

**ANNUAL REPORT
FY 2014**

NRSP-6: UNITED STATES POTATO GENE BANK

Acquisition, Classification, Preservation, Evaluation and Distribution of tuber-bearing *Solanum* Species.

COOPERATIVE AGENCIES AND PRINCIPAL LEADERS

State Agricultural Experimental Stations

Representative

Technical Representatives

Southern Region		C. Yencho
Western Region	Chair (2015)	D. Holm
North Central Region		D. Douches
Northeastern Region	Secretary (2015)	W. De Jong

Administrative Advisors

Southern Region		C. Nessler
Western Region		L. Curtis
North Central Region	Lead AA	R. Lindroth
Northeastern Region		E. Ashworth

United States Department of Agriculture

ARS

Technical Representative	Vice Chair (2015)	C. Brown
National Program Staff		P. Bretting
		G. Wisler
Midwest Area		R. Matteri & P. Simon

NIFA

A. M. Thro

APHIS

J. Abad

NRSP-6 Project Leader

J. Bamberg

Agriculture & Agrifood Canada

B. Bizimungu

PROGRESS AND PRINCIPAL ACCOMPLISHMENTS

A. Acquisitions and associated work

In 2014, we collected 18 germplasm accessions from Arizona under the BdRF (Bamberg, del Rio, Fernandez) prefix, with the kind support of K. Williams of the USDA Plant Exploration office at Beltsville. This trip followed the Mogollon Rim from Springerville to Flagstaff. We found robust populations at new sites quite separated from any previous collections, and extending the range of *S. fendleri* north by about 50 miles. The detailed trip report is available on request and on GRIN. We also sought and received 15 new cultivars and breeding clones from cooperators (La Rouge, Igorota, Amey, Peter Wilcox, Harley Blackwell, Sandy, Sylvia (CPVPA), Marine, Cynthia, (ver x cph) -8-1, (ver x cmm) -1, -2, -21-1; (ver x pnt) -1, -2.



C. Fernandez on Mogollon Rim near Woods Canyon Lake, AZ, site of new *S. fendleri* collection.

The NRSP-6 web page (<http://www.ars-grin.gov/nr6>) was updated to include all new stocks and screening information. Clients who have ordered from NRSP-6 within the past four years were contacted three times in 2014, informing them of new stocks of true seed, tubers, in vitro plantlets, or other samples. We used email and the website to extend technical instructions of various types. For example, we produced and selected the best 10% of seedling tubers in the winter at Davis, CA (see at right and insert). When planted in Wisconsin the following summer, they far outperformed random seedlings, allowing us to skip one field selection season.



B. Preservation and Evaluation

This year, 218 accessions were increased as botanical seed populations and 2,700 clonally. Over 700 potato virus tests were performed on seed increase parents, seedlots and research materials. Germination tests were performed on 1523 accessions, ploidy determinations were made on 23 accessions, and tetrazolium seed viability tests were done on 63 seedlots. Taxonomic status was assessed on all stocks grown. Nearly 4,000 individual field plots, greenhouse and screenhouse growouts



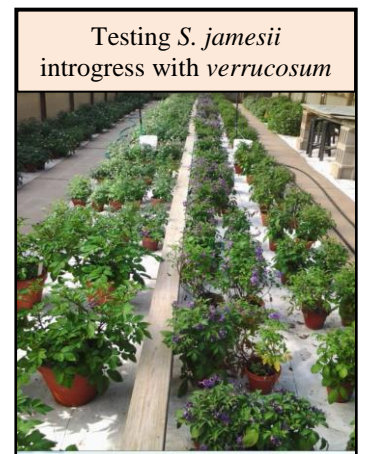
Double Corolla mutant

were done locally, at the research farm at Hancock, WI, or with cooperators at Davis, CA. We initiated a new test of winter field growouts for tuber evaluation with cooperators at Hastings, FL and Yuma, AZ. We continued breeding for improved *Criolla* or "egg yolk" style specialty potato with golden flesh (cooperator Douglass from FL). We completed a project using SNPs (cooperator Douches from MI) to assess partitioning of genetic diversity in model potato species with a view to understanding their best management.



