

# ANNUAL REPORT

Calendar Year 2002

## 1. NRSP-6: INTER-REGIONAL POTATO INTRODUCTION PROJECT

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

## 2. COOPERATIVE AGENCIES AND PRINCIPAL LEADERS

### State Agricultural Experimental Stations

### Representative

Southern Region		J. C. Miller, Jr.
Western Region	Chairman (2003)	A. R. Mosley
North Central Region	Secretary (2003)	D. S. Douches
Northeastern Region		

### United States Department of Agriculture

Agricultural Research Service		
Technical Representative	Vice Chair (2003)	C. R. Brown
National Program Staff		P. K. Bretting
Area Director, Midwest Area		A. D. Hewings
Cooperative States Research Education & Extension Service		A. M. Thro
Animal and Plant Health Inspection Service		L. E. Levy
Inter-Regional Potato Introduction Project	Project Leader	J. B. Bamberg

### Agriculture Canada

T. R. Tarn

### Administrative Advisors

Southern Region		R. L. Westerman
Western Region		M. J. Burke
North Central Region	Lead	S. A. Slack
Northeastern Region		S. D. Reiling

### **3. PROGRESS AND PRINCIPAL ACCOMPLISHMENTS**

#### **A. Introduction of New Stocks**

Dr. Bamberg, accompanied by Charles Fernandez (US Potato Genebank); Dr. Chuck Brown (USDA, Prosser WA); and Dr. Joe Pavek (USDA, Retired), participated in a successful expedition to the southwest United States and obtained 19 new accessions for the collaborative intergenebank research project, and collected additional populations for screening of Columbia root-knot nematode.

A total of 73 seed accessions were assigned PI numbers in 2002: 16 from Russia, 27 from Poland, 11 from Bolivia, and 19 from the SW United States. Six clonal accessions were assigned PI numbers in 2002: 4 from Mexico, 1 from Poland, and 1 from Bolivia. These accessions are now available from the NRSP-6 *Solanum* germplasm collection.

#### **B. Preservation and Increase of Stocks**

In 2002, a total of 91 accessions were increased as botanical seed populations.

A total of 600 potato spindle tuber viroid (PSTV) tests were performed on seed increase parents, seed lots and research materials. Germination tests were performed on 1,106 accessions; ploidy determinations were made on 30 accessions.

Research continues on the use of 2,4-D on pollinated flowers to help with fruit retention and seed production. Growth retardants are being assessed for use as tuber and flower promoters in the wild species and as a method to control plant height in greenhouse and screenhouse-grown plants for crossing.

The Association of Potato Intergenebank Collaborators (APIC) constructed a database of all wild potato holdings of the potato genebanks in Argentina, Europe, Peru, and the United States. The Intergenebank Potato Database (IPD) ([www.potgenebank.org/ipd/](http://www.potgenebank.org/ipd/)) continues to be a very useful resource for clientele around the world. Dr. Alfonso del Rio represented NRSP-6 at the APIC meeting in Hamburg, Germany.

A study was completed comparing germplasm from the Russian (VIR) and United States (NRSP-6) "duplicate" accessions. Most are significantly different. Work continues on comparisons between US and CIP collections. The next step in the study will be to look at DNA comparisons to variation in trait expression or frequency between intergenebank seedlots.

Work continued with Dr. C. Miller's lab screening for antioxidants in uncolored wild potato species' tubers. Previous screening among species identified ones with promising levels of tuber antioxidant capacity. Some diploid "Mexican" species seem to have high antioxidant in common: *S. cardiophyllum*, *S. jamesii*, and *S. pinnatisectum*. These and other species were retested with multiple PIs. Variation within promising PIs was also studied. Only *S. pinnatisectum* demonstrated particularly consistent high levels within populations.

