	
Bulgaria	India	New Zealand	Switzerland	
Canada	Ireland	Pakistan	Thailand	
Chile	Israel	Peru	Turkey	

Total PGRCU Funding

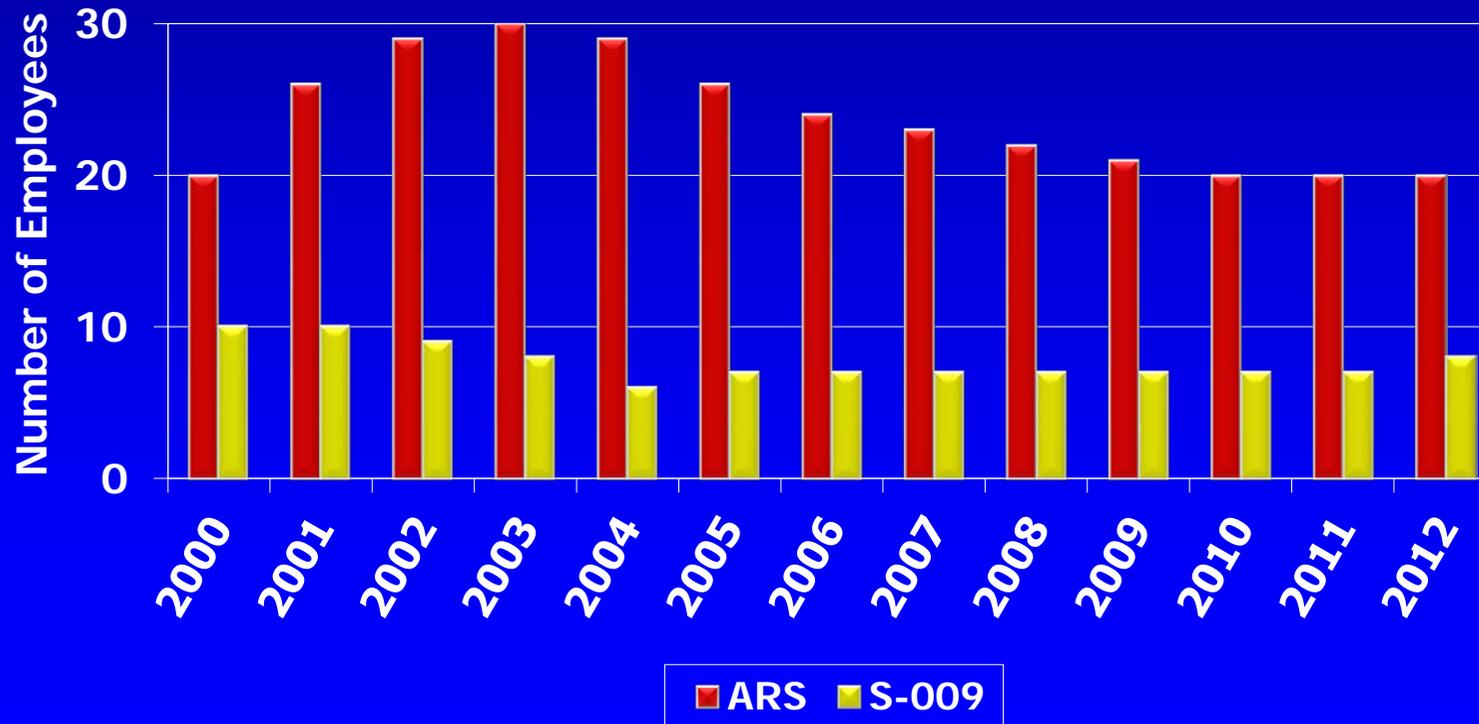
- ARS base funding
 - FY2012 = \$2,318,940
- S-009 base funding
 - FY2012 = \$417,723

PGRCU Funding

- ARS base funding
 - All salaries frozen in FY2011 and FY2012
 - Travel reduced 20% from FY2010 travel amounts
 - Travel reduced 30% in FY2013
- ARS temporary funding increases
 - FY2011
 - \$132,676 (4 C cold room)
 - \$ 15,294 (moveable shelves for 4 C cold room)
 - \$ 8,000 (-80 C freezer for molecular lab)

Staffing summary

- Current staff is 28 employees (20 ARS and 8 S-009)



FY 2012 ARS location closures

- Watkinsville, GA
 - J. Phil Campbell Sr. Natural Resource Conservation Center
- Clemson, SC
 - Cotton Quality Research Unit
- Brooksville, FL
 - Subtropical Agricultural Research Station



Items from ARS location closures

- Watkinsville, GA

- Hesston 180-90 tractor
- John Deere Z445 mower
- Side arm mower
- Boom sprayer and Nozzle sprayer
- Forklift
- Chisel plow
- Air compressor
- Honda EU 2000 generator
- Frigidaire freezer
- Roper refrigerator
- Gandy fertilizer spreader
- Laboratory glassware
- Filing cabinets, chairs, ladders, hand trucks, shop tools, chemicals



Items from ARS location closures

- Clemson, SC
 - Mettler balances (3)
 - InFocus projection system
 - Horizontal filing cabinets (4)
 - Metal work tables (5)
 - Fellowes paper shredder
 - Large wire carts (2) - seed storage
 - Maple work bench
 - Trash cart
 - Wrench set
 - Digital pipette
 - Laboratory glassware



Items from ARS location closures

- Brooksville, FL
 - John Deere 3055 tractor and loader
 - Vizio LCD TV
 - Hoshizaki ice machine
 - Fisher FS9H sonicator
 - MJ PTC-100 thermal controller
 - Metal carts
 - Office chairs (16)
 - Transilluminators
 - Mettler vibro-spatula
 - Bottle top dispensers
 - Power inverter



Vehicles from location closures

- Watkinsville, GA
 - 2009 Ford Escape Hybrid
 - 2006 4WD Chevy Avalanche
 - 2009 4WD Jeep Patriot



Building and Cold Room Construction

- ARS Seed Processing Building Addition
 - Contains new 4 C cold room (20 x 30')
 - Existing 4 C cold room in State Seed Storage building will be converted to -18 C
 - Current -18 C seed storage space of 1,061 sq ft will be increased to 1,897 sq ft to house bulk seed of entire Griffin collection in -18 C

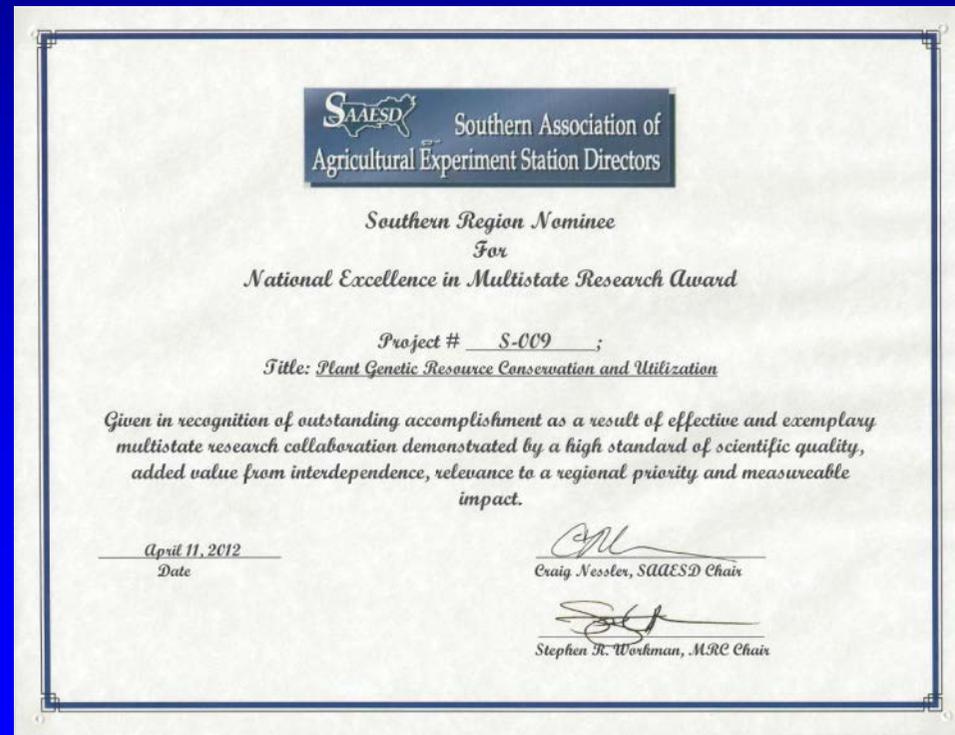


Facility Repair and Maintenance

- Connected electric power, installed tracks in concrete for new moveable shelves, and upgraded temperature alarm system for new 4C cold room.
- Installed energy efficient windows in Seed Processing Bldg.
- Replaced condensing unit for current -18 C freezer.
- Repaired corridor roof vents and replaced wind-speed monitoring weather station for greenhouse.
- Completed electrical upgrade in greenhouse and shop.
- Replaced chart recorder for small -18 C cold room.
- Replaced circulating pump for boiler in greenhouse.
- Conducted equipment repair on laminar flow hoods, Ford tractor, two fork lifts, and Hesston (Watkinsville) and John Deere (Brooksville) tractors.

S-009

Selected as the Southern Region Nominee for 2012
National Excellence in Multistate Research Award



2011 Seed & Plant Distributions

Plant Genetic Resources Conservation Unit, Griffin, GA

ADM-Edible Bean Specialites, Inc., Agradis, Agricom Seeds SRL, Agricultural Biotechnology Center, Agriculture & Agri-Food Canada, Agromen Sementes Agricolas Ltda, Akdeniz Univ., Alabama A&M Univ., Alcorn State Univ., Alpha Seed, American Takii, Inc., AQIS Nursery Stock, Arizona State Univ., Atlanta Public Schools, Baia Nicchia Farm & Nursery, Bati Akdeniz Agricultural Research Inst., Biopolis S.L., Blue Moon Farm, Botanisches Institut, Boyce Thompson Inst., Bozok Univ., Brandy Wine Seed Farms LLC, Brigham Young Univ., C & D Farms, Cache County Master Gardeners, Cairo Univ., California Polytechnic Univ., Campbell Soup Supply Co., Carthage College, Catholic Univ. of Cordoba, CEBAS-CSIC, Center for Disease Control & Prevention, Centro de Ciencias Ambientales, Centro Regional Universitario del Noroeste, Ceres, Inc., China Agricultural Univ., Chinese Academy of Sciences, Chromatin Inc., CIRAD, Clover Seed Co Ltd, Coffey Forage Seeds, Inc., Columbus Graminoid Collective, Comer Elementary School, Cornell Univ., Crop Research Inst., CSIC, Spanish Council for Scientific Research, CSIRO Plant Industry, CUGE Research, Cukurova Univ., Czech Univ. of Life Sciences, Delaware State Univ., Dept. of Agriculture, Food, & Fisheries (Ireland), Dept. of Employment, Economic Development & Innovation (Australia), Desert Sun Marketing Co., Dickinson State Univ., Dipasa USA, Inc., Donald Danforth Plant Science Center, Dongbu Hannong Co., Ltd., Duke Univ., Earth Note Co., Ltd., East-West Seeds, Educational Concerns For Hunger Organization, Elsoms Seeds Ltd, EMBRAPA-CENARGEN, Enza Zaden, Erciyes Univ., EuroAmerican Propagators LLC, Evers Park Elementary School, Florida International Univ., Florida Southern College, Fraunhofer-CMB, Fraunhofer USA - Center for Molecular Biotechnology, GNIS, Gold Seed Co., LLC, Grassland Oregon, Inc., GrassRoots Biotechnology, Inc., Guilford Elementary Middle School #214, H & W Genetex, Half Elven Research & Development, Haplotech Inc., Harbin Academy of Agricultural Science, Harvard Univ., Hazera Seeds, Inc., Heinrich-Heine Univ. Dusseldorf, High Mowing Organic Seeds, Hip-Gnosis Seed Development, Hishtil RM Ltd., HM Clause, Honda Research Inst. (Japan), Hongik Bio, Horticulture Research Inst. (Egypt), Hortigenetics Research (S.E. Asia) Limited, Hortus Botanicus Amsterdam, Huaihua Univ., Ibaraki Univ., Indiana Univ., Institut Waldenstein, Inst. of Agriculture of Steppe zone NAAS Ukraine, Inst. of Plant Breeding & Acclimatization (Poland), Inst. of Plant Genetics (Poland), Inst. of Sweetpotato Research, CAAS (China), Instituto de Investigaciones Agropecuarias (Chile), International Center of Insect Physiology & Ecology (Kenya), International Potato Center (CIP), Iowa State Univ., IPB Seeds, IRD (Institut de la Recherche pour le Developpement), Japan Grassland, Agriculture, & Forage Seed Association, Jardin Botanique Municipal, John Innes Centre, Johnston Seed Co., Jouffray-Drillaud SA, Kaneko Seeds Co., LTD, Kansas State Univ., Karadeniz Tarimsal Arastirma Enstitusu Mudurlugu, Kasetsart Univ., Known-You Seed Co. LTD, Lebensmittel Consulting, Leibiz Inst. of Plant Genetics & Crop Plant Research, Lincoln Park Zoo, Lincoln Univ., Long & Sweet LLC, Louisiana State Univ., Loyola Univ. Chicago, Lyndon State College, Machado Farms, Mano Farm, Maritsa Vegetable Crops Research Inst., Mars Chocolate North America, McIlhenny Co., Merritt College, Michigan State Univ., Michigan Technological Univ., Middle Tennessee State Univ., Mikado Kyowa Seed Co., LTD, Ministry of Agriculture (Egypt), Ministry of Agriculture (Barbados), Mississippi State Univ., Missouri Botanical Garden, MMR Genetics, Monsanto Vegetable Seeds, Municipal Botanical Garden, Mycelium.eu, Nagoya Univ., National Academy of Agricultural Science (South Korea), National Bureau of Plant Genetic Resources (India), National Inst. of Agrobiological Sciences (Japan), National Inst. of Crop Science (South Korea), New Avenue Productions, New Entry Sustainable Farming Project, New Jersey Inst. of Technology, New Mexico State Univ., NexGen Turf Research Inc., NexSteppe, Inc., National Inst. of Agricultural Botany (UK), North Carolina State Univ., North Dakota State Univ., North Star Farms, North-Central Florida Renewable RC&D Council, Nunhems Mexico S. A. de C. V, Oakland Univ., Ohio State Univ., Oklahoma State Univ., Ontario Ministry of Agriculture, Oregon State Univ., Pakistan Agricultural Research Council, Pan American Seed Co., Pannar Semillas SRL, Parshall Resource Center, Partner Seed, Patriot Seed Co., Peace Seeds/Seeds of Change, Pellissippi State Community College, Penn State Univ., Pioneer Hi-Bred International, Plant Introductions, Inc., Prairie Road Organic Farm, Purdue Univ., Radix Research, Inc., Rajamangala Univ. of Technology, Rare Vegetable Seeds Consortium, Rijk Zwaan Seeds, RIKEN Plant Science Center, Royal Botanic Gardens, Kew, Rutgers Univ., Sainsbury Laboratory, Saint Joseph's Univ., Sakata Seed America Inc., Salk Inst., Sambit Vietnam, Scuola Superiore Sant' Anna di Pisa, Seed Savers Exchange, Sichuan Agricultural Univ., Siechtitelska Stanice Hladke Zivotice Ltd., Simon Fraser Univ., Smith College, Smithsonian Institution, Snow Brand Seed Co., Ltd., South China Botanical Garden, Southeastern Louisiana Univ., Southern Univ., Spa Agriculture, Spanish National Research Council, Stanford Univ., Starke Ayres Seed Co., Sustain Commodities LLC, Svalbard Global Seed Vault, Syngenta Seeds, Inc., Synthetic Genomics, Inc., Takii Plant Breeding & Experimental Station, Tampa Bay Rare Fruit Council RFCI, Taos Univ., TasGlobal Seeds, Technisem, Tennessee State Univ., Texas A&M Univ., The College at Brockport, The Jamaica Focus MediaStream Corp., The Land Inst., The National Univ. of Singapore, The Seed Kingdom, The Wellness Farm, Inc., Tierra del Sol Organics, Triumph Seed, Tu Wien, Tuskegee Univ., United Genetics, Universidad Nacional de Rio Cuarto, Univ. of Arizona, Univ. of Arkansas at Pine Bluff, Univ. of California, Univ. of Cincinnati, Univ. of Connecticut, Univ. of Florida, Univ. of Georgia, Univ. of Illinois, Univ. of Jordan, Univ. of Kentucky, Univ. of Louisiana, Univ. of Maryland, Univ. of Massachusetts, Univ. of Minnesota, Univ. of Missouri, Univ. of Nebraska, Univ. of New Hampshire, Univ. of North Florida, Univ. of Ondokuz Mayıs, Univ. of Plymouth, Univ. of Puerto Rico, Univ. of Regensburg, Univ. of Sheffield, Univ. of Silesia, Univ. of South Carolina, Univ. of Southern Mississippi, Univ. of Tennessee, Univ. of Texas at Austin, Univ. of the Virgin Islands, Univ. of Toronto, Univ. of Vermont, Univ. of Wisconsin, Univ. of Wyoming, US Geological Survey, USDA, ARS, Valley Seeds, Vilmorin Inc., Vineland Research & Innovation Centre, Virginia State Univ., Virginia Tech, Warren Wilson College, Washington State Univ., Webutuk High School, Werner Farms, West Virginia State Univ., West Virginia Univ., Western Pacific Seeds, Western Seed Multiplication, Wheaton College, White Eagle Truck Farm, William & Mary Alumni Association, Word of Life Inst., Wuhan Botanical Garden, Xishuangbanna Tropical Botanical Garden, Yale Univ., Yokohama City Univ., York College, City Univ. of New York

