USDA SOYBEAN GERMPLASM COLLECTION REPORT -- 2013

February 2014

In 2013, we distributed 34,846 seed lots from 15,423 accessions from the USDA Soybean Germplasm Collection in response to 748 requests from 435 individuals. This is the twelfth year in a row and 16 of the past 19 years in which we have distributed more seed lots than total accessions in the Collection. Only two other collections in National Plant Germplasm System (NPGS) distributed more samples than the Soybean Collection in 2013. The PI station in Ames, IA (NC7) distributed 37,036 samples (0.70 distribution to inventory ratio) and the National Small Grains Collection distributed 44644 samples (0.31 distribution to inventory ratio). Our distribution to inventory ratio is 1.7. We hold 4% of the accessions in the NPGS but account for 15% of the samples distributed. There were 653 domestic requests (87% of the total) with a total of 30,862 seed packets representing 14,753 accessions sent to 361 researchers from 41 states. Domestically, public scientists made 458 requests, scientists with commercial companies made 144 requests, and individuals made 51 requests. There were 3,984 seed packets of 3,207 accessions in 95 orders sent to 74 scientists in 29 countries. Twenty-three requests were made for 1,801 seed packets of 986 perennial *Glycine* accessions. We also sent backup seeds of 300 accessions to the National Center for Genetic Resources Preservation (NCGRP) and 1,889 accessions for storage in the Svalbard Arctic Seed Vault. We have now sent 12,239 accessions to Svalbard. A sample for Svalbard is packaged each time new seeds are added to the Collection so over a period of 10 years all annual accessions will have been sent.

We planted 793 accessions of *G. max* and 26 *G. soja* for seed replacement in the Collection. These were planted at three locations: 466 *G. max* and 19 *G. soja* accessions at Urbana, 214 *G. max* and 7 *G. soja* accessions at Stoneville, and 133 *G. max* in Costa Rica. In 2013, we decided to extend the maximum age of *G. max* seeds in the Collection from 10 to 11 years. Ever since the Southern and Northern Collections were consolidated in 1991, our backlog of new seeds to be processed into the Collection has consistently exceeded more than one year. In 2013 we did plant those accessions with low seed counts but this decision reduced the number of accessions grown and we hope that during this year we can significantly reduce our backlog. We will monitor the 11-year-old seeds to determine if there is a significant decline in vigor. Because of budget constraints, we have not done a seed increase in Costa Rica for the preceding two years. Plots for pure lining new accessions were also planted in Urbana and Stoneville.

The evaluation of 459 accessions in maturity groups I – IV received since 1998 was repeated for a third year in Urbana, IL because of poor yields in the first two years due to summer droughts. Seed notes still need to be taken on accessions grown in Stoneville and Rosemont 2011 and 2012 evaluations.

Many of the *G. soja* accessions evaluated in 1998 and 1999 had maturity dates that varied widely between years or only had one year's data so 157 accessions were planted in a replicated study help determine maturity group designations.

The genotyping of 19,652 *G. max* and *G. soja* accessions with 52,041 SNPs was completed by Perry Cregan and Qijian Song in Beltsville, MD. Those data are now available through SoyBase (http://www.soybase.org/dlpages/index.php). Using these data 6198 *G. max* and 499 *G. soja* accessions were found to be 99.9% similar in SNP markers to at least one other accession (1908 *G. max* comparison groups with 72 accessions in the largest group, 138 *G. soja* groups with 54 accession in the largest group). Using qualitative, phenotypic data to remove accessions that were obviously different we narrowed this list down to 3413 *G. max* (1151 groups with 42 accessions in the largest group) and 414 *G. soja* accessions (137 groups with 46 accessions in the largest group). Starting with the largest groups of accessions with similar phenotype and SNP markers in maturity groups of 000 - IV, 1276 *G. max* and 214 *G. soja* accessions were planted in comparison plots in Urbana. Many of these looked similar in the field, but some

definitely look different. These SNP data will be very useful in defining genetic differences among accessions and we will be exploring ways that we can use these data in managing the Collection. It is not likely that we will eliminate any accessions from the Collection based on SNP similarity because the concurrence of this many SNP markers still cannot define two accessions as completely identical.

Fall field notes and harvest were hampered by the government shutdown during the first two weeks in October. Special permission was eventually granted on the Friday before the government was reopened to allow staff to return for harvesting germplasm plots.

After planting season was over we received seeds of 2 bulk *G. soja* samples collected in the Khabarovsk and Primorskii regions of the Russian Federation which will be grown for purelining next summer. Two domestic cultivars, 3 germplasm releases, and 14 private varieties with expired Plant Variety Protection certificates (PVPC) were also added to the Collection. Because of budget constraints we are not actively pursuing new acquisitions for the Collection but continue to add what becomes available to us.

The lights in the USDA buildings in Urbana were upgraded from the obsolete T12 to T8 fluorescent bulbs. The new lights are brighter and make it easier to classify seed samples.

Alyson Steines, the technician who worked with new introductions, tropical accessions, wild soybeans, and managed our greenhouse, resigned in August 2012. Because there had been a hiring freeze in place there was a large backlog of vacancies to be filled. Our request to fill her position was approved in the spring of 2013. An initial set of candidates was forwarded from the Office of Personnel Management in October. Because of a misinterpretation of job description, all but one of the candidates forwarded to us had little or no field or greenhouse experience. We decided not to select among those candidates and the search is being reopened.

NPGS will be adding transgenic cultivars to our collections when the patents on these cultivars expire. General policies and procedures on how to include these lines into collections and prevent transgenes from contaminating other accessions are being developed. The Soybean Collection will have to determine the specific procedures that we will follow.

In cooperation with Marcelo Oliveira of Embrapa, all of the soybean accessions in maturity groups IX and X are being evaluated in northern Brazil.

NPGS plans to implement the switch from GRIN to GRIN Global in 2014. The public version of GRIN-Global Release 1.7 is now available at http://npgsdb.ars-grin.gov/gringlobal .

Jim Heiholtz screened 1,636 accessions from the core collection accessions and 800 other MG V accessions for tolerance to Redbanded Stink Bug.

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As of December 31, 2013, the Collection contained the following entries:

USDA Soybean Germplasm Collection Inventory

Annual subcollection	Entries
Introduced *G. max*	17142
G. soja	1179
Germplasm releases	195
Modern cultivars	546
Old cultivars	208
Private cultivars	576
All isolines	599
Pigment mutants	47
Genetic types	192
Annual subtotal	**20684**

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*	32
G. peratosa	7
G. *pescadrensis*	68
G. *pindanica*	4
G. *rubiginosa*	38
G. *stenophita*	27
G. syndetika	6
G. *tabacina*	143
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
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	11,363	3,055
G. soja	2,051	1,081
Perennial G*lycine*	3,204	977

Not counting Crop Science Registration articles there are 94,094 accession linked to 1037 citations.