ANNUAL REPORT

Calendar Year 1994

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

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

2. COOPERATIVE AGENCIES AND PRINCIPAL LEADERS

State Agricultural Experimental Stations	**Representative**
North Central Region	F. I. Lauer
Western Region	A. R. Mosley
Southern Region	J. C. Miller, Jr.
North Eastern Region	A. F. Reeves

United States Department of Agriculture	
Agricultural Research Service	
Technical Representative	J. J. Pavek
National Program Staff	H. L. Shands
Area Director, Midwest Area	R. L. Dunkle
Cooperative States Research Service	D. R. Tompkins
Animal and Plant Health Inspection Service	A. T. Tschanz
Inter-Regional Potato Introduction Project	J. B. Bamberg

Agriculture Canada	T. R. Tarn

Administrative Advisors	
North Central Region, Chairman	R. L. Lower
Western Region	V. V. Volk
Southern Region	D. T. Smith
North Eastern Region	R. C. Seem

3. PROGRESS AND PRINCIPAL ACCOMPLISHMENTS

A. Introduction of New Stocks

Dr. Spooner participated in a successful collecting expedition to Bolivia in the winter of 1994 (Jan. 1 - Feb. 26) with Dr. van den Berg (The Netherlands), Dr. Garcia-Fernandez (Bolivia), and Dr. Luisa-Ugarte (Bolivia). This joint collecting expedition procured 47 accessions. The purpose of this trip was to recollect in many of the localities visited in the 1993 Bolivia expedition where no seeds or tubers could be found due to unseasonably wet weather. This collection will be increased at the German/Dutch genebank and shared among all cooperating agencies. Forty-four herbarium specimens were added to the NRSP-6 herbarium, PTIS.

Dr. Bamberg had a successful trip to SW Arizona to observe reproductive behavior of the native wild potato species and collected 8 additional germplasm samples (from diverse sites not previously represented in the genebank). This work is part of the intergenebank research project to investigate genetic drift in nature versus genebank maintenance.

B. Preservation and Increase of Stocks

In 1994, 207 accessions were increased. Ninety-seven accessions were received from U.S. Quarantine for a joint seed increase and Quarantine virus testing at NRSP-6. Of the 97 accessions 26 failed to germinate, 5 were not released by quarantine and 66 are being incorporated into the NRSP-6 inventory.

There were 58 new PI numbers assigned in 1994: 18 late blight breeding stocks from CIP, 19 accessions collected by Dr. Spooner in South America and 21 accessions from other South American collections.

This year a total of 1,344 potato spindle tuber viroid (PSTV) tests were performed on seed increases, seed lots and research materials. Germination tests were performed on 1,186 accessions. Many accessions were concurrently used for PSTV testing of new seedlots, field plantings for testing seedlot purity, or research plantings.

A new catalog, Elite Selections of Tuber-bearing *Solanum* Species Germplasm, was published. It is based on evaluation for disease, pest, and stress resistance of NRSP-6 stocks, listing the most resistant accessions for each. The complete evaluation dataset is also available in electronic form, hard copy, or on the GRIN (Genetic Resource Information Network) system.

C. Classification

Taxonomic determinations were performed on numerous plantings by Dr. Spooner. Dr. Spooner also continues taxonomic research on species relationships through international collaboration with Dr. Clausen (Argentina), R. Castillo (Ecuador), Dr. van den Berg (Netherlands), and A. Rodrigues (Mexico). These studies will provide a more stable and meaningful taxonomy for NRSP-6 stocks in the future.

D. Distribution

NRSP-6 distributed 5,348 units of seed (50 seeds per unit), 829 tuber families and 837 in vitro stocks to clientele in 18 states of the United States and 17 other countries. Internally, NRSP-6 used 12,989 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

	Units[1]				
Category	S	TF	IVS	TOTAL	PI'S
Domestic	4,046	303	718	5,067	3,587
Foreign	1,302	526	115	1,943	900
NRSP-6[2]	12,989	0	4	12,993	2,382
Total	18,337	829	837	20,003	6,869

1 Types of stocks sent/(number of seeds, tubers or plantlets per standard shipping unit): S= True Seeds/(50), TF= Tuber Families/(10), IVS=in vitro stocks/(1).