Cold resistant breeding work continues with recurrent selection of *S. tuberosum*, *S. acaule* and *S. commersonii* hybrids. Materials are now maturing earlier with the introgression of very early varieties and which survive in vitro leaf freezing to  $-5^{\circ}\text{C}$ . Selections were planted at Copic Bay, Oregon area in the summer of 2002. The best selections will be submitted to UW Madison colleagues for more focused lab assessments.

Late Blight screening at a field site very close to Lake Michigan (cool temperatures and high humidity) was completed for a second year. In 2001, two highly segregating PIs of *S. microdontum* 473170 and *S. okadae* 458367 and their F2 hybrids were tested. There was a 70% correlation with previous results on the same clones at Cornell by Bill Fry, so this local test will be useful to verify resistance of newly imported germplasm. In 2002, Polish, Russian, Mexican and CIP introductions were tested.

Geographical parameters and proximity to related species predict genetic variation in the inbred potato species *Solanum verrucosum*. Such links had not been previously detected in *S. fendleri*, *S. jamesii* or *S. suurense*. Resolution and fine-tuning to locations may be enhanced by inbreeding and uniformity. The highest correlations to genetic rarity (a population's average genetic difference from all others) were latitude, longitude and proximity to the nearest *S. hjertingii* population.

### **C. Classification**

Dr. Spooner continues to resolve problems in taxonomic classification that impede both efficient documentation and use of the germplasm. At present Dr. Spooner, in collaboration with Dr. R van den Berg, Dr. R. Hijmans, and Dr. A. Rodriguez, is working on a book of Wild Potato Species of North and Central America, which will be a valuable tool for germplasm users worldwide.

### **D. Distribution**

NRSP-6 distributed 3,447 units of seed, 643 tuber families, 919 in vitro stocks and 215 herbarium samples to clientele in 20 states of the United States and 14 other countries. Internally, NRSP-6 used 6,371 units of seed for chromosome counts, germination tests, identification and taxonomic check plantings, in vitro maintenance, seed increases, PSTV tests, and miscellaneous plantings. The volume and types of stocks sent to various consignee categories are summarized in the table below.

**VOLUME AND TYPES OF STOCKS DISTRIBUTED**

Category	Units <sup>1</sup>						PIs
	S	TF	TS	IVS	HERB	TOTAL	
Domestic	3,165	613	186	583	215	4,762	4,074
Foreign	282	30	293	336	0	941	704
NRSP-6 <sup>2</sup>	6,367	0	1	3	0	6,371	2,384
Total	9,814	643	480	922	215	12,074	7,162

<sup>1</sup> Types of stocks sent/(number of seeds, tubers or plantlets per standard shipping unit): S= True Seeds/(50), TF= Tuber Families/(10), TS=Tuber Stocks/(3), IVS=In Vitro Stocks/(1), Herbarium/(1).

<sup>2</sup> Includes chromosome counts, germination tests, ID and Taxonomic check plantings, in vitro maintenance, seed increases, PSTV tests, miscellaneous plantings, and NSSL seed backup.

**G. Visitors From Other Countries**

Ms N. Gomez	Panama
Dr. P. Anderson	Peru
Dr. J. Prohens	Spain
Dr. Y. Hosaka	Japan

**4. USEFULNESS OF FINDINGS**

NRSP-6's purpose is to provide a ready source of raw materials, technology and information to support potato enhancement, breeding and research in the US and around the world. Thus, one way the success of NRSP-6 can be measured is by the use of NRSP-6 germplasm in the pedigrees of new, improved potato cultivars. Another is in the use of NRSP-6 stocks in more basic research programs, which also ultimately contribute to human utilization of the potato crop, these being reflected in publications.

Five cultivar releases were published in the American Journal of Potato Research in 2002: 'AC Sunbury', 'IdaRose', 'Red Companion', 'Gem Russet', and 'Bannock Russet'. All are known to have wild species in their pedigrees.

Section 6 lists 124 papers, 32 abstracts, 1 poster, and 3 theses which report the use of NRSP-6 *Solanum* introductions this year.