Appendix 2

MR. DAVID PINNOW

PLANT PATHOLOGY AND GERMINATION LAB
DEVELOPMENT AND PROGRESS

Plant Pathology at PGRCU 1985 to Present

**David Pinnow, Support Scientist, Category 3
S-9 Annual Meeting July 31 - August 1, 2012**

A Brief History

- ▶ Early 1985– Gil Lovell is the Chief and only Curator—one technician for field notes on all crops, small field crew and two helpers in the Seed Room. A previous Ph.D. pathologist, Grover Sowell, had retired the year before; Merrelyn Spinks had been doing GRIN for two years
- ▶ Later in 1985—Dr. Jarret was hired as a Category 1 Scientist–Geneticist & hired a technician; Dr. Gillaspie was hired as the Research Leader and Category 1 Scientist in Plant Pathology—he hired two biological research technicians
- ▶ 1987---Dr. Pittman was hired as the Peanut Curator and hired a technician; Lee Ann Chalkley was hired as Seed Room Manager
- ▶ 1989---I was hired as a research support scientist to handle applied plant pathology such as screening collections, diagnosis and control recommendations and some additional help with pathology research

My original main job responsibilities were:

- a) Peanut Collection Seed Testing for Peanut Stripe Virus / Screening Quarantine Peanuts for virus
- b) Vigna Regeneration Screening for Viruses
- c) Sweet Potato Collection Screening for SPVD of clones not coming through the Beltsville quarantine program
- d) New Greenhouse Caretaker---organize watering, spraying, work orders for repairs, etc.
- e) Additional pathology research technical support / diagnosis and control recommendations as needed for curators

So how did that work out????

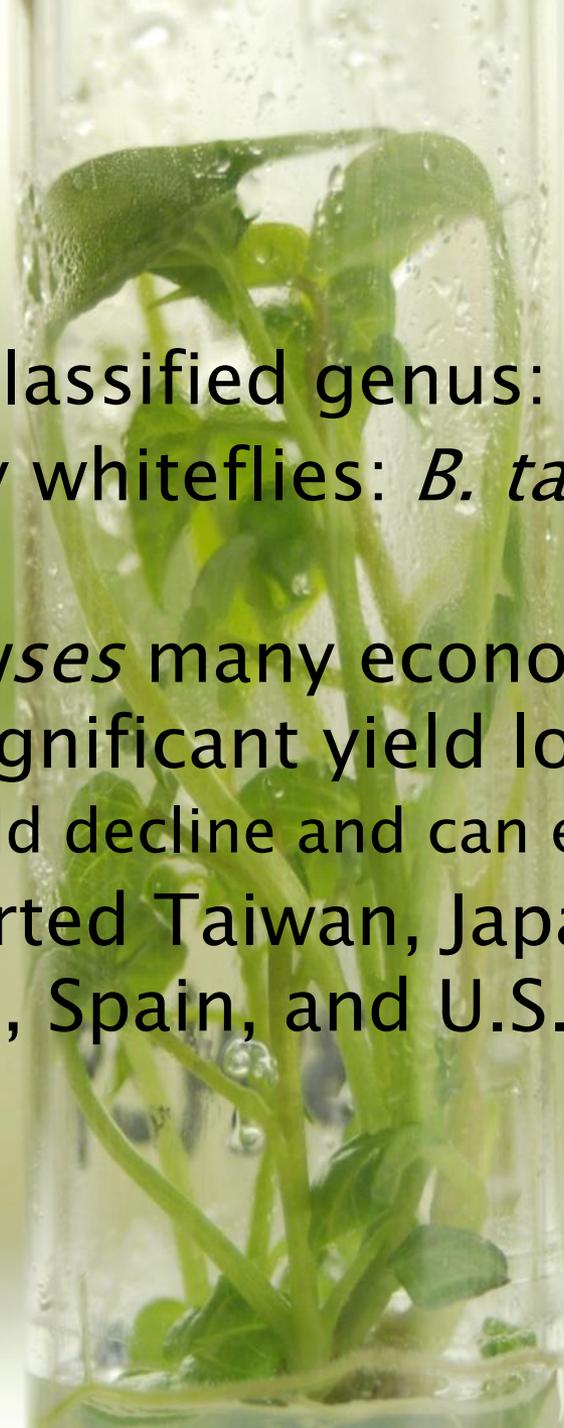
- ▶ a) PStV peanut accession seed testing went on till 1996, then on shipped seed only/quarantine peanut screening continues
- ▶ b) Vigna regeneration screening in field and greenhouse went on till 2007
- ▶ c) sweet potato collection screening for SPVD– mostly accomplished by 2009; added SPFMV testing in 1998 & SPVG testing in 2002
- ▶ d) greenhouse control decentralized to curators' individual care in 1993.
- ▶ e) some help with pathology research continued under the research pathologist until his retirement in 2007; diagnosis and control recommendations continue to this day

What are Present Responsibilities ?

- 1) Occasional screening of germplasm for diseases as requested and needed
- 2) Field and Greenhouse Diagnosis and Control recommendations; Information on diseases or insect problems for import permit distribution issues
- 3) Virus testing of peanut quarantine lines—normally annual
- 4) Inspection and seed treatment of distribution materials for diseases or insects for import requirements
- 5) Occasional Pathology Research or Applied Problem –Solving screening projects
- 6) Molecular Lab research support on several crops, e.g.-- castor bean, sesame, peanut, sorghum, watermelon
- 7) Appointed unit CDSO in 1993 and Germination Lab Supervisor in 2001—continuing through present

SPLCV

- ▶ DNA virus classified genus: *Begomovirus*
- ▶ Vectored by whiteflies: *B. tabaci* and *B. argentifolii*
- ▶ *Begomoviruses* many economically important diseases, significant yield loss around the world
 - SPLCV – yield decline and can effect quality traits
- ▶ SPLCV reported Taiwan, Japan, China, Italy, Kenya, Peru, Spain, and U.S.

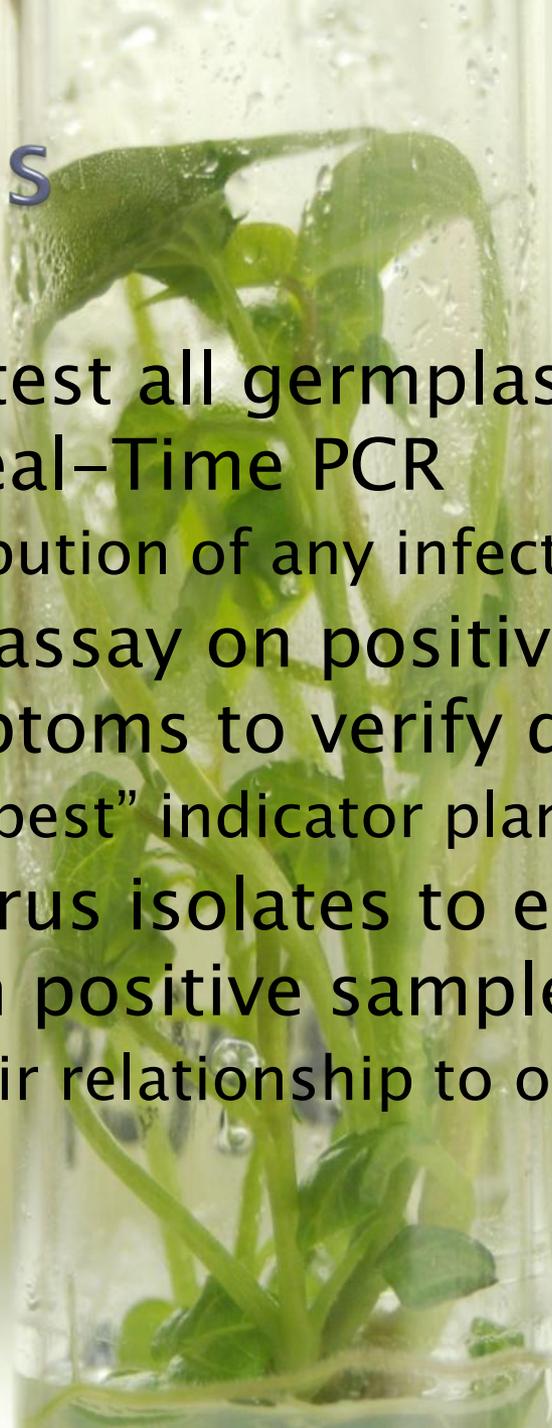


SPLCV



Objectives

- ▶ Empirically test all germplasm accessions for SPLCV by Real-Time PCR
 - Avoid distribution of any infected material found
- ▶ Perform bioassay on positive samples and record symptoms to verify qPCR
 - Determine “best” indicator plant
- ▶ Sequence virus isolates to examine the variability in positive samples
 - Evaluate their relationship to other similar viruses

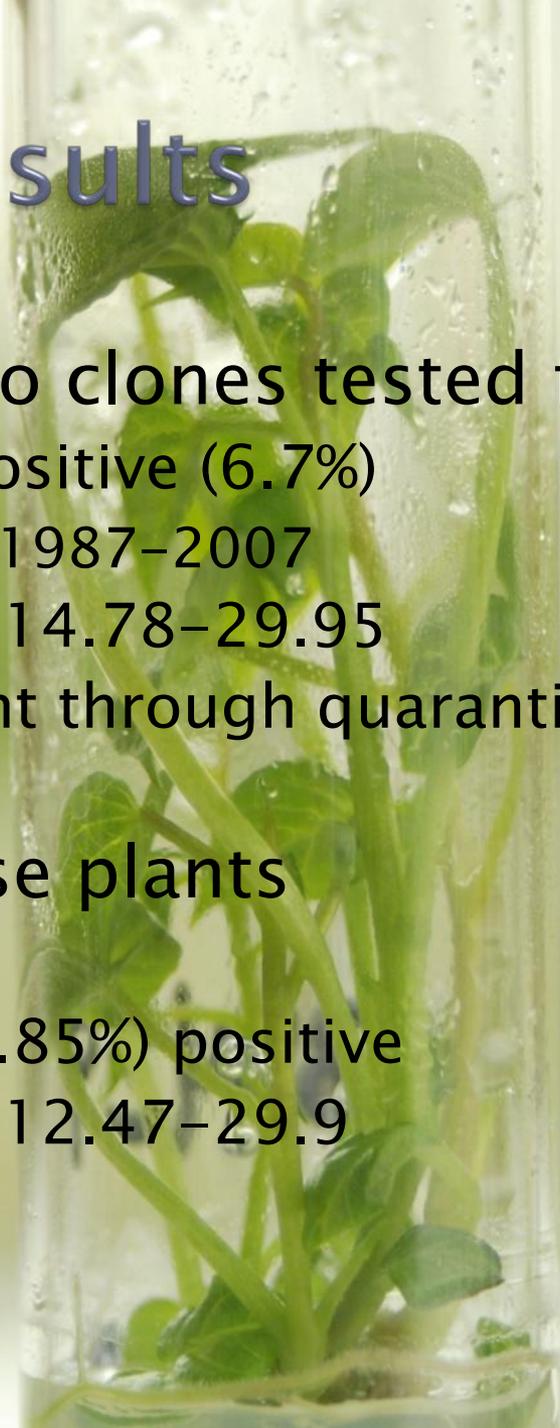


Real-Time PCR

- ▶ 2 primers and 1 dual end labeled probe
 - 6-Fam
- ▶ Target coat protein – conserved
 - Product size 67 bp
- ▶ Pooled Samples 4 fold
 - Spiked each pool with positive control