We evaluated for heat stress tolerance (cooperators at Parlier, CA), folate (cooperator Goyer from OR), glycoalkaloids (cooperator Navarre from WA), anti-obesity (cooperator Kemin from IA), new *Double Corolla* mutant, Zebra Chip resistance in *bulbocastanum* (with R. Cooper in WA).

We tested all *S. verrucosum* accessions for crossability to *S. jamesii* through mentor pollination (right).



Testing *S. jamesii* introgress with *verrucosum*

C. Classification

Dr. Spooner is working on monographs that will fully document the taxonomic reduction of the genebank's holdings to about 100 species.

D. Distribution service



Distribution of germplasm is at the heart of our service. The volume and types of stocks sent to various consignee categories are summarized in the table below. In 2014, we had 200 domestic orders to clients in 37 states and 18 foreign orders to 9 other countries. Half of the domestic orders are for breeding and genetics, ¼ for home gardeners, and remainder ¼ for pathology, physiology, entomology, taxonomy and education.

In 2014 we maintained the popular offering of 100 cultivars as tubers by devising and implementing an iron-clad disease control and quarantine program for their production (full details available at our website).



Category	Units of Germplasm Sent ¹							Total	PIs
	Seed	TU	TF	IV	DNA	Plants	Herb		
Domestic	2282	2212	21	1149	282	24		5970	4463
Foreign	122			328				450	232
Total	2404	2212	21	1477	282	24		6420	4695

¹ Types of stocks sent/(number of seeds, tubers or plantlets per standard shipping unit): Seed= True Seeds/(50), TU = Tuber families/(12), TC = Tuber Clones/(3), IV = *in vitro* stocks/(3), DNA = dried leaf samples/(1), Plants = rooted cuttings /(1), Herb= herbarium specimens/(1).

E. Outreach

Media coverage, Tours, Teaching, TechTran and Trips with presentations done

Summer student interns participated in experiments: Ahna Keilar (seed germ and seedling transplant tech), Abe Keilar (crossing tech for jam and blb), Hannah Haight (prebiotic assay and nutrient microbial bioassays), Rosa Lozano, (Colombian student visitor for *Criolla* potatoes).

Potato Association of America meeting in Spokane-- research presentations/abstracts.

Chinese, Russian, and Japanese potato scientists, UW River Falls Horticulture students, and Southern Door HS Spanish class tour genebank.



Staff Horticulturist T. Kazmierczak and visiting Colombian student Rosa Lozano

Leadership: Bamberg continued as Editor in Chief for the American Journal of Potato Research, and Chair of the USDA/ARS Potato Crop Germplasm Committee.

Reports & Plans: ARS: PGO, CGC, CRIS, Annual Performance, Budget. NRSP6: Annual Report, TAC meeting minutes, Project Renewal FY16-20. PAA: AJPR Editor in Chief report. UW-Hort: Annual Performance. PARS: Tour guide & field book.

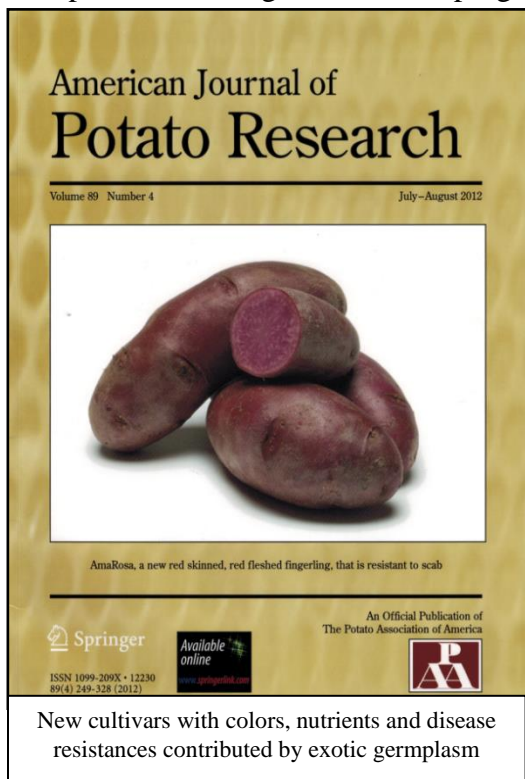
Management of Grants & Awards: Potato CGC grants, AJPR Outstanding Paper

IMPACT STATEMENT

In 2014, seed increase success and distributions were steady, supporting the needs of the nation and world for resources to genetically improve the potato crop.