**5. WORK PLANNED FOR 2003**

Evaluation experiments will be continued on *Solanum* species for the following traits: antioxidants, frost hardiness, rooting vigor, tuber calcium, late blight resistance, hormone mutants, and glycoalkaloids.

The general objective of NRSP-6, to promote and facilitate potato research and breeding, will be pursued by continuing high quality service with respect to introduction, preservation, classification, evaluation, and distribution of potato germplasm to clients in the U.S. and around the world.

APIC intergenebank projects researching the status and dynamics of genetic diversity in the collection using RAPDs and strengthening ties with sister genebanks around the world will be continued.

## **6. PUBLICATIONS ISSUED DURING THE YEAR**

### **A. Publications issued by NRSP-6 Personnel**

- del Rio, A.H. and J.B. Bamberg. 2002. Lack of association between genetic and geographic origin characteristics for the wild potato *Solanum sucrense* Hawkes. *Am. J. Potato Res.* 79:335-338.
- Hijmans, R.J., D.M. Spooner, A.R. Salas, A. Guarino, and J. de la Cruz. 2002. Atlas of wild potatoes. Systematic and Ecogeographic Studies on Crop Genepools, International Plant Genetic Resources Institute, Rome 10:i-ix, 1-129.
- Huaman, Z. and D.M. Spooner. 2002. Reclassification of landrace populations of cultivated potatoes (*Solanum* sect. *Petota*). *Am. J. Bot.* 89:947-965.
- Raker, C. and D.M. Spooner. 2002. The Chilean tetraploid cultivated potato, *Solanum tuberosum*, is distinct from the Andean populations; microsatellite data. *Crop Sci.* 42:1451-1458.
- Rodriguez, A. and D.M. Spooner. 2002. Subspecies boundaries of the wild potatoes *Solanum bulbocastanum* and *S. cardiophyllum* based on morphological and nuclear RFLP data. *Acta Mexicana* 61:9-25.
- Spooner, D.M. 2002. Strengths and weaknesses of molecular markers for studies of diversity in genebank holdings. In: Proceedings of the International Workshop on: Aplicaciones de los marcadores moleculares en la conservacion y manejo de la agrobiodiversidad, International Potato Center, CIP, Lima, Peru.
- Spooner, D.M., R.G. van den Berg, G. Bryan, and A. del Rio. 2002. Reduction of species in the wild potato *Solanum* section *Petota* series *Longipedicellata*: AFLP, RAPD and chloroplast SSR data. XXVI<sup>th</sup> International Horticultural Congress, Toronto, ON, Canada, August 11-17, 2002, pp. 114-115. (Abstract)
- van den Berg, R.G., G. Bryan, A. del Rio, and D.M. Spooner. 2002. Reduction of species in the wild potato *Solanum* section *Petota* series *Longipedicellata*: AFLP, RAPD and chloroplast SSR data. *Theor. Appl. Genet.* 105:1109-1114.