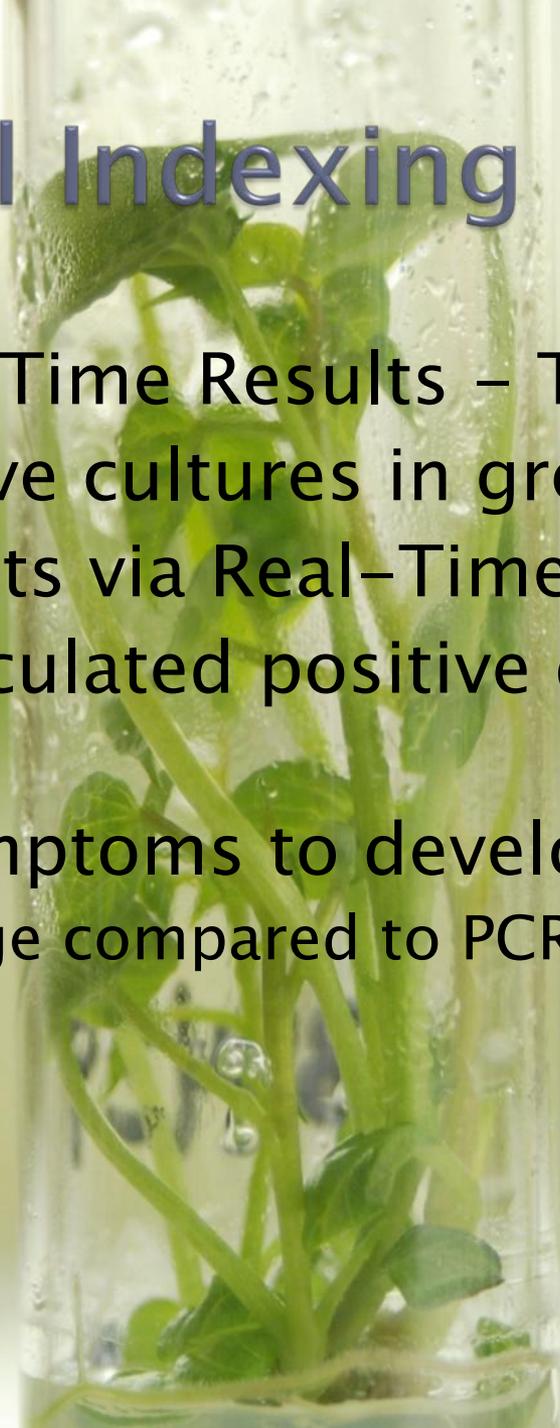


SPLCV Results



- ▶ 701 in vitro clones tested for SPLCV
 - 47 were positive (6.7%)
 - Received 1987–2007
 - Ct ranged 14.78–29.95
 - 15/47 went through quarantine – tested?
 - 1998
- ▶ Greenhouse plants
 - 85 tested
 - 26/85 (30.85%) positive
 - Ct ranged 12.47–29.9

Biological Indexing

A clear glass vial is shown, partially filled with water. Inside the vial, a green plant specimen is submerged. The plant has several stems and small, rounded leaves. The water is clear, and there are some bubbles visible on the glass surface. The background is a soft, out-of-focus green, suggesting a greenhouse or laboratory setting.

- ▶ Verify Real-Time Results – Traditional Method
- ▶ Grew positive cultures in greenhouse after testing plants via Real-Time PCR for SPLCV
- ▶ Grafted inoculated positive onto *I. nil* and *I. turbinata*
- ▶ Wait for symptoms to develop
 - Disadvantage compared to PCR assay

Biological Index

I. nil - over 10 -12 weeks to develop symptoms

PI 16175 Ct =15.58



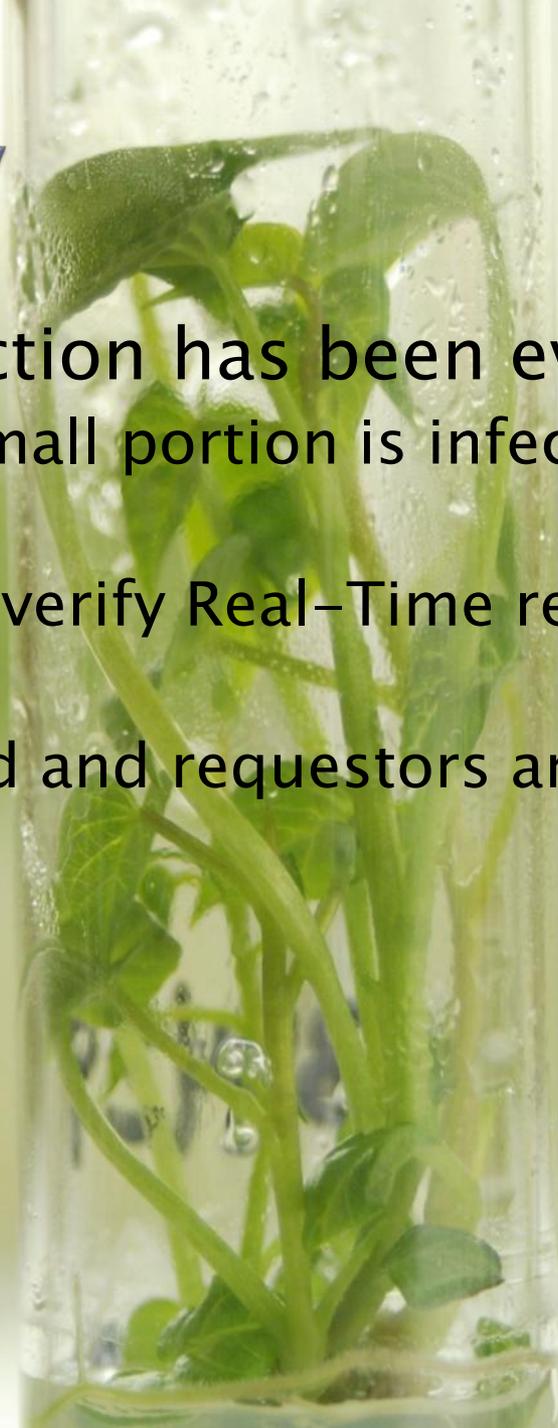
I. turbinata - 3 weeks to develop symptoms

PI 16175 Ct =15.58



Summary

- ▶ Entire collection has been evaluated for SPLCV
 - Relatively small portion is infected
 - Indexing to verify Real-Time results
 - Documented and requestors are informed on status



Future Project Ideas

- ▶ Development of a Molecular test for detection of Potato Spindle Tuber Viroid in our outgoing distributions of some vegetables

**Germination Lab
Development and
Progress at the PGRCU
2001-2012**



The First Year 2001

Dr. Pederson saw the need to establish a germination lab

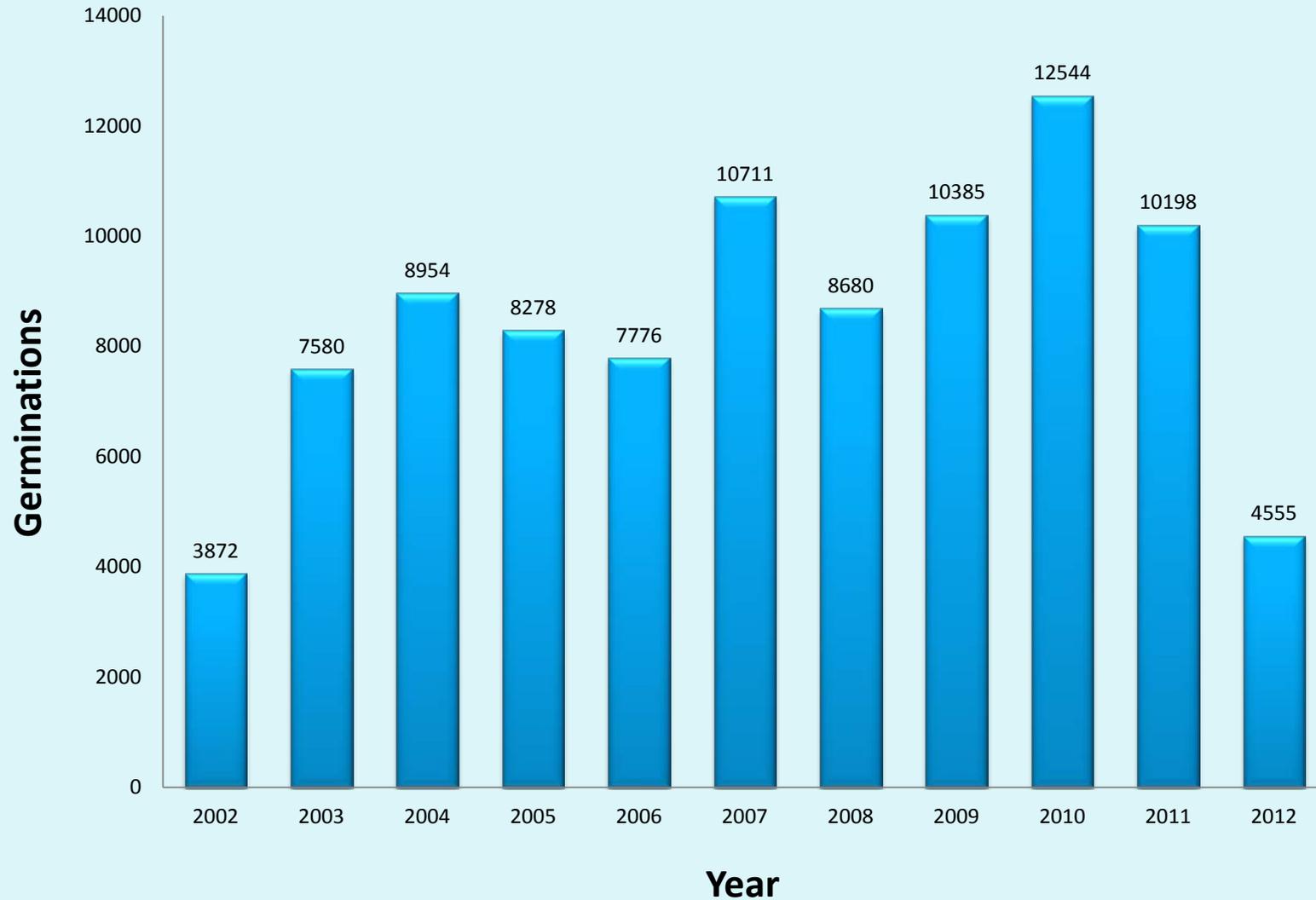
He asked me to use my background to begin planning for a germination lab

Storage room up at the old S-9 greenhouse was cleaned out, painted, and equipped as a germination lab and office; old work room down the hall was converted to an incubator room; equipment and supplies were ordered; protocols for the main crops established and work began on a small scale—mostly on sorghum

2002—the Real Take-Off

- Phiffie Vankus was hired on June 16, 2002, and the numbers really took off !!!!!!!

2002—the Real Take-Off



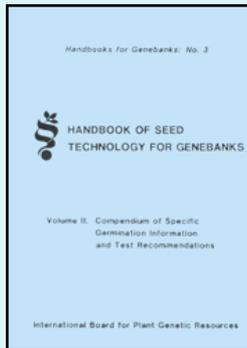
Current Germination Protocols



Association of Official Seed Analysts
(AOSA)



International Seed Testing Association
(ISTA)

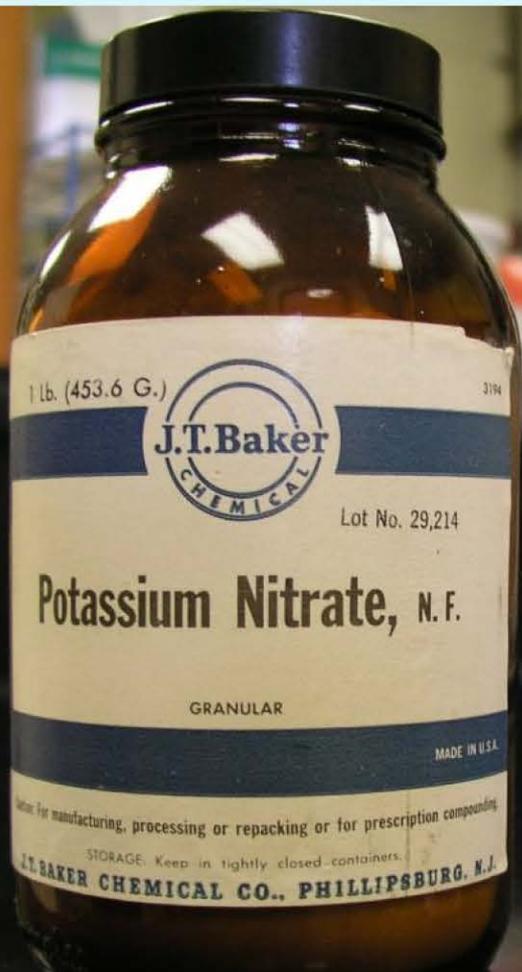


Handbook of Seed Technology for
Genebanks
http://www2.bioversityinternational.org/publications/Web_version/52/

Germination Obstacles

- Rare, minor species
- Major species but not a cultivated variety
- Germination influenced by long term storage





Grass
Requested by Melanie
Panicum amarum Var.
Amarulum
P.I. 476815 02



Melanie - Grass
P.I. 390723

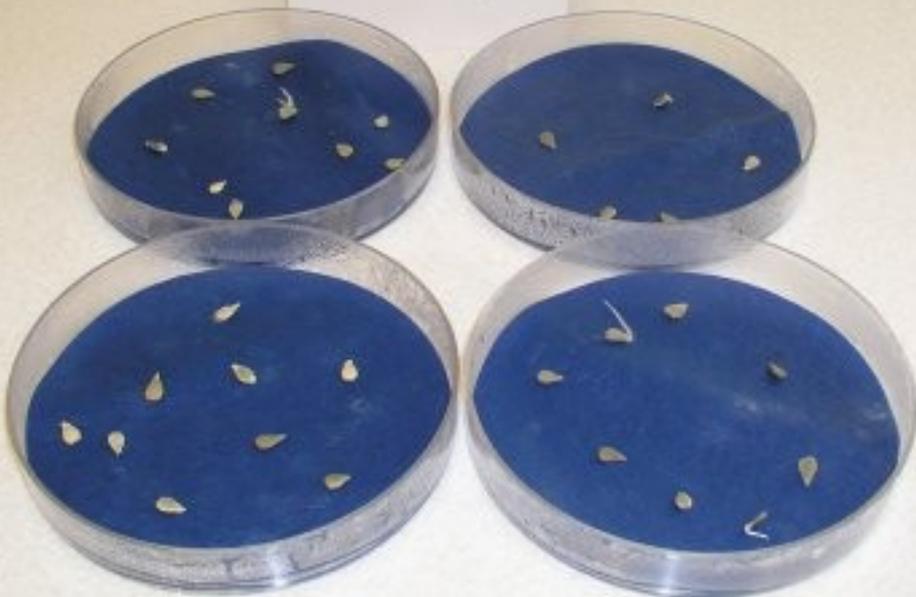


Panicum Virgatum
Switchgrass
P.I. 636468 01



grasses

2004 Miscellaneous Cucurbits
Regeneration on Trellis
At Experiment Station
P.I. 512105 02



Experiment 107
Cucurbitaceae



cucurbits

Germination Card

30

P. I. SPURAH 01Common Name: Sorghum
Genus: Sorghum
Species: bicolor
Subspecies:
Date received: 03-12-03
Start Date: 3-2-05
Completed date: 3-10-05Temp: 20/30
Light: 8 hours
Medium: paper towels
Seed order# 155005
Total Seed Planted: 100

Num. Seeds	R-1	R-2	R-3	R-4	Date	R-1	R-2	R-3	R-4
Date:									
Normal	<u>44</u>	<u>46</u>							
Abnormal	<u>2</u>								
Diseased/Dead	<u>4</u>	<u>4</u>							
Dormant									
Hard									
Total									

Normal Total/% Normal

Comments: _____

1

Comments: _____

90.90%P. I. SPURAH 01Common Name: Sorghum
Genus: Sorghum
Species: bicolor
Subspecies:
Date received: 03-12-03
Start Date: 3-2-05
Completed date: 3-10-05Temp: 20/30
Light: 8 hours
Medium: paper towels
Seed order# 155005
Total Seed Planted: 100

Num. Seeds	R-1	R-2	R-3	R-4	Date	R-1	R-2	R-3	R-4
Date:									
Normal	<u>44</u>	<u>46</u>							
Abnormal	<u>2</u>								
Diseased/Dead	<u>3</u>	<u>3</u>							
Dormant	<u>3</u>	<u>1</u>							
Hard									
Total									

Normal Total / % Normal

Comments: _____

1

Comments: _____

90.90%

Collection Germination Results

	2002-2009	2010-2012
Clover	85.8%	86.6%
Sorghum	74.0%	82.9%*
Pearl millet	81.0%	98.3%*
Warm Season grasses	21.8%	53.5%*
Castor bean	94.3%	94.3%
Guar	98.7%	98.7%
Hibiscus	90.2%	90.2%
Warm season legumes	72.4%	77.1%
Sesame	99.5%	99.5%

Collection Germination Results

	2002-2009	2010-2012
Cultivated Peanuts	35.5%	89.6%*
Wild Peanuts	49.9%	57.9%
Cucurbits	46.8%	48.3%
Eggplant	92.0%	92.0%
Gourds	53.3%	53.7%
Luffa	80.5%	82.3%
Okra	59.1%	59.1%
Pepper	98.7%	99.2%
Cowpeas	27.7%	85.3%*

Collection Germination Results

	2002-2009	2010-2012
Mung bean	92.8%	92.8%
Other Vigna	48.5%	60.5%*
Watermelon	91.8%	91.9%
Miscellaneous legumes	76.2%	72.3%
Winged Bean	--	25.6%
Seeded Ipomoeas	--	44.7%
Bambara Groundnut	--	62.5%

In addition we do a number of special order germinations each year for our curators or scientists who are doing research projects (e.g., peanut seed dormancy, watermelon mutation studies, pre-regeneration germinations, etc.) These figures are not included in the totals above. They are in addition to the regular collection germination figures.