As the most consumed and most valuable US vegetable, potato substantially influences the farm economy and environment in many states. High value-added processing and high and regular consumption gives potato significant impact in all states with respect to the food economy and citizens' health.

Because potato has more useful exotic germplasm than any other crop, there is much activity in federal, state, and private breeding and research programs using genebank stocks. Potato is a high input crop with many

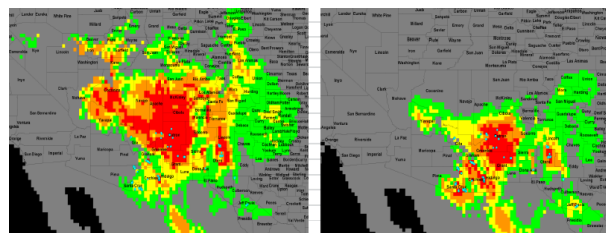


opportunities of improvement that can be addressed by germplasm. Potato is a prohibited import crop, so genetic resources already in the US genebank are the only ones readily available to germplasm users. Continuing restrictions on international germplasm collecting and sharing make what we already have at NRSP6 even more precious. NRSP6 is the premier potato genebank in the world, and the only program in the nation responsible for providing these potato genebank services.

The payoff in funding the genebank is in discovering and deploying traits that are useful to the public and the industry. We participated in successful selection of better stocks for golden flesh, frost resistance in Peruvian highlands, folate, potassium, resistance to tuber greening, glycoalkaloids, and a natural appetite suppressing protein. Many new cultivars were published this year: Yukon Gem, Classic Russet, Clearwater Russet, Alta Crown, Cooperation-88, Alpine Russet, Sentinel, Huckleberry Gold, Teton Russet, Elkton, M7 Germplasm Release, AmaRosa, Purple Pelisse, Owyhee Russet, Palisade Russet, Saikai 35. They all have NRSP6 exotic germplasm in their pedigrees, including species *S. andigena*, *acaule*, *chacoense*, *demissum*, *infundibuliforme*, *phureja*, and *vernei*.

Salary and travel support plus cash gifts from industry totaled \$45K in 2014.

The ability to efficiently evaluate traits is rapidly improving. We are on the brink of a leap forward in breeding through molecular markers and genetic technology. Potato is an increasingly important world food. Climate is changing, and health issues and their economic impact are increasing in our aging population. Because of these factors, there has never been a more important (or exciting) time to be involved in



Modeling expected changes in suitable habitats for potato

improving potato through mining the rich deposits of traits in the US Potato Genebank.

WORK PLANS / STAFF & FUNDING / ADMINISTRATION

In FY15, we plan to continue the service program to acquire, preserve, classify, and promptly distribute high quality germplasm and data to all requesters. We will endeavor to say "yes" to requests for custom service and advice whenever we are able.

We plan to restore the ½ position of A. del Rio that was cut due to funding shortfalls in recent years, thus rebuilding our program in the area of genetic diversity management research (making use of the new, more powerful DNA markers now available), collecting research (predicting sites likely threatened by climate change), and benefit sharing collaborations with Andean germplasm donor countries (in particular, the successful frost resistance breeding effort in Puno).

We expect to continue participation in "teaching" activities by hiring summer student interns who learn about potato science and help us explore promising new research and technology ideas (this has resulted in students participating in germplasm collecting, formal presentations at PAA, and authorship on peer reviewed publications). Rapport with potato science and scientists will be maintained by service as editor of American Journal of Potato Research, and participation in the Potato Association of America.

We expect to continue the service to industry partners that has been attracting their strong support, and similarly maintain strong ties with our sister genebanks around the world.

We intend to seek opportunities to evaluate and deploy germplasm in ways that impact the consumer, notably with respect to nutritional traits, thus enhancing the reputation, demand, and positive health and economic impact of the potato crop on society.