2 Includes chromosome counts, germination tests, ID and Taxonomic check plantings, in vitro maintenance, seed increases, PSTV tests, and miscellaneous plantings.

E. Evaluation of Stocks

Mission

The project's mission with respect to evaluation is to locate and characterize useful traits so that the best materials and most efficient approaches are available for subsequent germplasm enhancement.

1. Tuber Traits

Wild species do not produce tubers in the long days of North American summers, so their tuber traits cannot be assessed in the field. A project was initiated in 1993 in which wild accessions are being systematically crossed with adapted (cultivated) forms to produce F_2 true seed families. This moved the potential valuable tuber traits of species to a background in which they can be revealed. In the fall of 1993 the first tubers from our F_2 tuber traits project were harvested from the field. We also continue to produce the F_1 and F_2 seed lots for other accessions in the tuber traits project, and will advertise these to our cooperators as they become available.

2. Frost Hardiness

Work was continued on frost hardiness and its relationship to calcium uptake into the foliage, determination of the inheritance of cold tolerance among potato species, and methods of crossing this into cultivated forms.

3. Tuber Calcium

Progress was made on a stepwise "fine screening" program identifying species, then accessions within species, then individuals within accessions with outstanding ability to accumulate tuber calcium. This trait has been shown to be closely associated with resistance to important storage rots and other tuber quality traits. These materials will be powerful tools for studying physiology and genetics of the trait and for use in breeding.

4. Colorado Potato Beetle

The CPB project continues to examine the intra-population variation for various parameters of CPB resistance. Significant intra-accession variation was found for every parameter, even in extremely resistant families. The resistant clones within accessions will be intermated to determine if seedlots pure for “ultra-resistance” can be synthesized by selection.

5. GA Locus

Experiments were continued to characterize a gibberellin deficiency locus with respect to effects on yield, chipping and specific gravity. Gibberellin affects many economic traits of potato (sprouting, day-length adaptation, and carbohydrate accumulation). A better understanding of the genetic and physiological bases of these important traits will help to facilitate their improvement.

6. Male Fertility in Heat Stress

Continued screening for male fertility in heat stress identified one species combining abundant flowering and viable pollen even under severe heat stress. This trait should be valuable in True Potato Seed (TPS) production in hot climates and may have application in the tomato crop.

7. Nitrogen-use Efficiency

This project represents the first systematic evaluation of potato germplasm for nitrogen-use efficiency. A "mini-core" collection of 39 wild potato species was evaluated for biomass accumulation in field plots given low and normal nitrogen applications. Differences were found in species' ability to accumulate nitrogen at both low and normal nitrogen levels, exceeding those of the check varieties.

8. Bee Pollinations

Three non-compatible accessions of wild potatoes were grown in each of two screened cages in the field this summer. One hive of 10-15 bees (*Bombus impatiens*) was alternated between the two cages with one day of abstinence before being switched. Fruit and seed set was excellent, even for some accessions which are known to be difficult to increase via hand pollinations. Investigations will continue on the possibility of bee pollination for seed production.

9. Characterization for Utility Traits

The success of using *Solanum* germplasm for breeding is influenced by relative plant vigor, flowering, pollen shed and pollen viability. Relative scores for these parameters were published in the Elite Selections... publication. Characterization of the collection for these traits continues.

F. Inter-genebank Collaboration

In August, the fifth meeting of the Association of Potato Inter-genebank Collaborators (APIC) was held in St. Petersburg, Russia. St. Petersburg was chosen as the meeting site in order to meet Russian colleagues and get an overview of their programs and facilities so that they might be brought more closely into collaboration in the APIC organization. Participating genebanks were represented by R. Hoekstra (BGRC), J. Bamberg (NRSP-6), Z. Huaman (CIP), K. Schuler (GLKS), J. Hawkes (CPC), G. Razoryonov (VIR), S. Kiru (VIR), J. Frcek (Czech Republic), Dr. K. Budin (VIR), Dr. L. Gorbatenco (VIR), and J. Domkarova (VIR).

S. Kiru (VIR) gave an overview of their potato collection. They have about 3,500 wild species accessions, very rich in diversity but very poor with respect to seed quantities and virus diseases. Funding at this point is for maintenance only, no evaluation, virus testing or virus elimination.