OverAll Progress

- 12.4% of collections are unavailable
- 1.4% are clonal only—most Ipomoea, many grasses, etc.
- Guidelines: no germination sample if under 210 seed in storage or original seed inventory
- **We have done 81.6% of all collections and 91.4% of those actually available**
- **We will be starting over re-testing in 2013 (first year of next 5 year Project Plan) in addition to keeping current with new regenerations**

Bottom Line

- In a little over 10 years, virtually all available collections have been germinated !!
- Special Thanks to Phiffie Vankus who did 98+% of these germinations by herself and the Seed Room Staff who prepared and prioritized the samples and loaded germination data to GRIN—Lee Ann Chalkley, Sylvia Jones, Sharon Dixon, and Tiffany Fields



Appendix 3

DR. MING LI WANG

EVALUATION OF PLANT GERMPLASM COLLECTIONS
VIA BIOCHEMICAL ANALYSIS

Evaluation of Plant Germplasm Collections via Biochemical Analysis

Ming Li Wang
Molecular and Biochemical Genetics Laboratory
PGRCU

S9 Meeting, July 31, 2012

Chemical Compounds of Interest

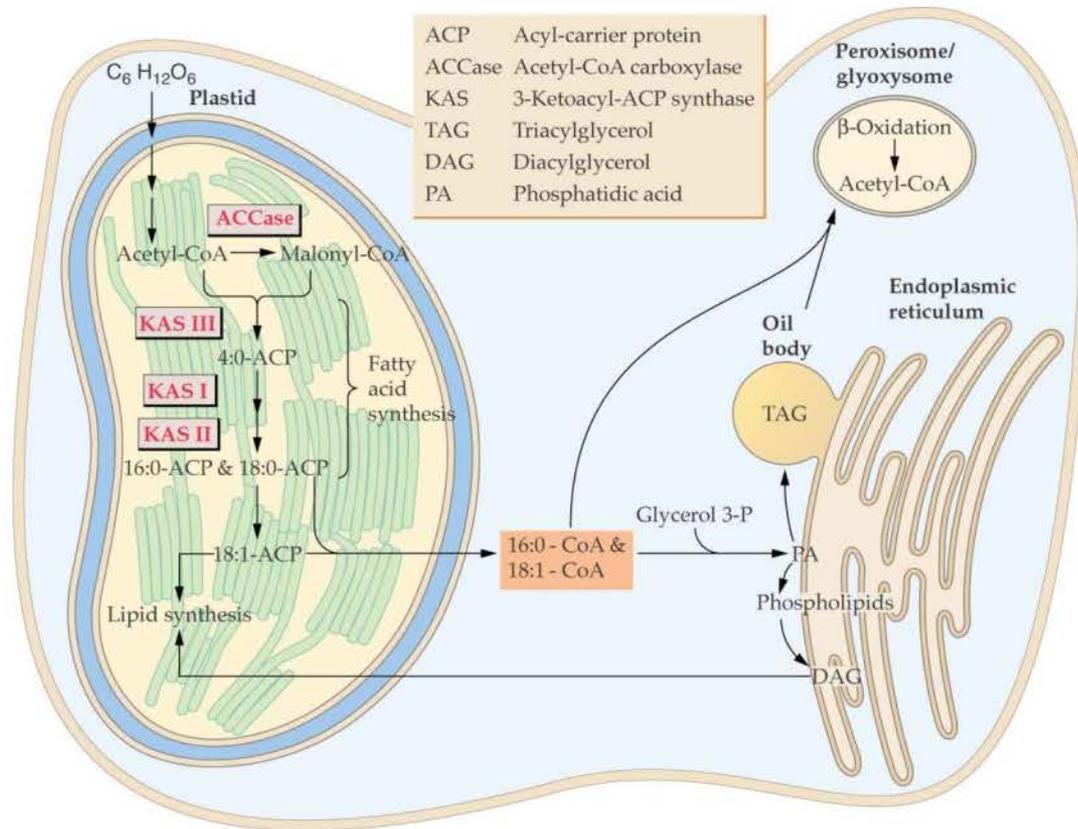
Major Compounds (Nutrients or industrial utilization)

- Protein: total crude protein content and amino acids
- Carbohydrates: sugars, cellulose, and hemi-cellulose
- Lipids: oil content and fatty acid composition

Minor Phytochemicals (Nutraceuticals or pharmaceuticals)

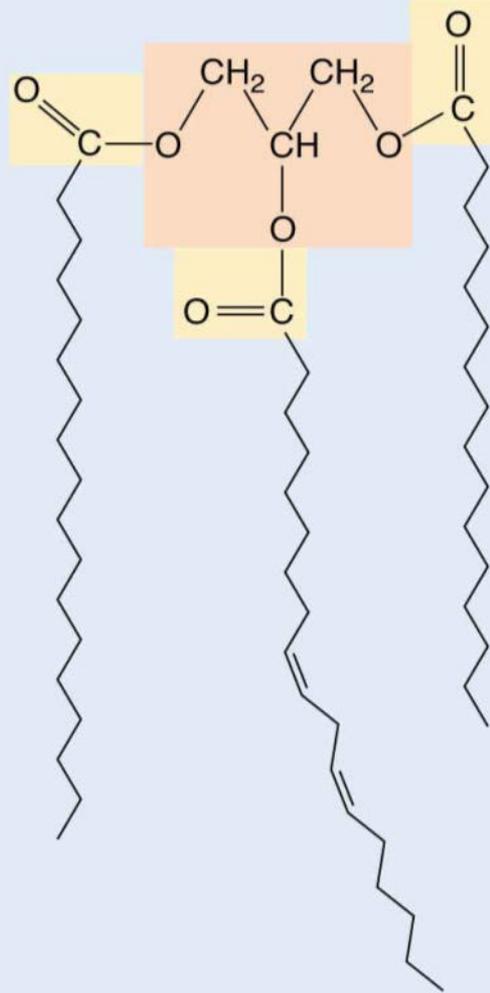
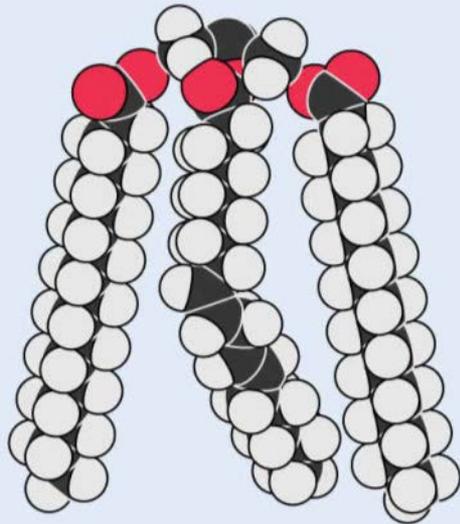
- Resveratrol
- Anthocyanins
- Flavonoids: kaempferol, myricetin, and quercetin
- Isoflavonoids: daidzein and genistein

Oil Biosynthesis at the Cell Level



Triacylglycerols and Fatty Acid Classification

Triacylglycerol
(TAG)



Classification:

Saturated fatty acids

Unsaturated fatty acids

Unusual fatty acids

Saturated Fatty Acids

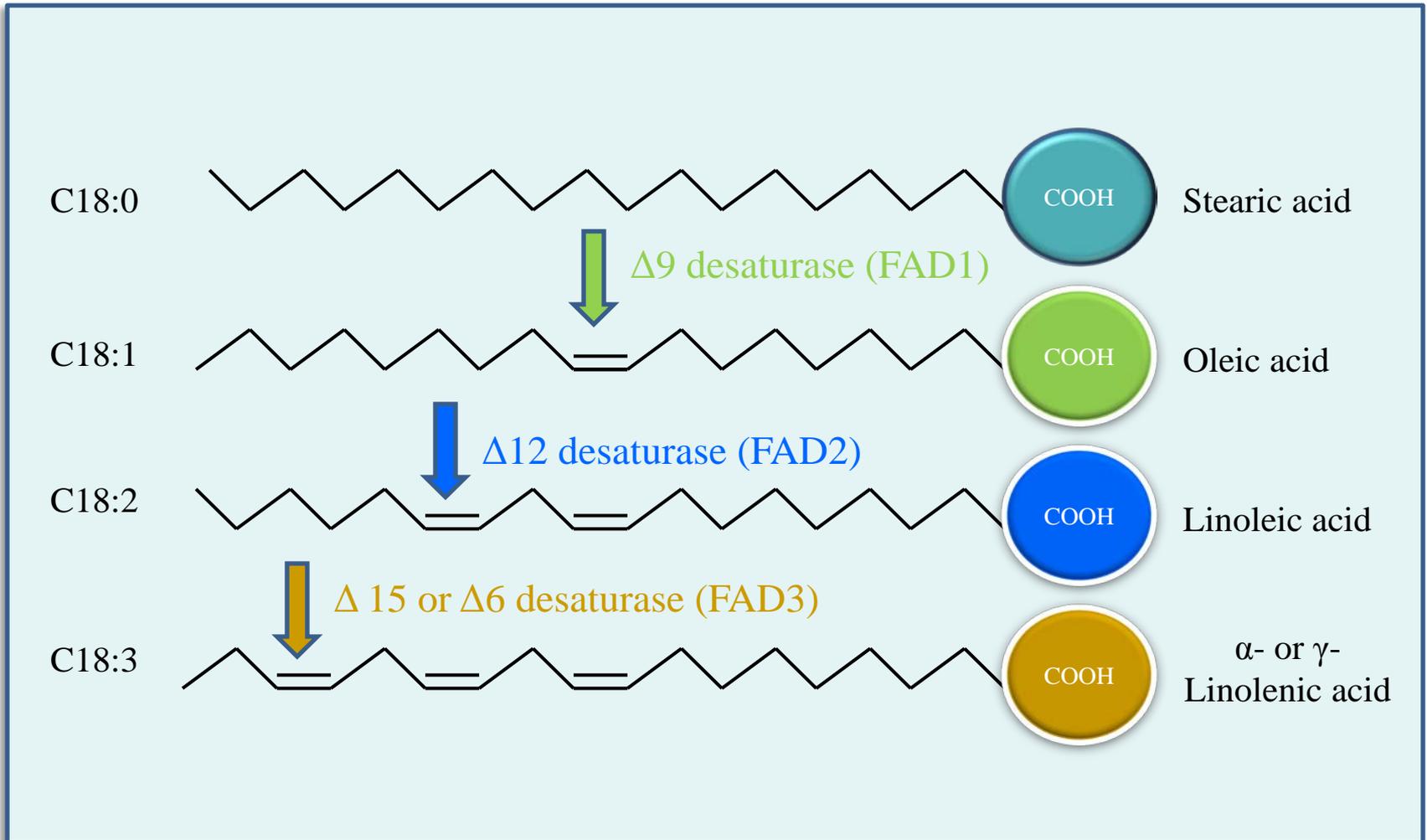
Common name	Systematic name	Structure	Abbreviation ^a
<i>Saturated fatty acids</i>			
Lauric acid	<i>n</i> -Tetradecanoic acid	$\text{CH}_3(\text{CH}_2)_{10}\text{COOH}$	12 : 0
Palmitic acid ^b	<i>n</i> -Hexadecanoic acid	$\text{CH}_3(\text{CH}_2)_{12}\text{CH}_2\text{CH}_2\text{COOH}$	16 : 0
Stearic acid ^b	<i>n</i> -Octadecanoic acid	$\text{CH}_3(\text{CH}_2)_{12}\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{COOH}$	18 : 0
Arachidic acid	<i>n</i> -Eicosanoic acid	$\text{CH}_3(\text{CH}_2)_{12}\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{COOH}$	20 : 0
Behenic acid	<i>n</i> -Docosanoic acid	$\text{CH}_3(\text{CH}_2)_{12}\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{COOH}$	22 : 0
Lignoceric acid	<i>n</i> -Tetracosanoic acid	$\text{CH}_3(\text{CH}_2)_{12}\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{COOH}$	24 : 0