**B. Journal Articles and Abstracts Reporting Research with NRSP-6 Stocks**

- Adams, J.S. 2002. Banking on Genes: Preserving the traits of today for the potato of tomorrow. *Potato Grower* (November): 26-28.
- Ahloowalia, B.S. 2000. Global conference on potato, New Delhi, India, 6-11 December 1999. *AgBiotechNet* 2(ABN049):1-4.
- Ahn YulKyun, Kim HeiYoung, Choi HakSun, Kim KiTaek, and Park HyoGuen. 2001. Production of interspecific somatic hybrids between the cultivated potato (*Solanum tuberosum*) and the wild species (*S. brevidens*). *J. Korean Soc. Hort. Sci.* 42(4):420-424.
- Ahn YulKyun, Sin JiYoung, Lee DongWoo, Om YoungHyun, and Park HyoGuen. 2001. Characteristics of interspecific somatic hybrids between *Solanum brevidens* and *S. tuberosum* ('Superior', 'Dejima', and dihaploid of 'Superior'). *J. Korean Soc. Hort. Sci.* 42(4):425-429.
- Ahn YulKyun, Kang JuChang, Kim HeiYoung, Lee SeungDon, and Park HyoGuen. 2001. Resistance to blackleg and tuber soft rot in interspecific somatic hybrids between *S. brevidens* and *S. tuberosum* ('Superior', 'Dejima', and dihaploid of 'Superior'). *J. Korean Soc. Hort. Sci.* 42(4):430-434.
- Ahn YulKyun, Bang JaeWook, Choi GookSeoun, and Park HyoGuen. 2001. Introgression of resistance to PLRV and PVY from *Solanum brevidens* into *S. tuberosum* ('Superior', 'Dejima', and dihaploid of 'Superior') by interspecific somatic hybrids. *J. Korean Soc. Hort. Sci.* 42(6):707-711.
- Ahn Yul-Kyun, Bo-Sun Kim, Jae-Wook Bang, and Hyo-Guen Park. 2002. Cytogenetic analysis of somatic hybrids between *Solanum brevidens* and *S. tuberosum* ('Superior', 'Dejima', and dihaploid of 'Superior') by GISH. XXVI<sup>th</sup> International Horticultural Congress, Toronto, ON, Canada, August 11-17, 2002, p. 110. (Abstract)
- Anjum, M.A. 2001. Cytology of potato callus cells in relation to their frost hardiness. *Biologia Plantarum* 44(3):325-331.
- Ashouri, A., D. Michaud, and C. Cloutier. 2001. Recombinant and classically selected factors of potato plant resistance to the Colorado potato beetle, *Leptinotarsa decemlineata*, variously affect the potato aphid parasitoid *Aphidius nigripes*. *Biocontrol* 46(4):401-418.
- Audy, Patrice, Richard Tarn, and Agnes Murphy. 2002. Identification of a differential gene expression pattern related to resistance to potato late blight. XXVI<sup>th</sup> International Horticultural Congress, Toronto, ON, Canada, August 11-17, 2002, pp. 110-111. (Abstract)

- Barone, A., J. Li, A. Sebastiano, T. Cardi, and L. Frusciante. 2002. Evidence for tetrasomic inheritance in a tetraploid *Solanum commersonii* (+) *S. tuberosum* somatic hybrid through the use of molecular markers. *Theor. Appl. Genet.* 104(4):539-546.
- Ballvora, A., M.R. Ercolano, J. Weiss, K. Meksem, C.A. Bormann, P. Orberhagemann, F. Salamini, and C. Gebhardt. 2002. The *R1* gene for potato resistance to late blight (*Phytophthora infestans*) belongs to the leucine zipper/NBS/LRR class of plant resistance genes. *Plant J.* 30(3):361-371.
- Bisognin, D.A., D.S. Douches, K. Jastrzebski, and W.W. Kirk. 2002. Half-sib progeny evaluation and selection of potatoes resistant to the US8 genotype of *Phytophthora infestans* from crosses between resistant and susceptible parents. *Euphytica* 125(1):129-138.
- Boluarte-Medina, T. and R.E. Veilleux. 2002. Phenotypic characterization and bulk segregant analysis of anther culture response in two backcross families of diploid potato. RAPD markers for androgenesis in potato. *Plant Cell, Tissue and Organ Culture* 68(3):277-286.
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- Bradeen, J.M., S.K. Naess, J. Song, S.M. Wielgus, and G.T. Haberlach. 2002. Analysis of 300kb of genomic sequence associated with late blight resistance of potato. XXVI<sup>th</sup> International Horticultural Congress, Toronto, ON, Canada, August 11-17, 2002, p. 117. (Abstract)
- Bradshaw, J.E., A.K. Lees, and H.E. Stewart. 2000. How to breed potatoes for resistance to fungal and bacterial diseases. *Pl. Breed. Seed Sci.* 44(2):3-20.
- Brown, C.R., H. Mojtahedi, and G.S. Santo. 2002. Characteristics of resistance to Columbia root-knot nematode introgressed from several Mexican and North American wild potato species. XXVI<sup>th</sup> International Horticultural Congress, Toronto, ON, Canada, August 11-17, 2002, p. 116. (Abstract)
- Bryan, G.J., K. McLean, J.E. Bradshaw, W.S. de Jong, M. Phillips, L. Castelli, and R. Waugh. 2002. Mapping QTLs for resistance to the cyst nematode *Globodera pallida* derived from the wild potato species *Solanum vernei*. *Theor. Appl. Genet.* 105(1):68-77.
- Bu QingYun, Lu WenHe, Chen YiLi, Tian XingYa, Wang FengYi, and Qin Xin. 2002. Evaluation of some newly developed diploid hybrids and their breeding value in 4x-2x crosses. *J. NE Ag. Univ. (English Edition)* 9(1):35-41.

