USDA SOYBEAN GERMPLASM COLLECTION REPORT -- 2015
February 2016

In 2015, we distributed 26,237 seed lots from 12,745 accessions from the USDA Soybean Germplasm Collection in response to 655 requests from 382 individuals. This is the fourteenth year in a row and 18 of the past 21 years in which we have distributed more seed lots than total accessions in the Collection. There were 584 domestic requests (89% of the total) with a total of 23,728 seed packets representing 12,046 accessions sent to 320 researchers from 41 states. Domestically, public scientists made 395 requests, scientists with commercial companies made 116 requests, and individuals made 73 requests. There were 2,509 seed packets of 2,040 accessions in 71 orders sent to 62 scientists in 25 countries. Thirty-four requests were made for 483 seed packets of 403 perennial *Glycine* accessions. We also sent backup seeds of 360 accessions to the National Center for Genetic Resources Preservation (NCGRP) and 1,971 accessions for storage in the Svalbard Arctic Seed Vault. 99% of the collection is backed up at NCGRP and 75% is backed up at the Svalbard Arctic Seed Vault.

We planted 2,371 accessions of *G. max* for seed replacement in the Collection. These were planted at two locations: 1,515 *G. max* and 236 *G. soja* accessions at Urbana and 856 *G. max* and 8 *G. soja* accessions at Stoneville. Pure line rows were grown from 57 plants harvested from 2 bulk *G. soja* samples planted in 2014. These seeds were collected by Erick Sachs, Univ. of Illinois; Elena Dzyubenko, Larissa Bagmet, and Andrey Sabitov N.I. Vavilov All-Russian Scientific Research in the Khabarovsk and Primorski regions of the Russian Federation. DNA was collected from each row and will be used to determine what will be added to the Collection. This will also provide useful data about genetic variation within natural *G. soja* populations.

We planted for the first time 302 soybean accessions donated by Le Huy Ham, Ministry of Agriculture and Rural Development, Institute of Agricultural Genetics, Pham Van Dong Rd, Tuliem, Hanoi, Vietnam and 21 accessions donated by Can Tho University, Vietnam. Henry Nguyen, University of Missouri, was instrumental in helping to obtain this germplasm. Because of the cropping systems in Vietnam we cannot predict the maturity group based on latitude so all new accessions were grown in Stoneville in 2015. Based on 2015 maturity dates, pure line rows will be divided between Urbana and Stoneville in 2016.

We also received 23 Embrapa cultivars from Marcelo Oliveira, Londrina, Paraná, Brazil. In past all accessions received from outside of the U.S. were pure lined but cultivars, germplasm releases and other entries from within the U.S. were added to the Collection as received. We are considering that for foreign cultivars that have been officially released in their country of origin and we can determine that our seed source correctly represents that cultivar, we will not pure line them before adding them to the Collection. This would help ensure that our inventory is not genetically different from what is held in the originating country. Foreign accessions that have not been pure lined would be labeled in the database.

The old insect-proof screen cages had disintegrated from age and weathering, and were replaced with two new cages.

Some of the *G. soja* accessions evaluated at Urbana in 1998 and 1999 had data that differed greatly between years. We compared plots grown from older sources and the 1999 sources and in at least 43 cases, the plants grown from 1999 seed were different from those grown from earlier sources. The seed from the 1998 evaluation year appears to be correct. We have earlier seed sources for all *G. soja* accessions so to be safe, all 1999 seed sources have been removed from the Collection. Letters were sent to all scientists who received any seed lots from the 1999 seed source or seed lots that had been increased from this seed. Since 1999 was the second year of an evaluation trial, seed from older backup sources were planted to obtain correct evaluation data as well as fresh inventory samples. There was only enough space in the screen cages for 236 of the Northern accessions so the rest will be grown in 2016.

Evaluation of accessions that were found to be very similar by genotyping with the 50K SNP chip by Perry Cregan and Qijian Song in Beltsville, MD is continuing. Rusty Smith planted 161 accessions and 462 accessions

were planted in Urbana. In these tests we are comparing phenotypes of accessions with greater than 99.9% similarity based on the SNP data. Tests in previous years have shown many qualitative differences among accessions with greater than 99.9% SNP similarity. We are re-genotyping 24 of these accessions to make sure that the DNA samples were correctly labeled. There were 66 *G. soja* accessions that had 1999 Urbana seed genotyped. Earlier seed sources of these accessions will be genotyped to make sure that we have data on the correct accession.

Thirteen germplasm releases, two cultivars, and five private varieties with expired Plant Variety Protection certificates (PVPC) were added to the Collection.

For a variety of reasons the vacancy created when Alyson Steines, the technician who worked with new introductions, tropical accessions, wild soybeans, and managed our greenhouse, resigned in August 2012 has still not been filled. Because of the changes that have occurred in the needs of the Collection, we are considering abolishing this position. The option would remain to reinstate the position in the future.

The National Plant Germplasm System will be adding transgenic cultivars to our collections when the patents on these cultivars expire. General policies and procedures on how to handle such material have been established. The Soybean Collection will have to determine the specific procedures that we will follow and what accessions will be added.