Unsaturated Fatty Acids

Unsaturated fatty acids

Oleic acid ^b	<i>cis</i> -9-Octadecenoic acid	$\text{CH}_3(\text{CH}_2)_7\overset{\text{H}}{\underset{ }{\text{C}}}=\overset{\text{H}}{\underset{ }{\text{C}}}(\text{CH}_2)_7\text{COOH}$	18 : 1 ^{Δ9}
Petroselinic acid	<i>cis</i> -6-Octadecenoic acid	$\text{CH}_3(\text{CH}_2)_{10}\overset{\text{H}}{\underset{ }{\text{C}}}=\overset{\text{H}}{\underset{ }{\text{C}}}(\text{CH}_2)_4\text{COOH}$	18 : 1 ^{Δ6}
Linolenic acid ^b	<i>cis,cis</i> -9,12-Octadecatrienoic acid	$\text{CH}_3(\text{CH}_2)_4\overset{\text{H}}{\underset{ }{\text{C}}}=\overset{\text{H}}{\underset{ }{\text{C}}}-\text{CH}_2-\overset{\text{H}}{\underset{ }{\text{C}}}=\overset{\text{H}}{\underset{ }{\text{C}}}(\text{CH}_2)_7\text{COOH}$	18 : 2 ^{Δ9,12}
α-Linoleic acid ^b	<i>all-cis</i> -9,12,15-Octadecatrienoic acid	$\text{CH}_3\text{CH}_2\overset{\text{H}}{\underset{ }{\text{C}}}=\overset{\text{H}}{\underset{ }{\text{C}}}-\text{CH}_2-\overset{\text{H}}{\underset{ }{\text{C}}}=\overset{\text{H}}{\underset{ }{\text{C}}}-\text{CH}_2-\overset{\text{H}}{\underset{ }{\text{C}}}=\overset{\text{H}}{\underset{ }{\text{C}}}(\text{CH}_2)_7\text{COOH}$	18 : 3 ^{Δ9,12,15}
γ-Linoleic acid	<i>all-cis</i> -6,9,12-Octadecatrienoic acid	$\text{CH}_3(\text{CH}_2)_4\overset{\text{H}}{\underset{ }{\text{C}}}=\overset{\text{H}}{\underset{ }{\text{C}}}-\text{CH}_2-\overset{\text{H}}{\underset{ }{\text{C}}}=\overset{\text{H}}{\underset{ }{\text{C}}}-\text{CH}_2-\overset{\text{H}}{\underset{ }{\text{C}}}=\overset{\text{H}}{\underset{ }{\text{C}}}(\text{CH}_2)_4\text{COOH}$	18 : 3 ^{Δ6,9,12}
Roughanic acid	<i>all-cis</i> -7,10,13-Hexadecatrienoic acid	$\text{CH}_3\text{CH}_2\overset{\text{H}}{\underset{ }{\text{C}}}=\overset{\text{H}}{\underset{ }{\text{C}}}-\text{CH}_2-\overset{\text{H}}{\underset{ }{\text{C}}}=\overset{\text{H}}{\underset{ }{\text{C}}}-\text{CH}_2-\overset{\text{H}}{\underset{ }{\text{C}}}=\overset{\text{H}}{\underset{ }{\text{C}}}(\text{CH}_2)_5\text{COOH}$	16 : 3 ^{Δ7,10,13}
Erucic acid	<i>cis</i> -13-Eicosenoic acid	$\text{CH}_3(\text{CH}_2)_7\overset{\text{H}}{\underset{ }{\text{C}}}=\overset{\text{H}}{\underset{ }{\text{C}}}(\text{CH}_2)_{11}\text{COOH}$	22 : 1 ^{Δ13}

Desaturation of C18 Fatty Acids

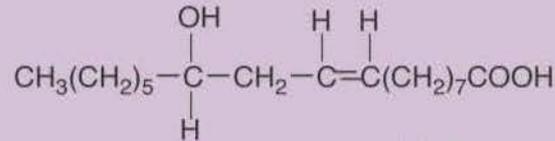


Unusual Fatty Acids and Conversion

Some unusual fatty acids

Ricinoleic acid

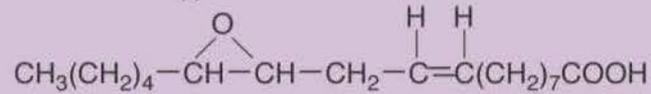
12-Hydroxyoctadeca-9-enoic acid



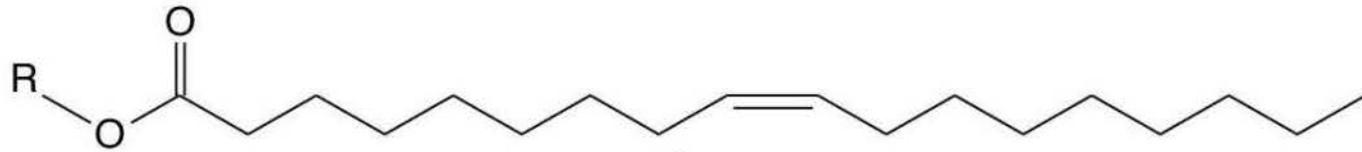
12-OH-18:1^{Δ9}

Vernolic acid

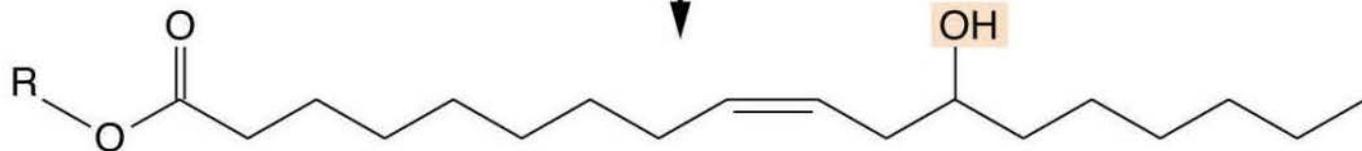
12,13-Epoxyoctadeca-9-enoic acid



Oleic acid ester



Ricinoleic acid ester



Cyt $b_{5\text{red}}$

O_2

Oleate hydroxylase

Cyt $b_{5\text{ox}}$

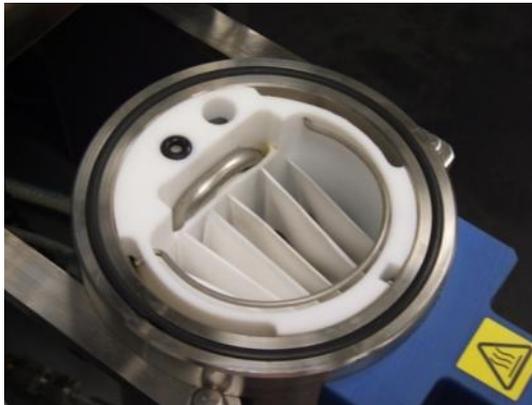
H_2O

Hydraulic Press for Plant Oil Extraction

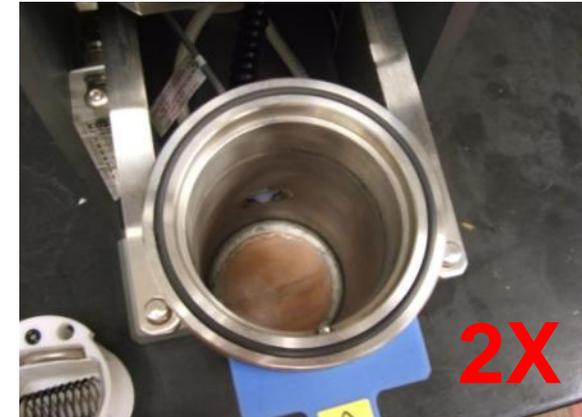


First generation equipment: 50 samples (4 people for 2 weeks)

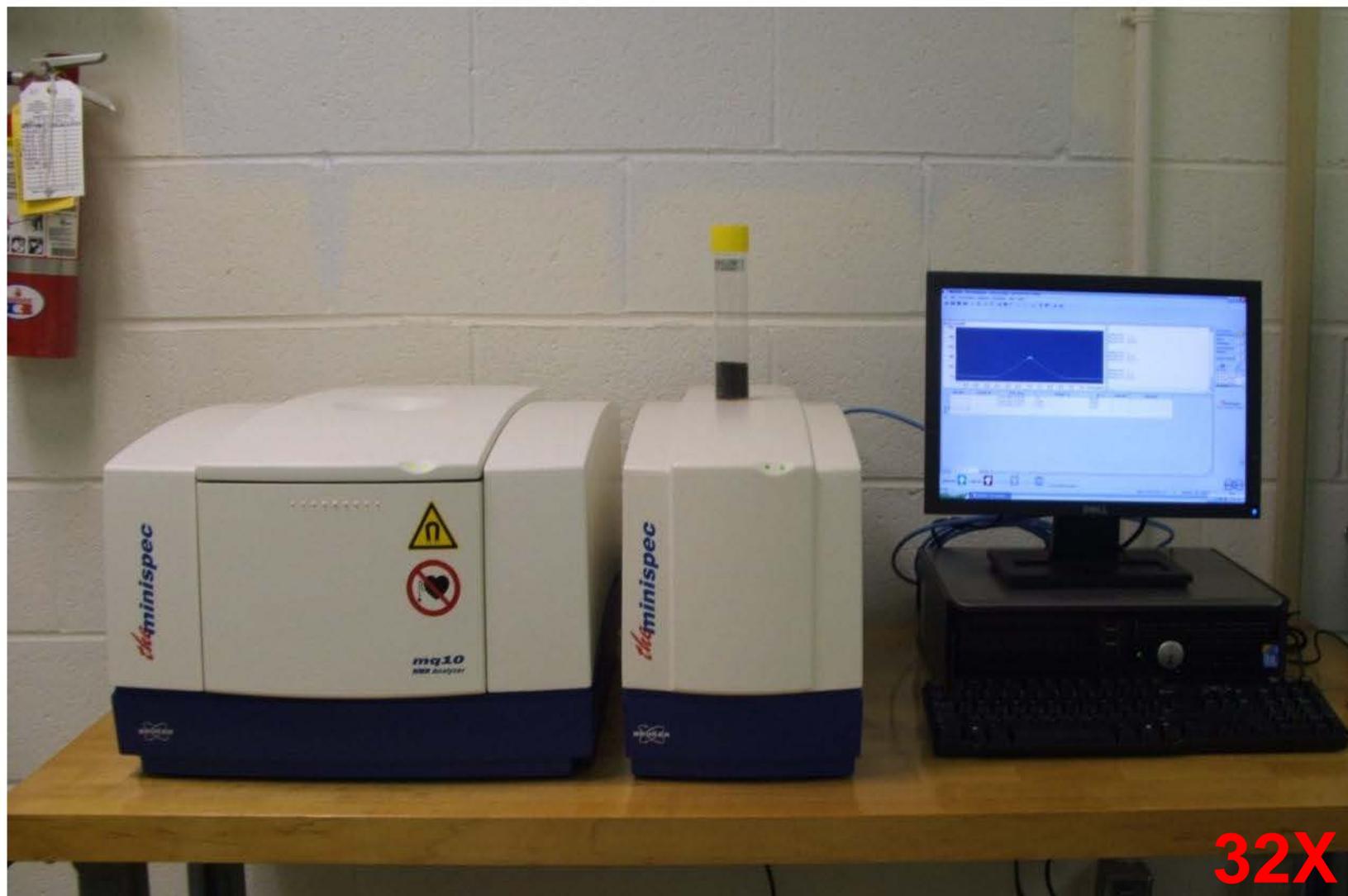
Ankom XT15 Oil Extractor



Second generation equipment:
50 samples (2 people for 2 weeks)
Bags cost: \$1.00/per bag



Nuclear Magnetic Resonance (NMR)



32X

Third generation equipment: 200 samples (1 person for 1 week)

Oilseed Crops and Plant Species Interested

Major Oilseed Crops

- Peanut (8,100 cultivated + 100 wild species accessions): High oil, high oleic acid, and high yield (3H)
- Castor (1,033 accessions): Lubricant for high-speed engines (racing car and airplanes) and biodiesels, *J. Agric. Food Chem.* 59:9250-9256, 2011.
- Sesame (1,232 accessions): High quality oil

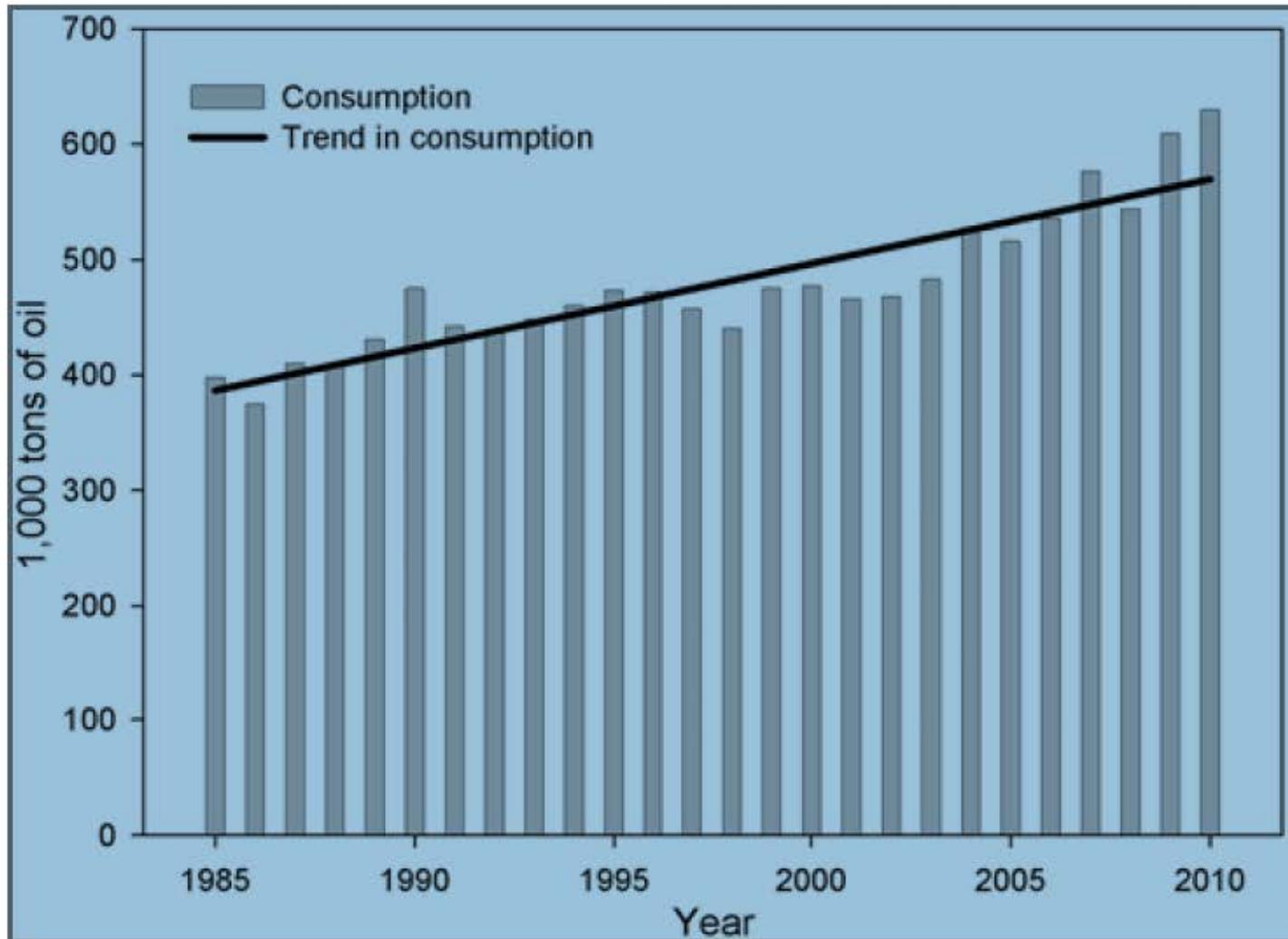
Minor Oilseed Plant Species

- Hibiscus (329 = 222 *H. cannabinus* + 107 *H. sabdarifa* accessions): Two unusual fatty acids, *J. Agric. Food Chem.* 60:6620-6626, 2012.
- Okra, *J. Agric. Food Chem.* 59:4019-4024, 2010.
- Watermelon, *J. Agric. Food Chem.* 60:5199-5204, 2012.
- Pepper/squash/pumpkin