- Capo, A., M. Cammareri, F. Della Rocca, A. Errico, A. Zoina, and C. Conicella. 2002. Evaluation for chipping and tuber soft rot (*Erwinia carotovora*) resistance in potato clones from unilateral sexual polyploidization (2x x 4x). *Am. J. Potato Res.* 79:139-145.
- Cardi, T., M. Mazzei, and L. Frusciante. 2000. Multivariate analysis of variation in the field of tetraploid and (hypo)-hexaploid *Solanum commersonii* (+) *S. tuberosum* somatic hybrids. *Italian J. Agronomy* 4(2):67-74.
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- Carputo, D., L. Frusciante, L. Monti, M. Parisi, and A. Barone. 2002. Tuber quality and soft rot resistance of hybrids between *Solanum tuberosum* and the incongruent wild relative *S. commersonii*. *Am. J. Potato Res.* 79:345-352.
- Chani, E., V. Ashkenazi, J. Hillel, and R.E. Veilleux. 2002. Microsatellite marker analysis of an anther-derived potato family: skewed segregation and gene-centromere mapping. *Genome* 45:236-242.
- Christ, B.J., K.G. Haynes, and B.T. Vinyard. 2002. Inheritance of early blight resistance from open-pollinated 4x-2x potato hybrids. *Am. J. Potato Res.* 79:403-410.
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- Cook, R. and G.R. Noel. 2002. Cyst nematodes: *Globodera* and *Heterodera* species. In: *Plant resistance to parasitic nematodes* [J.L. Starr, R. Cook, and J. Bridge, Eds.]. CABI Publishing 71-105.
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- Culley, D.E., B.B. Dean, and C.R. Brown. 2002. Introgression of the low browning trait from the wild Mexican species *Solanum hjertingii* into cultivated potato (*S. tuberosum* L.). *Euphytica* 125(3):293-303.
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- Dinu, I.I. and C.A. Thill. 2002. Cytological analysis of a *S. pinnatisectum* – *S. tuberosum* bridging genotype developed by EBN manipulation and sexual crosses. Presented at 86<sup>th</sup> Annual PAA Meeting, XXVI<sup>th</sup> International Horticultural Congress, Toronto, ON, Canada, August 11-17, 2002. *Am. J. Potato Res.*: In Press. (Abstract)
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- Hayes, R.J. and C.A. Thill. 2002. Introgression of cold (4 C) chipping from 2x (2 Endosperm Balance Number) potato species into 4x (4EBN) cultivated potato using sexual polyploidization. *Am. J. Potato Res.* 79:421-431.
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- Helgeson, J.P. and G.T. Haberlach. 2002. Useful lessons learned from somatic hybrids. XXVI<sup>th</sup> International Horticultural Congress, Toronto, ON, Canada, August 11-17, 2002, p. 122. (Abstract)
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**7. APROVED**

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A. R. Mosley, Chairman, Technical Committee

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Date

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S. A. Slack, Lead Administrative Advisor

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Date