For some time there has been a discussion within the soybean research community about the need for a soybean genetic stocks collection to preserve the many lines that are being developed by various mutagens or with transgenic procedures. The initial collection could range from a few hundred to tens of thousands of accessions depending on the criteria for inclusion. For this purpose, we received an increase in our budget in 2014. This funding was not nearly sufficient for a new collection but we have requested some high priority, non-transgenic stocks that will be added to the Collection. The Type Collection currently functions as a genetic stock collection. How it will be integrated with the new stocks has not been determined. What we can currently do does not fully meet the needs of research community for preserving genetic stocks so a more complete solution still needs to be devised.

In cooperation with Marcelo Oliveira of Embrapa, all of the soybean accessions in maturity groups IX and X were scheduled to be evaluated in Sinope in northern Brazil. This test has been planted three times since October of 2014 and each time adverse weather conditions has prevented the successful completion of the research. We hope that will be replanted in 2016.

NPGS implemented the switch from GRIN to GRIN Global on November 30, 2015. This version has a field for ontologies, which have been entered for 56 soybean crop traits. The public version of GRIN-Global Release 1.9.4.2 is now available at http://npgsweb.ars-grin.gov/gringlobal . Users can create accounts to make seed requests online, view their order history and receive email updates about GRIN-Global.

Patti Witcher, Dept. of Agricultural Sciences, Texas A&M University-Commerce, continued to screen MG V accessions for tolerance to red banded stink bug.

Not counting registration articles in Crop Science and Journal of Plant Registrations there are 93,346 accessions linked to 398 citations in GRIN-Global. 19,899 unique accessions are covered by at least one citation not including USDA Technical Bulletins or Crop Science registration articles. These citations are listed on the accession's information page, and a complete list of all of the publications referencing accessions for soybeans with number of accessions cited can be found on the general crop information page.

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As of December 31, 2015, the Collection contained the following entries:

USDA Soybean Germplasm Collection Inventory

Annual subcollection	**Entries**
Introduced *G. max*	17152
G. soja	1179
Germplasm releases	210
Modern cultivars	547
Old cultivars	208
Private cultivars	585
All isolines	599
Pigment mutants	47
Genetic types	197
Annual subtotal	**20728**

Perennial species	**Entries**
G. *arenaria*	5
G. *argyrea*	14
G. *canescens*	123
G. *clandestina*	90
G. *curvata*	9
G. *cyrtoloba*	48
G. dolichocarpa	13
G. *falcata*	29
G. *latifolia*	44
G. *latrobeana*	6
G. *microphylla*	33
G. peratosa	7
G. *pescadrensis*	68
G. *pindanica*	4
G. *rubiginosa*	38
G. *stenophita*	27
G. syndetika	6
G. *tabacina*	142
G. *tomentella*	299
Perennial subtotal	**1005**

Collection total 21689

Number of accessions screened for which data is entered in GRIN:

Perennial *Glycine*		
Type	**Descriptor**	**Accessions screened**
	Core subset	115
	Image	957
CHEMICAL	Bowman-Birk Inhibitor	560
CYTOLOGIC	Chromosome number	774
DISEASE	Sclerotinia stem rot	777
DISEASE	Sudden death syndrome	754
MORPHOLOGY	Adventitious roots	319
MORPHOLOGY	Leaflet arrangement	291
MORPHOLOGY	Upper pubescence type	290
MORPHOLOGY	Upper terminal leaflet length	265
MORPHOLOGY	Upper terminal leaflet shape	292
MORPHOLOGY	Upper terminal leaflet width	293
NEMATODE	Soybean cyst nematode, race 3	490

Glycine max		
Type	**Descriptor**	**accessions screened**
	Core Subset	1685
Chemical	Arginine	5530
Chemical	Cysteine	5530
Chemical	human allergen P34	13267
Chemical	Iodine number	2817
Chemical	Isoleucine	5530
Chemical	Leucine	5530
Chemical	Linoleic	16521
Chemical	Linolenic	16520
Chemical	Lysine	5530
Chemical	Methionine	7069
Chemical	Oil	16625
Chemical	Oleic	15803
Chemical	Other fatty acid composition	5720
Chemical	Palmitic	15803
Chemical	Petiole ureide	2499
Chemical	Protein	16625
Chemical	Stachyose	5522
Chemical	Stearic	15803
Chemical	Sucrose	5483
Chemical	Threonine	5530
Chemical	Tryptophan	5530
Chemical	Valine	5530
Disease	Bacterial pustule	3438
Disease	Bean pod mottle virus	424
Disease	Brown stem rot	4027
Disease	Frogeye C-32 isolate	1688
Disease	Frogeye race 2	2665
Disease	Frogeye race 11	109
Disease	Frogeye, unspecified race	115
Disease	Northern stem canker	1489
Disease	Peanut mottle virus	2150
Disease	Phytophthora rot, race 1	9988
Disease	Phytophthora rot, race 10	629
Disease	Phytophthora rot, race 12	646
Disease	Phytophthora rot, race 17	2235
Disease	Phytophthora rot, race 2	433
Disease	Phytophthora rot, race 20	659
Disease	Phytophthora rot, race 25	2844
Disease	Phytophthora rot, race 3	2826
Disease	Phytophthora rot, race 30	115
Disease	Phytophthora rot, race 30T	263
Disease	Phytophthora rot, race 31	145
Disease	Phytophthora rot, race 33	113
Disease	Phytophthora rot, race 38	65
Disease	Phytophthora rot, race 4	1478
Disease	Phytophthora rot, race 5	798
Disease	Phytophthora rot, race 6	139
Disease	Phytophthora rot, race 7	2980
Disease	Phytophthora rot, race 8	149
Disease	Phytophthora rot, race 9	96
Disease	Pythium ultimum	1290
Disease	Southern stem canker	120
Disease	Soybean mosaic virus	236
Disease	Soybean rust, mixed	437