Z. Huaman (CIP) reported on the status of the IPD (Intergene-bank Potato Database). Which now contains about 8,600 unique accessions and comprises 220 taxa, of which 50% are from 14 species. This database gives curators the first opportunity to assess need for seed increase, backup, collecting, and exchange, from a global perspective.

J. Bamberg reported on the joint APIC research project to measure genetic diversity in two model wild potato species. This year multiple polymorphic RAPD markers were developed for each family of the test materials. A complimentary field experiment was conducted, and the materials were scored for morphological characteristics which appear to vary within and among the families. Data is now being computerized and analyzed. This project is providing NRSP-6 and other cooperating international potato genebanks with the first empirical information about how to most efficiently manage and collect germplasm.

G. Visitors from Other Countries

Dr. Jose Buso, EMBRAPA, Brasillia, Brazil

Dr. Pramod Jha, Environmental Protection Council, Katmandu, Nepal

Dr. Uriel Maldonado, PICTIPAPA, Toluca, Mexico

Dr. Tom Stones, Potex LTD, Newcastle, England

Dr. Antonio Torres, EMBRAPA, Brasillia, Brazil

4. USEFULNESS OF FINDINGS

NRSP-6's purpose is to provide a ready source of raw materials, technology and information which 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 varietal releases were published in the American Potato Journal in 1994: 'A.C. Ptarmigan', 'Maine Chip', 'Goldrush', 'Prestile', and 'Russet Bake King'. All are known to have wild species' introductions in their pedigrees.

Section 6 lists 92 papers, 26 abstracts, and 9 theses reporting the use of NRSP-6 *Solanum* introductions this year.

5. WORK PLANNED FOR 1995

Dr. Spooner will participate in a collecting expedition to Guatemala in October and November 1995.

Participation in APIC will continue to improve exchange, quarantine, collection, documentation, technology transfer, safety backup and international relationships worldwide as related to potato germplasm. Specifically, we will publish and distribute the IPD (Intergene-bank Potato Database), and continue RAPD and morphological analysis of materials used in the joint research project. We will pursue the possibility of mapping the origins of the accessions in the IPD via computer and host Dr. Stepan Kiru (VIR) as a visitor to NRSP-6 in the summer of 1995, possibly in conjunction with the 7th meeting of APIC.

We plan to upgrade greenhouse compartments 1-5, replace Lexan hold down strips, install sidewalks, improve vents and thermostatic controls.

Research projects will continue with the goal of uncovering and characterizing useful traits in germplasm which can be utilized by other scientists (see Section E., *Evaluation...*).

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.

A. Publications issued by NRSP-6 Personnel

Bamberg, J. B. 1994. Allelism of endosperm balance number (EBN) in *Solanum acaule* and other wild potato species. Theor. Appl. Genet. 89:682-686.

Bamberg, J. B. 1994. Announcement: New catalog of potato germplasm available. Am. Potato J. 71:69.

Bamberg, J. B. 1994. Screening potato (*Solanum*) species for male fertility under heat stress. Am. Potato J. 71:660. (Abstract)

Bamberg, J. B. and D. M. Spooner. 1994. The United States Potato Introduction Station herbarium. Taxon 43:489-496.

Bamberg, J. B., Max W. Martin and J. J. Schartner. 1994. Elite selections of tuber-bearing *Solanum* species germplasm. Univ. Wisc. Press. 67 pp.

Bamberg, J. B., R. E. Hanneman, Jr., J. P. Palta, and J. F. Harbage. 1994. Using disomic 4x(2EBN) potato species' germplasm via bridge species *Solanum commersonii*. Genome 37:866-870.

Contreras-M., A., L. Ciampi, S. Padulosi, and D. M. Spooner. 1994. Potato germplasm collecting expedition to the Guaitecas and Chonos Archipelagos, Chile, 1990. Potato Res. 36:309-316.

Errebhi, Mohamed, Carl J. Rosen, Florian Lauer, and Max Martin. 1994. Evaluation of wild potato germplasm for nitrogen use efficiency. Am. Potato. J. 71:670-671 (Abstract)

Giannattasio, R. and D. M. Spooner. 1994. A reexamination of species boundaries between *Solanum megistacrolobum* and *S. toralapanum* (*Solanum* sect. *Petota*, series *Megistacroloba*): morphological data. Syst. Bot. 19:89-105.