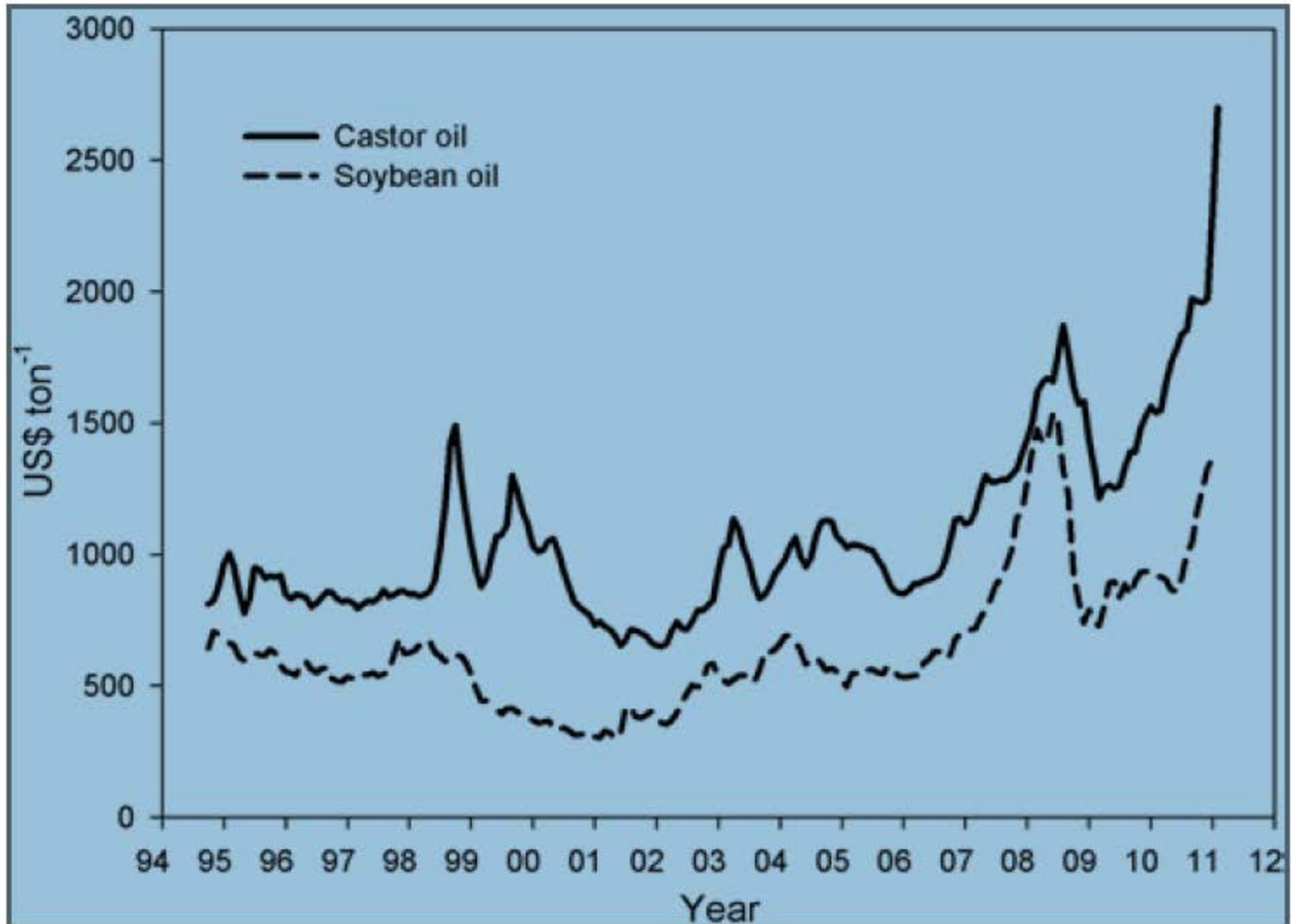
Castor Flowers and Bagging



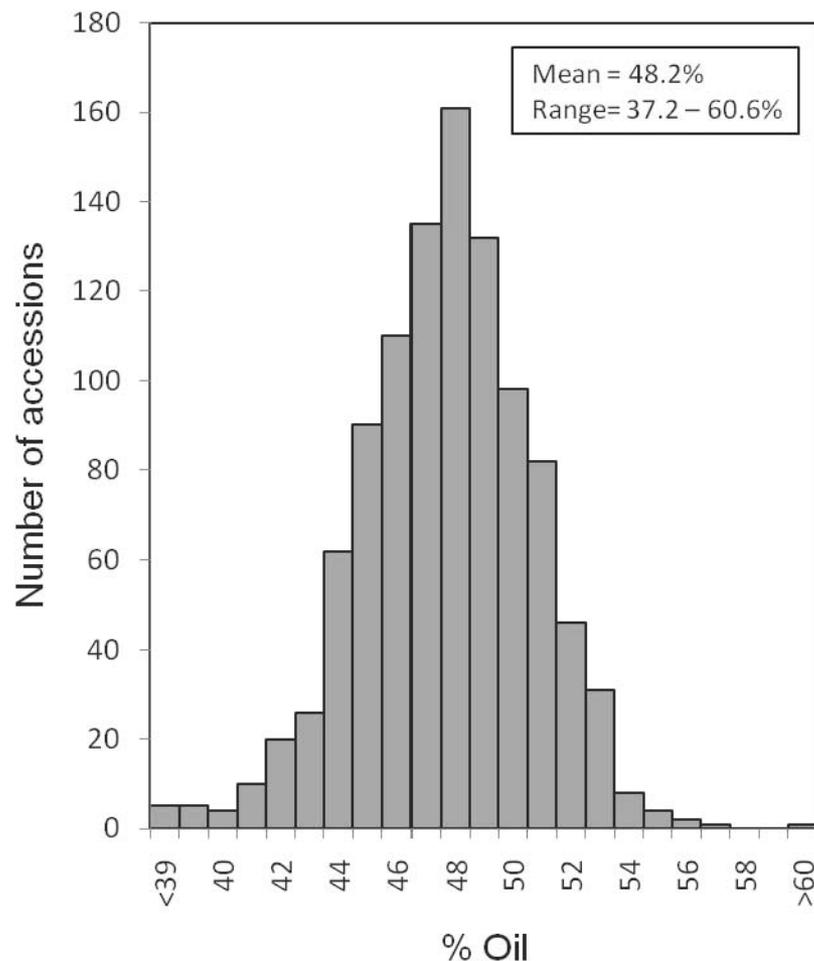
Castor Oil Consumption in the World



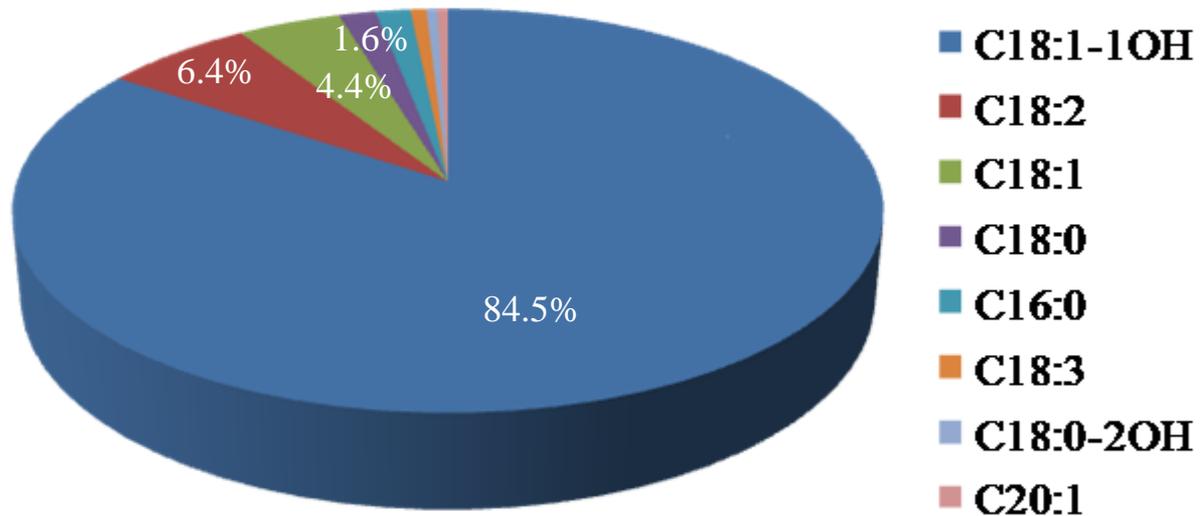
Price Comparison of Castor and Soybean Oils



Range and Sample Distribution of Oil Content in the Entire USDA Castor Germplasm Collection



Fatty acid composition



Variability of Fatty Acid Composition in the Entire USDA Castor Germplasm Collection

Variable	Number	Mean	Standard Deviation	Minimum	Maximum
Seed weight	1033	28.29878	5.82433	10.120	73.320
C16:0	1031	1.47784	0.19242	1.035	2.435
C18:0	1031	1.57622	0.33627	0.865	4.600
C18:1	1031	4.41046	1.08858	1.805	9.770
C18:2	1031	6.42407	0.64710	4.755	9.270
C18:3	1031	0.67755	0.15564	0.445	1.445
C20:1	1031	0.44777	0.12247	0.105	1.155
C18:1-1OH	1031	84.51185	1.44325	78.285	87.975
C18:0-2OH	1031	0.47471	0.09086	0.190	0.920

Correlation Coefficients and Probability

	SeedCl	SeedWt	C16:0	C18:0	C18:1	C18:2	C18:3	C20:1	RA	DHSA
Oil	0.09126 0.0033 1033	0.15740 <.0001 1033	-0.10517 0.0007 1031	0.07736 0.0130 1031	0.20298 <.0001 1031	-0.15973 <.0001 1031	-0.39375 <.0001 1031	-0.03591 0.2494 1031	-0.04115 0.1868 1031	0.02174 0.4856 1031
SeedCl		0.02941 0.3450 1033	-0.01522 0.6254 1031	0.05668 0.0689 1031	0.06824 0.0284 1031	-0.05765 0.0643 1031	-0.01697 0.5863 1031	0.03956 0.2044 1031	-0.03653 0.2412 1031	-0.02864 0.3583 1031
SeedWt			-0.20713 <.0001 1031	-0.17212 <.0001 1031	-0.03432 0.2709 1031	-0.10443 0.0008 1031	-0.13629 <.0001 1031	0.07442 0.0168 1031	0.13920 <.0001 1031	0.15324 <.0001 1031
C16:0				0.22736 <.0001 1031	-0.07930 0.0109 1031	0.73586 <.0001 1031	0.45759 <.0001 1031	0.08500 0.0063 1031	-0.48425 <.0001 1031	-0.45929 <.0001 1031
C18:0					0.41058 <.0001 1031	0.00538 0.8630 1031	-0.06890 0.0270 1031	0.08511 0.0062 1031	-0.56133 <.0001 1031	-0.22201 <.0001 1031
C18:1						-0.19081 <.0001 1031	-0.41883 <.0001 1031	0.48820 <.0001 1031	-0.73900 <.0001 1031	-0.17751 <.0001 1031
C18:2							0.44431 <.0001 1031	0.25276 <.0001 1031	-0.46378 <.0001 1031	-0.15083 <.0001 1031
C18:3								0.01974 0.5267 1031	-0.03312 0.2881 1031	-0.07341 0.0184 1031
C20:1									-0.60569 <.0001 1031	0.09345 0.0027 1031
RA										0.25183 <.0001 1031