Glycine max		
Type	**Descriptor**	**accessions screened**
Disease	Soybean rust, red-brown	103
Disease	Soybean rust, tan	3099
Disease	Soybean sudden death syndrome	6859
Growth	Height	16195
Growth	Stem termination type	17441
Insect	Beet armyworm	5
Insect	Corn ear worm	27
Insect	Leaf hopper injury	784
Insect	Mexican bean beetle damage	5049
Insect	Soybean aphid resistance	3315
Insect	Soybean looper	2335
Insect	Velvetbean caterpillar	133
Defoliation	Defoliation by chewing insects	339
Molecular	Maturity Locus E3	119
Morphology	Branching	2151
Morphology	Early shattering score	14779
Morphology	Flower color	17711
Morphology	Hilum color	17744
Morphology	Image	2033
Morphology	Late shattering score	12243
Morphology	Lodging	16040
Morphology	Lower leaflet ration	15
Morphology	Mottling score	13016
Morphology	Other leaf traits	950
Morphology	Other plant traits	257
Morphology	Other seed traits	3462
Morphology	Pod color	17649
Morphology	Pod length	15
Morphology	Pubescence color	17711
Morphology	Pubescence density	17654
Morphology	Pubescence form	17196
Morphology	Seed coat color	17784
Morphology	Seed coat luster	17550
Morphology	Seed quality	16198
Morphology	Seed shape	8159
Morphology	Seed weight	16202
Morphology	Stem termination score	11145
Morphology	Upper leaflet length	15
Morphology	Upper leaflet shape	15
Nematode	Cyst nematode, race 1	496
Nematode	Cyst nematode, race 14	2493
Nematode	Cyst nematode, race 2	214
Nematode	Cyst nematode, race 3	12097
Nematode	Cyst nematode, race 4	7379
Nematode	Cyst nematode, race 5	11227
Nematode	Reniform nematode	120
Phenology	Flowering	16204
Phenology	Maturity date	16378
Phenology	Maturity group	17790
Phenology	Twining date	14
Production	Yield	16021
Root	Root fluorescence	796
Stress	Chlorosis score	1974
Stress	High temperature	520
Stress	Salt reaction	564

Glycine soja		
Type	**Descriptor**	**Accessions screened**
Chemical	Human allergen P34	1116
Chemical	Linoleic	1075
Chemical	Linolenic	1075
Chemical	Oil	1075
Chemical	Oleic	1075
Chemical	Other fatty acid composition	182
Chemical	Palmitic	1075
Chemical	Protein	1075
Chemical	Stearic	1075
Disease	Bean pod mottle virus	116
Disease	Phytophthora rot, race 3	448
Disease	Soybean mosaic virus	182
Disease	Height	182
Disease	Stem termination type	258
Insect	Beet armyworm	425
Insect	Soybean looper	379
Insect	Velvetbean caterpillar	408
Morphology	Flower color	1004
Morphology	Hilum color	1035
Morphology	Image	1073
Morphology	Leaflet shape	1060
Morphology	Leaflet size	1060
Morphology	Lower leaflet area	1041
Morphology	Lower leaflet aspect	1049

Glycine soja		
Type	**Descriptor**	**Accessions screened**
Morphology	Lower leaflet ratio	182
Morphology	Other leaf traits	38
Morphology	Other plant traits	3
Morphology	Other seed traits	299
Morphology	Pod color	1001
Morphology	Pod length	182
Morphology	Pubescence color	1003
Morphology	Pubescence density	1002
Morphology	Pubescence form	450
Morphology	Seed coat color	1038
Morphology	Seed coat luster	569
Morphology	Seed shape	185
Morphology	Seed weight	182
Morphology	Upper leaflet length	182
Morphology	Upper leaflet shape	182
Nematode	Cyst nematode, race 1	1078
Nematode	Cyst nematode, race 3	545
Nematode	Cyst nematode, race 4	1
Nematode	Cyst nematode, race 5	547
Phenology	Flowering	1076
Phenology	Maturity date	1076
Phenology	Maturity group	1003
Phenology	Twining date	182
Stress	Chlorosis score	19

Photos stored in GRIN:

	Number of Photos	Number of Accessions
G. max	13,559	3,815
G. soja	2,051	1,081
Perennial G*lycine*	3,204	997