Giannattasio, R. and D. M. Spooner. 1994. A reexamination of species boundaries and hypotheses of hybridization concerning *Solanum megistacrolobum* and *S. toralapanum* (*Solanum* sect. *Petota,* series *Megistacroloba*): molecular data. Syst. Bot. 19-106-115.

Longtine, C., J. Bamberg and E. Radcliffe. 1994. Fine screening *Solanum* accessions for resistance to Colorado potato beetle. Proc. 2nd Nat. IPM sym./workshop, April 21, Las Vegas, NV. (Abstract)

Spooner, D. M. and J. B. Bamberg. 1994. Potato genetic resources: Sources of resistance and systematics. Proc. of the Symp. "Potato Production: Can we break the chemical dependency?". Am. Potato J. 71:325-337.

Spooner, D. M., R. G. van den Berg and J. B. Bamberg. 1994. Examination of series and species boundaries of *Solanum* series *Demissa* and potentially related species in series *Acaulia* and series *Tuberosa* (Solanaceae: sect. Petota). Am. Potato J. 71:In press. (Abstract)

Spooner, D. M., R. G. van den Berg, M. L. Garcia, and W. Garcia. 1994. Bolivia, 1993/1994 potato germplasm collecting expeditions: new germplasm resources. Am. Potato J. 71:In press. (Abstract)

B. <u>Journal Articles and Abstracts Reporting Research with NRSP-6 Stocks</u>
(Note: Publications from previous years are included if missed in previous annual reports.)

Al-Saikhan, M. S., L. R. Howard and J. C. Miller Jr. 1994. Antioxidant activity and total phenolic content in different genotypes of potato (*Solanum tuberosum*, L.). J. Food Sci. (In press).

Balbyshev, N. F., B. Farnsworth, R. H. Johansen, and J. H. Lorenzen. 1994. Broadening the Genetic Base of CPB Resistance. Am. Potato J. 71(10):660. (Abstract)

Bani-Aameur, F., F. I. Lauer and R. E. Veilleux. 1992. Frequency of 2n pollen in diploid hybrids between *Solanum phureja* Juz. & Buk. and *Solanum chacoense* Bitt. Potato Res. 35(2):161-172.

Barone, A., D. Carputo and L. Frusciante. 1993. Selection of potato diploid hybrids for 2n gamete production. J. Genetics & Breeding 47(4):313-318.

Beck, C. I. and T. H. Ulrich. 1993. Environmental release permits: valuable tools for predicting food crop developments. Bio/Technology 11(13):1524-1528.

Birhman, R. K. and G. S. Kang. 1993. Analysis of variation and interrelationships in potato germplasm. Euphytica 68(1-2):17-26.

Bonierbale, M. W., R. L. Plaisted, O. Pineda, and S. D. Tanksley. 1994. QTL analysis of trichome-mediated insect resistance in potato. Theor. & Appl. Genet. 87(8):973-987.

Bonierbale, M., R. L. Plaisted and S. D. Tanksley. 1992. Applications of genome mapping in potato: a review. In: Proceedings of the Joint Conference of the EAPR Breeding & Varietal Assessment Section and the EUCARPIA Potato Section, Landerneau, France, 12-17 Jan 1992 (F. Rousselle-Bourgeois and P. Rousselle, Eds.).Ploudaniel, France; INRA 59-66.

Borisjuk, N., L. Borisjuk, G. Petjuch, and V. Hemleben. 1994. Comparison of nuclear ribosomal RNA genes among *Solanum* species and other Solanaceae. Genome 37(2):271-179.

Brown, Charles R., C.-P. Yang, H. Mojtahedi, and G. S. Santo. 1994. Mapping of Resistance to Columbia Root-Knot Nematode to a *Solanum bulbocastanum* Chromosome. Am. Potato J. 71(10):664. (Abstract)

Brown, Charles. 1994. Use of *Bombus occidentalis* to Pollinate Potato. Am. Potato J. 71(10):663-664. (Abstract)

Cardi, T., V. Iannamico, F. D'Ambrosio, E. Filippone, and P. F. Lurquin. 1993. *In vitro* regeneration and cytological characterization of shoots from leaf explants of three accessions of *Solanum commersonii*. Plant Cell, Tissue and Organ Culture 34(1):107-114.