Hibiscus Flowers and Seed Morphology

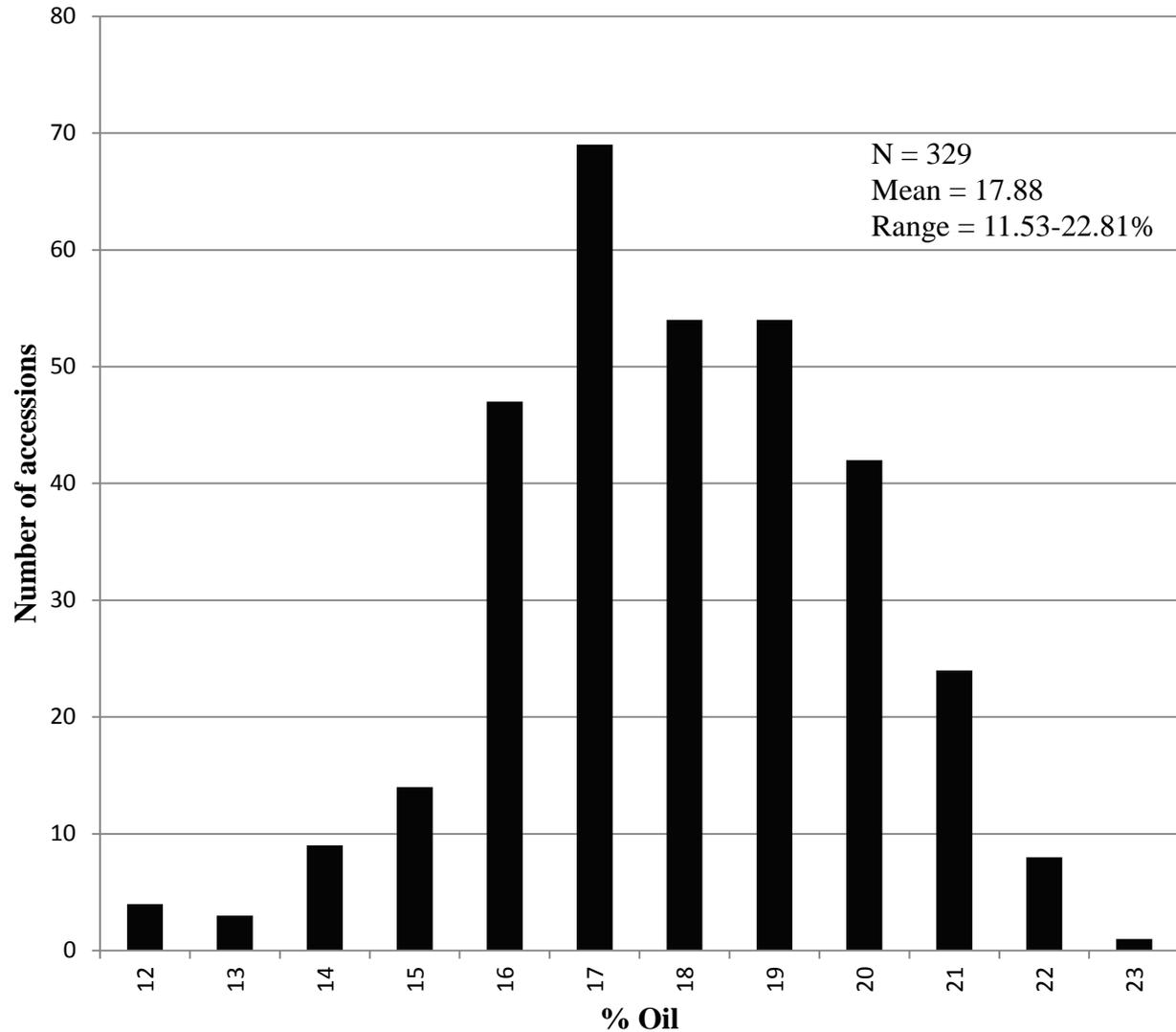


H. cannabinus L. (kenaf)

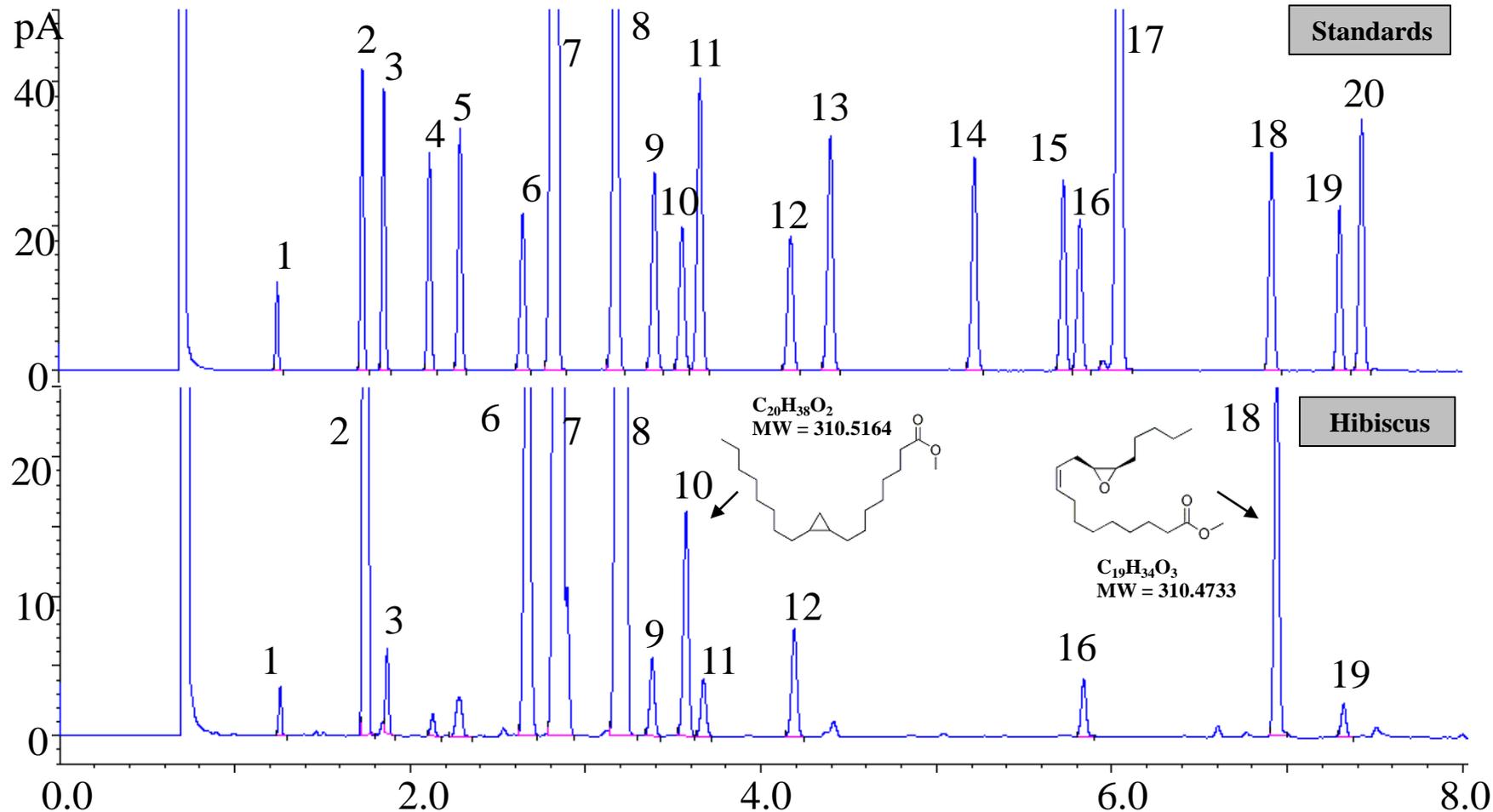


H. sabdariffa L. (roselle)

Range and Sample Distribution of Oil Content in *Hibiscus* Germplasm Accessions



Chromatograms of Methyl Esters



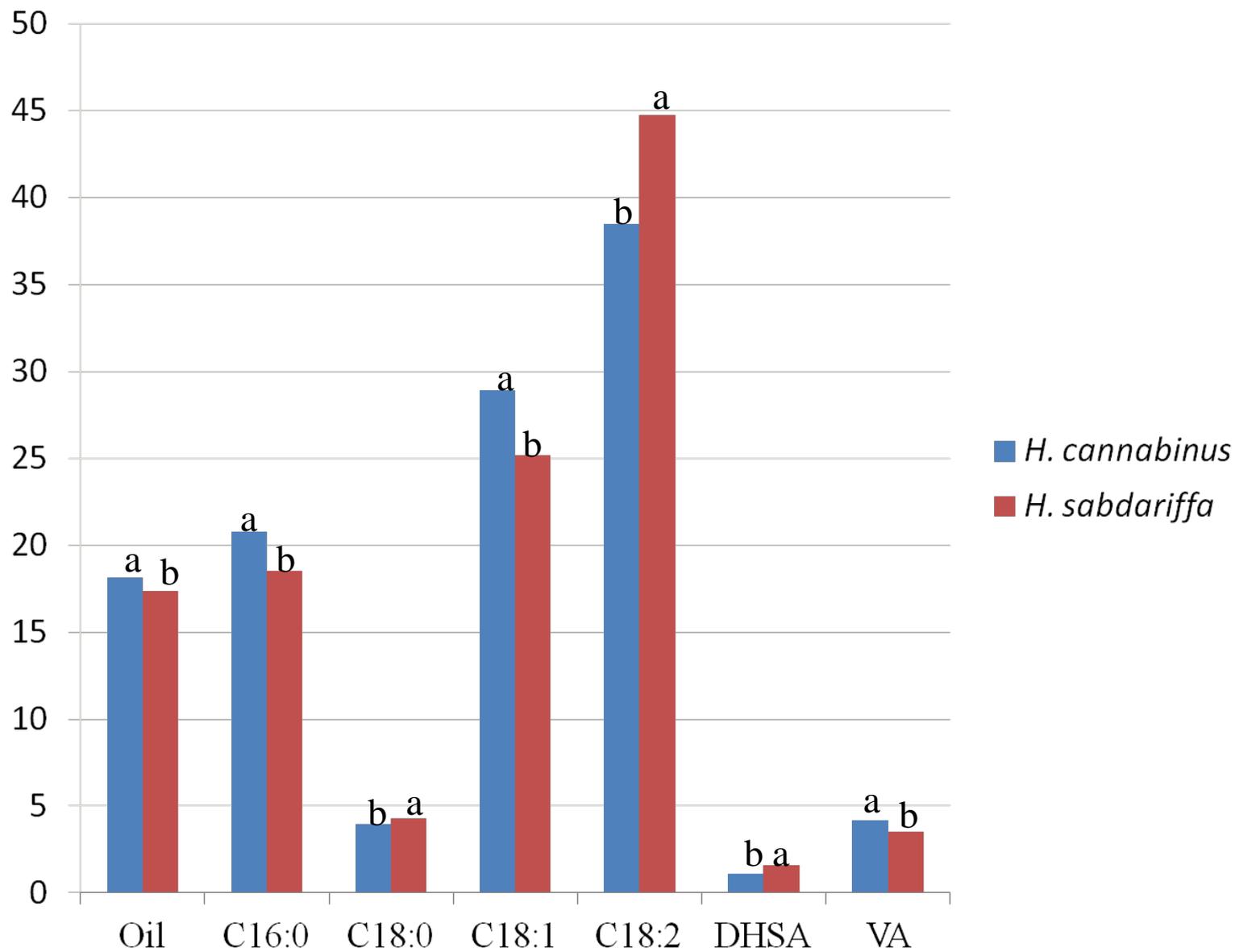
1. C14:0	6. C18:0	11. C18:3 α	16. C22:0
2. C16:0	7. C18:1	12. C20:0	17. C22:1
3. C16:1	8. C18:2	13. C20:1	18. Vernolic acid
4. C17:0	9. C18:3 γ	14. C20:4	19. C24:0
5. C17:1	10. DHSA*	15. C20:5	20. C22:6

* DHSA = Dihydrosterculic acid methyl ester

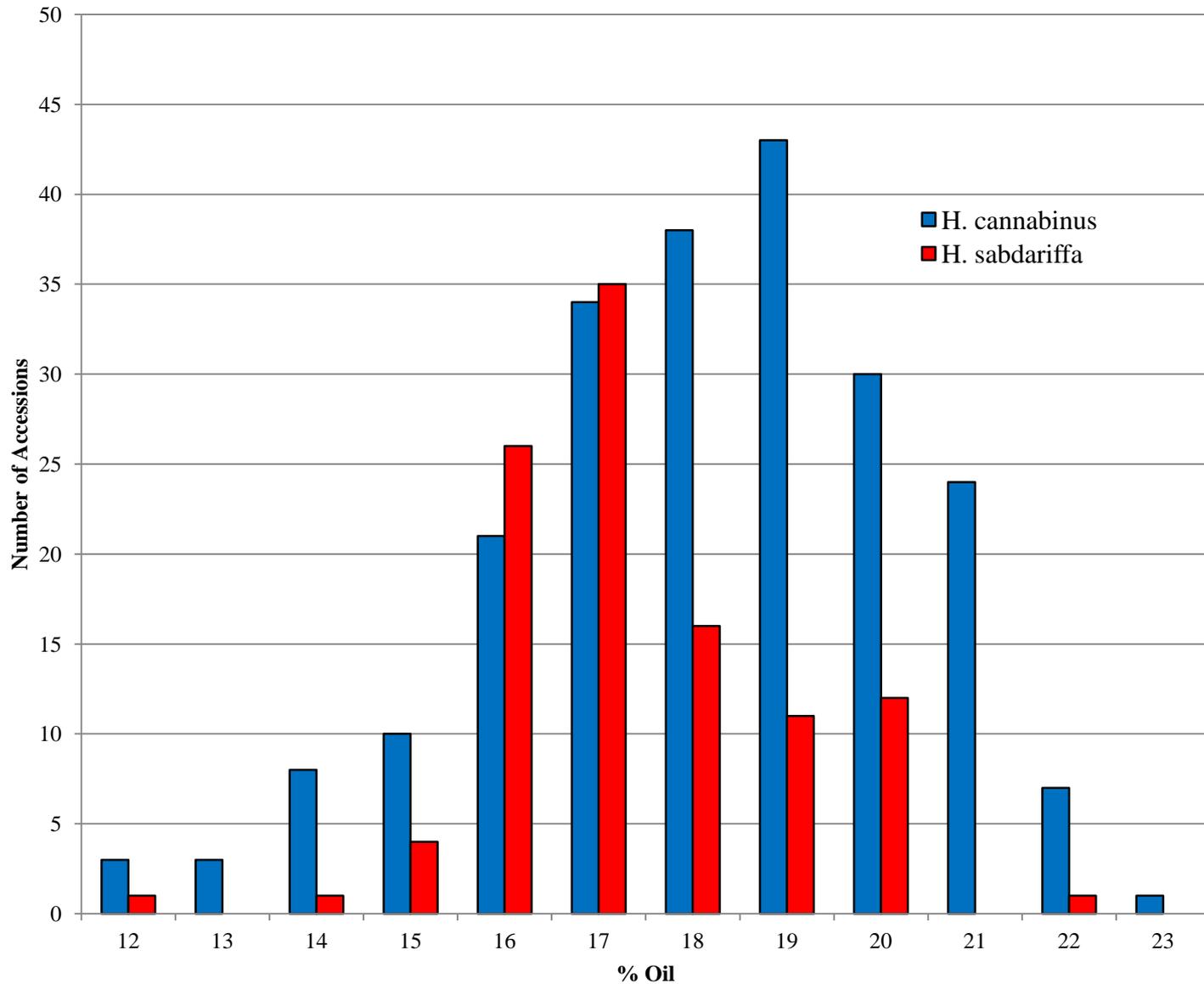
Variability in Seed Weight and Fatty Acid Composition among *Hibiscus* Accessions

Trait	N	Mean	SD	Minimum	Maximum
Seed weight	984	2.23	1.52	0.56	4.84
C14:0	656	0.18	0.05	0.07	0.37
C16:0	656	20.02	1.76	15.65	25.35
C16:1	656	0.52	0.13	0.25	0.94
C18:0	656	4.08	0.64	2.75	7.32
C18:1	656	27.69	4.93	14.34	49.78
C18:2	656	40.52	5.68	21.71	61.18
C18:3 γ	656	0.50	0.20	0	1.68
DHSA	656	1.24	0.50	0.47	3.69
C18:3 α	656	0.37	0.12	0.15	1.02
C20:0	656	0.49	0.14	0.22	0.88
C22:0	656	0.28	0.09	0.09	0.77
VA	656	3.95	2.13	0.26	9.61
C24:0	656	0.16	0.03	0.09	0.26