We expect to continue and expand approaches to evaluation and technology that multiply information gathering:

1. Multiple data collection schemes for a single grow-out, multiplex testing.
2. Synergistic cooperation with specialists in various disciplines, and Latin American projects for benefit sharing and developing systems for testing germplasm that mitigates impact of climate change.
3. Testing for links between easily assessed traits and more difficult traits.
4. Making use of our *in vitro* facilities and expertise to investigate microbial bioassays and selecting agents.
5. Characterizing visual (cog), genetic, geographic, and trait differences within species as predictors of germplasm application
6. DNA-based tests for assessing genetic diversity with respect to collecting and preservation techniques, and climate change.



PUBLICATIONS

Many other scientists are publishing research that directly or indirectly originated from NRSP6 stocks. Publications that mention potato species (both old and new taxonomy) are likely to have such a connection to USPG germplasm and service. The search below produced hits which the reader can regenerate independently, or which can be accessed through our website: <http://www.ars-grin.gov/nr6>.

Staff publications (for 2014 and previous) which give details on the initiatives summarized above can be accessed through the personnel links for Bamberg, Spooner, and Jansky at the genebank website.

The search below does not catch cultivars, breeding stocks and genetic stocks, which have some 900 particular names to search, or are *tuberosum* and therefore more likely to be of independent origin. Note that even when the publication is of foreign origin, and the researcher probably received materials from another genebank, that foreign genebank may have originally received those materials from USPG. Since potato research and breeding is a slow process, materials published in 2014 could, of course, have been ordered many years previously. Similarly, these articles may only cite previous work with exotic species as related background information published by others, not because they were the materials used in the present experiment.

Digitop > browse by type: Databases > AGRICOLA > (log in) > cut and paste string below into "simple search" box > click "go"

This hits records in Agricola or CAB abstracts: 208 in CY2012, and 158 in CY2013

Solanum and (abancayense or acaule or achacachense or acroglossum or acroscopicum or aemulans or agrimonifolium or ajanhuii or alandiae or albicans or albornozi or ambosinum or andreanum or arnezii or astleyi or avilesii or aymaraesense or berthaultii or blanco-galdosii or boliviense or brachistotrichum or brachycarpum or brevicale or buesii or bukasovii or bulbocastanum or burkartii or cajamarquense or canasense or candolleanum or capsicibaccatum or cardiophyllum or chacoense or chancayense or chilliasense or chillonanum or chiquidenum or chomatophilum or circaefolium or clarum or coelestipetalum or colombianum or commersonii or contumazaense or curtilobum or demissum or doddsii or dolichocremastrum or edinense or edinense or ehrenbergii or etuberosum or fendleri or fernandezianum or flahaultii or gandarrillasii or garcia-barrigae or gourlayi or guerreroense or hintonii or hjertingii or hondelmannii or hoopesii or hougassii or huancabambense or hypacrarthrum or immite or incamayoense or infundibuliforme or iopetalum or irosinum or jamesii or juzepczukii or kurtzianum or laxissimum or leptophyes or leptosepalum or lesteri or lignicaule or limbaniense or lobbianum or longiconicum or macropilosum or maglia or malmeanum or marinasense or matehualae or medians or megistacrolobum or michoacanum or microdontum or minutifoliolum or mochiquense or morelliforme or moscopanum or multidissectum or multiinterruptum or nayaritense or neocardenasii or neorossii or neovalenzuelae or okadae or oplocense or orocense or orophilum or otites or oxycarpum or palustre or pampasense or papita or paramoense or pascoense or paucijugum or paucissectum or phureja or pinnatisectum or piurae or polyadenium or polytrichon or raphanifolium or rechei or sambucinum or sanctae-rosae or sandemanii or santolallae or scabrifolium or schenckii or soestii or sogarandinum or solisii or sparsipilum or spegazzinii or stenophyllidium or stoloniferum or subpanduratum or sucrense or sucubunense or tarijense or tarnii or trifidum or tundalomense or tuquerrense or ugentii or velardei or venturii or vernei or verrucosum or violaceimarmoratum or weberbaueri or yungasense or gonicalyx or stenotomum or andigenum or andigena or (USDA and "Solanum tuberosum")) (doc-type:Articles or doc-type:Books) pub-year:2013