Carputo, D., A. Barone, D. Consoli, and L. Frusciante. 1994. Use of seedling tubers from TPS in Southern Italy. Am. Potato J. 71(1):29-38.

Chauvin, L., P. Rousselle, C. Borgat, and F. Rousselle-Bourgeois. 1992. Production and characterization of potato somatic hybrids. In: Proceedings of the Joint Conference of the EAPR Breeding & Varietal Assessment Section and the EUCARPIA Potato Section, Landerneau, France, 12-17 Jan 1992 (F. Rousselle-Bourgeois and P. Rousselle, Eds.). Ploudaniel, France; INRA 94-96.

Clulow, S. A., M. J. Wilkinson and L. R. Burch. 1993. *Solanum phureja* genes are expressed in the leaves and tubers of aneusomatic potato dihaploids. Euphytica 69(1-2):1-6.

Colon, L. T., R. Eijlander, D. J. Budding, M. T. van Ijzendoorn, M. M. J. Pieters, and J. Hoogendoorn. 1993. Resistance to potato late blight (*Phytophthora infestans* (Mont.) de Bary) in *Solanum nigrum, S. villosum* and their sexual hybrids with *S. tuberosum* and *S. demissum*. Euphytica 66(1-2):55-64.

Corsini, D. L., J. J. Pavek, M. W. Martin, and C. R. Brown. 1994. Potato germplasm with combined resistance to leafroll virus and viruses X and Y. Am. Potato J. 71(6):377-385.

Douches, David S. and Rosanna Freyre. 1994. Identification of genetic factors influencing chip color in diploid potato (*Solanum spp.*). Am. Potato J. 71(9):581-590.

Franca, F. H. and W. M. Tingey. 1994. Influence of light level on the performance of the Colorado potato beetle on *Solanum tuberosum* L. and on resistance expression in *S. berthaultii* Hawkes. J. Am. Soc. Hort. Sci. 119:915-919.

Franca, F. H., R. L. Plaisted, R. T. Roush, S. Via, and W. M. Tingey. 1994. Selection response of the Colorado potato beetle for adaptation to the resistant potato, *Solanum berthaultii* Hawkes. Entomol. Exp. Appl. 73:101-109.

Franca, Felix H. and Ward M. Tingey. 1994. *Solanum berthaultii* Hawkes affects the digestive system, fat body and ovaries of the Colorado potato beetle. Am. Potato J. 71(6):405-410.

Freyre, R. and D. S. Douches. 1994. Isoenzymatic identification of quantitative traits in crosses between heterozygous parents: mapping tuber traits in diploid potato (*Solanum* spp.). Theor. & Appl. Genet. 87(7):764-772.

Frusciante, L., A. Barone, D. Consoli, C. Conicella, and L. M. Monti. 1992. 2n gametes for true seed production (TSP) in potato: basic and applied aspects. In: Angiosperm pollen and ovules (E. Ottaviano, D. L. Mulcahy, M. Sari Gorla, and G. B. Mulcahy, Eds.). New York, USA; Springer Verlag 274-278.

Fuchs, R. L., J. E. Ream, B. G. Hammond, M. W. Naylor, R. M. Leimgruber, and S. A. Berberich. 1993. Safety assessment of the neomycin phosphotransferase II (NPTII) protein. Bio/Technology 11(13):1543-1547.

Fuchs, R. L., R. A. Heeren, M. E. Gustafson, G. J. Rogan, D. E. Bartnicki, R. M. Leimgruber, R. F. Finn, A. Hershman, and S. A. Berberich. 1993. Purification and characterization of microbially expressed neomycin phosphotransferase II (NPTII) protein and its equivalence to the plant expressed protein. Bio/Technology 11(13):1537-1542.

Gebhardt, Christiane. 1994. RFLP mapping in potato of qualitative and quantitative genetic loci conferring resistance to potato pathogens. Am. Potato J. 71(5):339-345.

Gibson, R. W., J. Valkonen, E. Pehu, M. G. K. Jones, and A. Karp. 1992. Broad spectrum virus resistance in *Solanum brevidens* and its introduction by protoplast fusion to cultivated potato. In: Biotechnology: enhancing research on tropical crops in Africa (G. Thottappilly, L. M. Monti, D. R. Mohan Raj, and A. W. Moore, Eds.). Wageningen, Netherlands; Technical Centre for Agricultural and Rural Cooperation 305-312.