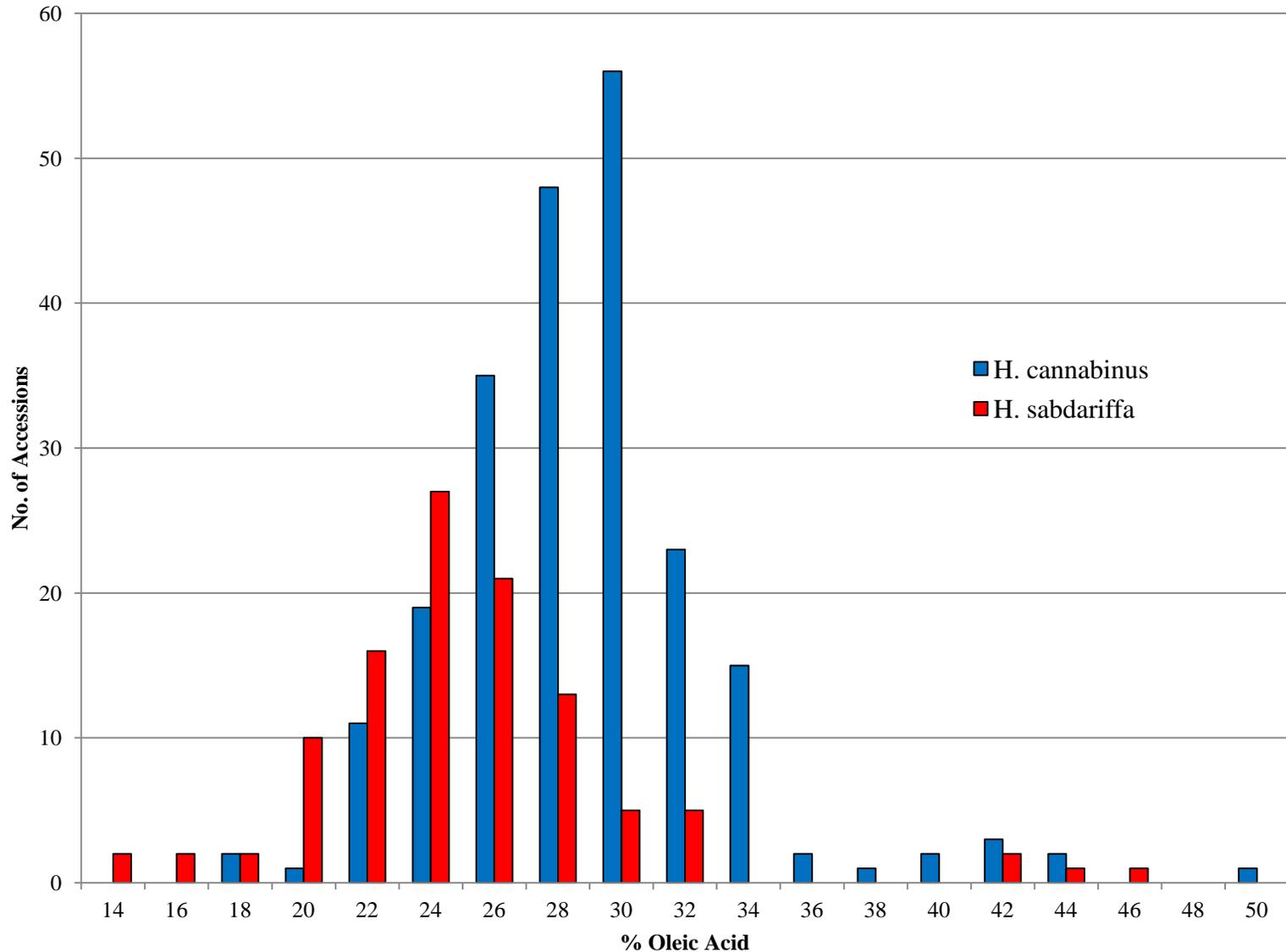
Comparison Oil Content and FA in Two Species



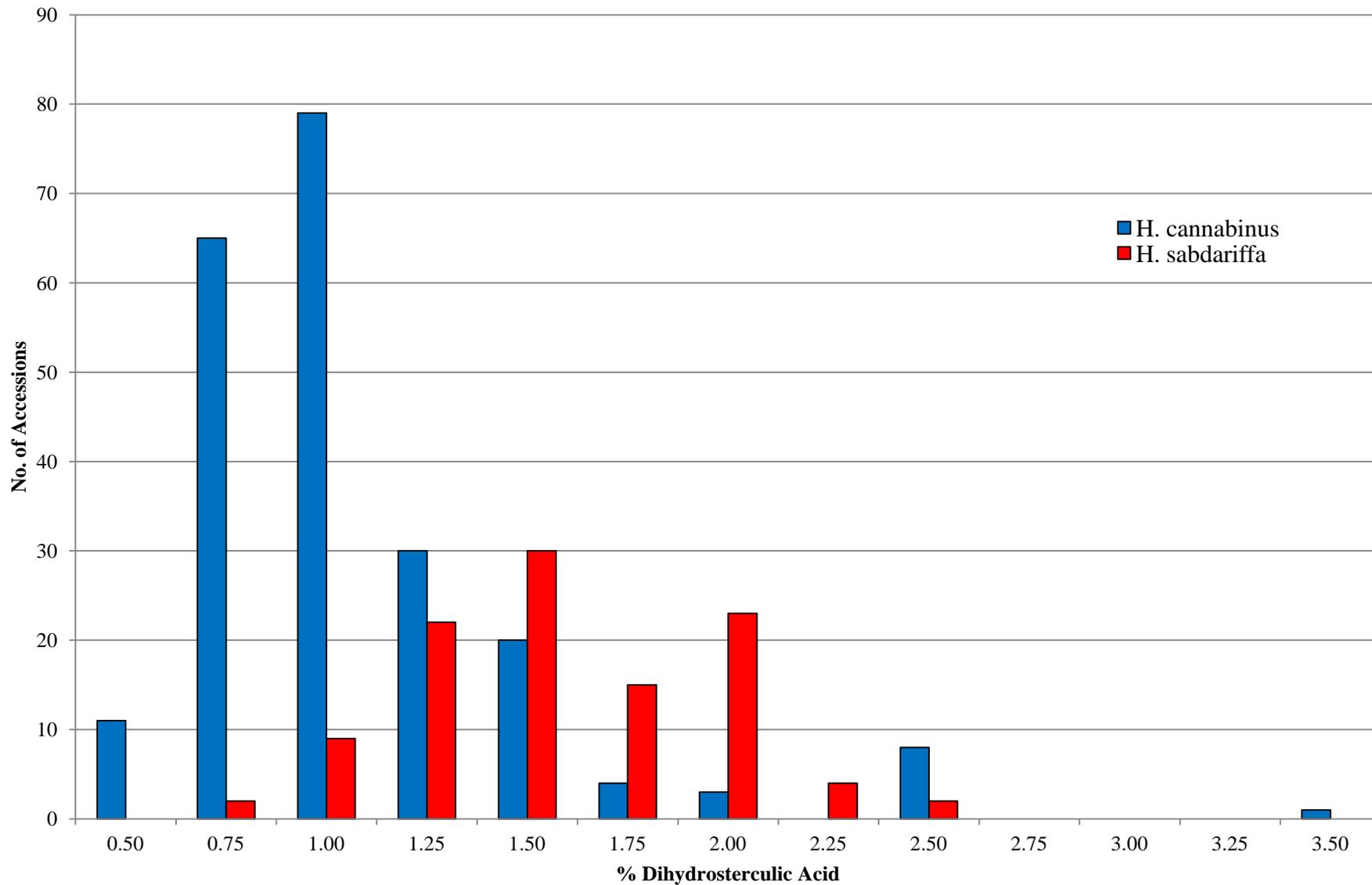
Oil Content Distribution in Two Species



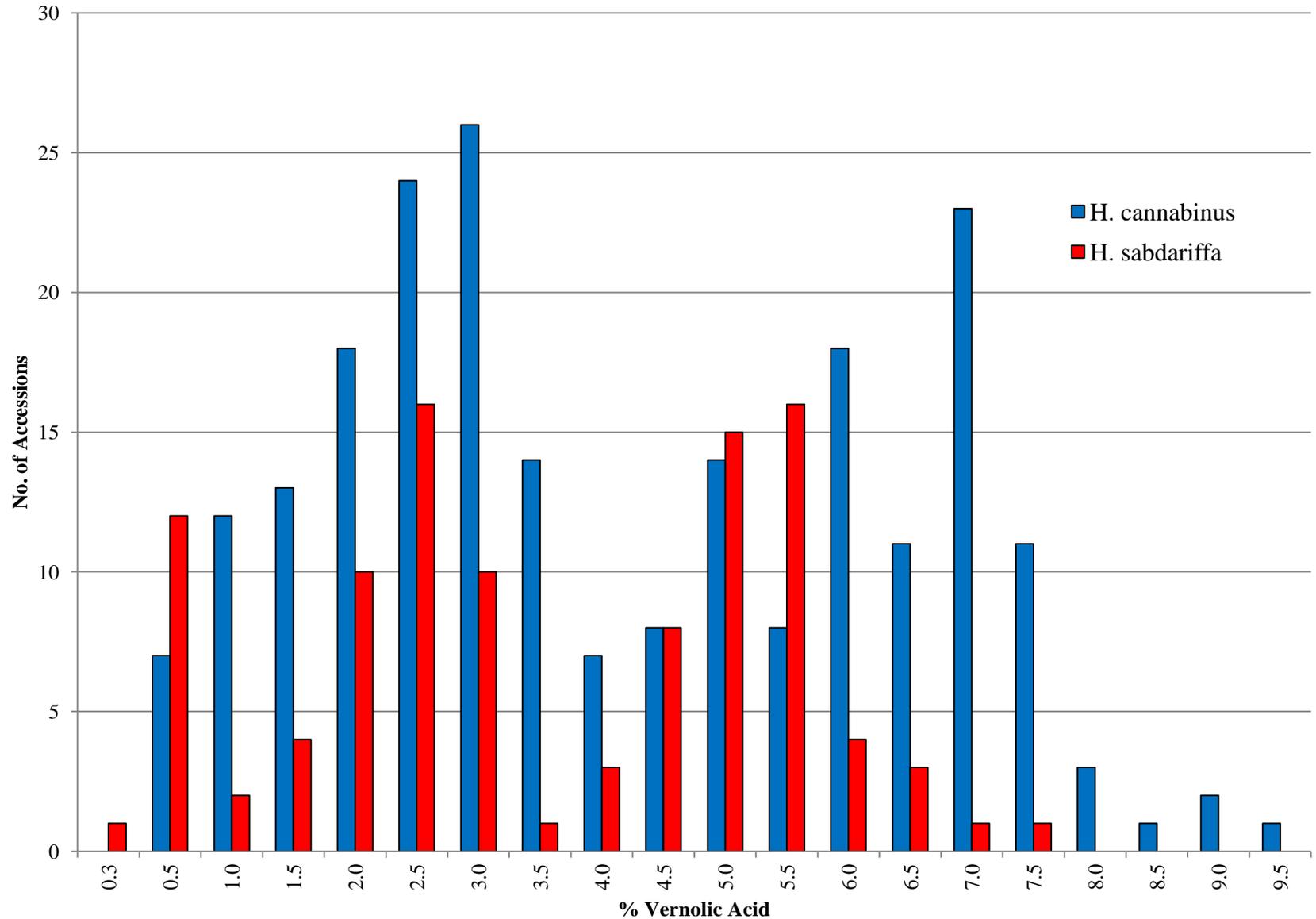
Oleic Acid Content Distribution in Two Species

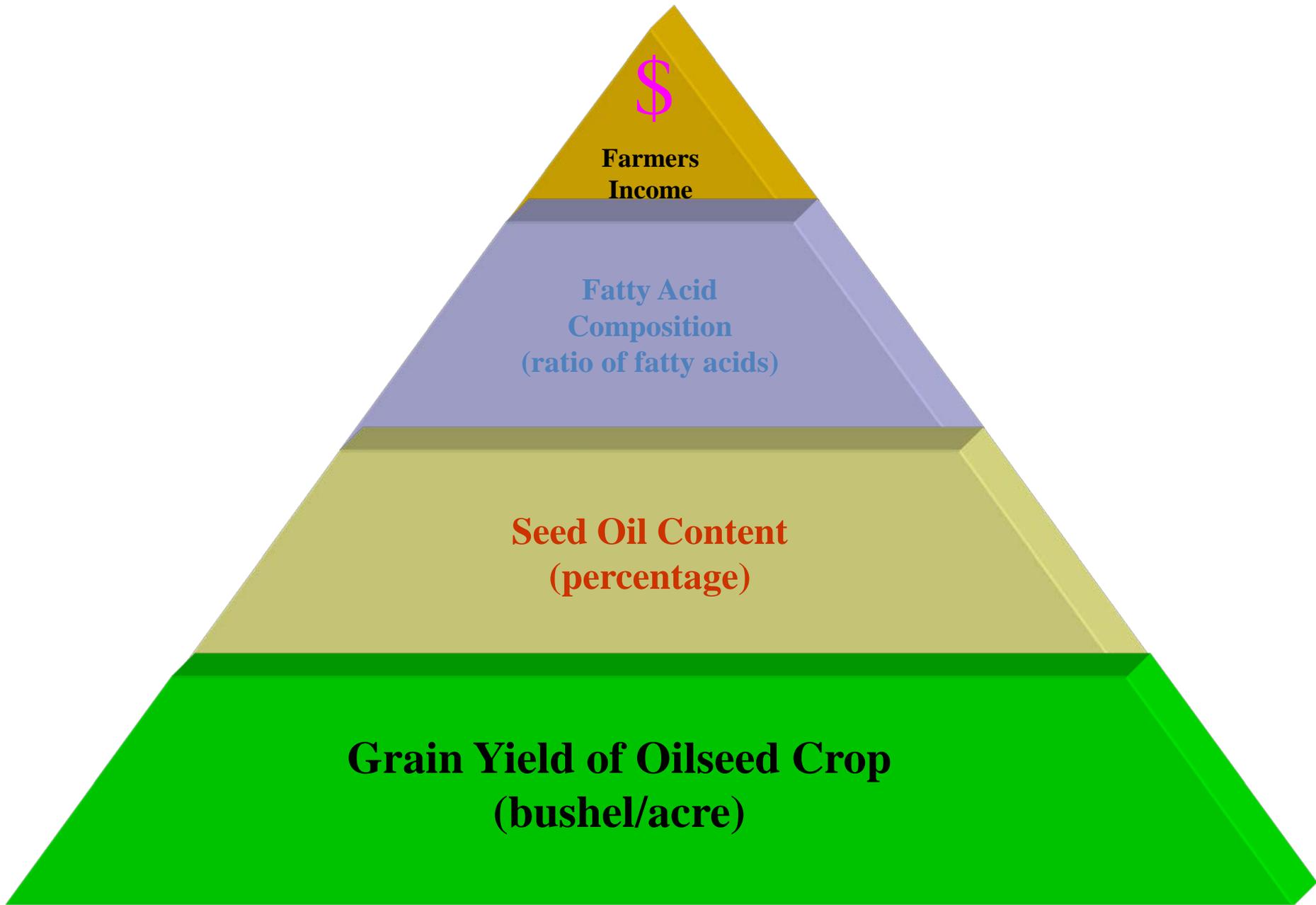


DHSA Content Distribution in Two Species



Vernolic Acid Content Distribution in Two Species





\$

**Farmers
Income**

**Fatty Acid
Composition
(ratio of fatty acids)**

**Seed Oil Content
(percentage)**

**Grain Yield of Oilseed Crop
(bushel/acre)**

Acknowledgements

Mr. Brandon Tonnis

Mr. David Pinnow

Mr. Brice McEver

Mr. Ken Manley

Ms. Tiffany Fields

Ms. Merrelyn Spinks

Ms. Lee-Ann Chalkley

Dr. Noelle Barkley

Dr. Brad Morris

Dr. Roy Pittman

Dr. Gary Pederson

Dr. Zhenbang Chen

Mr. Jerry Davis

Dr. Paul Raymer

Dr. Manjeet Chinnan

Dr. Dick Auld

Dr. Tom Stalker

PGRCU, USDA-ARS

PGRCU, USDA-ARS

PGRCU, UGA

PGRCU, UGA

PGRCU, USDA-ARS

University of Georgia

University of Georgia

University of Georgia

University of Georgia

Texas Tech University

NC State University