Giovannini, T., R. Alicchio and L. Concilio. 1993. Genetic analysis of isozyme and restriction fragment patterns in the genus *Solanum*. J. Genetics & Breeding 47(3):237-243.

Gopal, J. 1994. Flowering behavior, male sterility and berry setting in tetraploid *Solanum tuberosum* germplasm. Euphytica 72(1-2):133-142.

Goth, R. W., K. G. Haynes and D. R. Wilson. 1994. Evaluation of Potato Breeding Selections for Resistance to Late Blight. Am. Potato J. 71(10):673. (Abstract)

Goth, R. W., K. G. Haynes and D. R. Wilson. 1994. Verticillium wilt resistant germplasm: Release of Russet Clone B0169-56. Am. Potato J. 71(11):735-742.

Greenspan Gallo, L., S. A. Slack and R. Loria. 1994. An approach to field screening potato genotypes for potato leaf roll virus resistance. Am. Potato J. 71(2):115-125.

Hannapel, D. J. 1993. Nucleotide and deduced amino acid sequence of the 22-kilodalton cathepsin D inhibitor protein of potato (*Solanum tuberosum* L.). Pl. Phys. 101(2):703-704.

Hanneman, R. E. Jr. 1994. Assignment of Endosperm Balance Numbers to the tuber-bearing Solanums and their close non-tuber-bearing relatives. Euphytica 74:19-25.

Hanneman, R. E. Jr. 1994. The testing and release of transgenic potatoes in the North American center of diversity. pp. 42-67. IN: Biosafety for Sustainable Agriculture: Sharing Biotechnology Regulatory Experiences of the Western Hemisphere (A. F. Krattiger and S. Rosemarin, Eds.). ISAAA, Ithaca & SEI, Stockholm.

Hartman, G. L. and J. G. Elphinstone. 1994. Advances in the control of *Pseudomonas solanacearum* race 1 in major food crops. In: Bacterial wilt: the disease and its causative agent, *Pseudomonas solanacearum* (A. C. Hayward and G. L. Hartman, Eds.). Wallingford, UK; CAB Internatl 157-177.

Hawkes, J. G. 1993. A Chilean wild potato species and the publication of its name, *Solanum maglia* (Solanaceae). Taxon 42(3):671-673.

Hosaka, K. 1993. Similar introduction and incorporation of potato chloroplast DNA in Japan and Europe. Jap. J. Genet. 68(1):55-61.

Hosaka, K. and R. E. Hanneman, Jr. 1994. Random amplified polymorphic DNA markers detected in a segregating hybrid population of *Solanum chacoense* x *S. phureja*. Jpn. J. Genet. 69:53-66.

Hutten, R. C. B., E. J. M. M. Scholberg, D. J. Huigen, J. G. T. Hermsen, and E. Jacobsen. 1994. Analysis of dihaploid induction and production ability and seed parent X pollinator interaction in potato. Euphytica 72(1-2):61-64.

Ishimaru, Carol A., Nora L. V. Lapitan, Anne VanBuren, Ann Fenwick, and Kristin Pedas. 1994. Identification of parents suitable for molecular mapping of immunity and resistance genes in *Solanum* species. Am. Potato J. 71(8):517-533.

Johansen, R. H., B. Farnsworth, G. A. Secor, N. C. Gudmestad, A. Thompson-Johns, and E. T. Holm. 1994. Goldrush: A new high quality Russet-skinned potato cultivar. Am. Potato J. 71(12):809-816.

Kao, T. H. 1992. Molecular genetics of gametophytic self incompatibility in Solanaceae. In: Angiosperm pollen and ovules (E. Ottaviano, D. L. Mulcahy, M. Sari Gorla, and G. B. Mulcahy, Eds.). New York, USA; Springer Verlag 66-74.

Kobayashi, Ruth S., Stephen L. Sinden and Lind L. Sanford. 1994. Effect of Ploidy on Foliar Glycoalkaloid Concentration and Colorado Potato Beetle Resistance in *Solanum Chacoense.* Am. Potato J. 71(10):680. (Abstract)

Lawson, D. R., W. A. Erb and A. R. Miller. 1992. Analysis of *Solanum* [*S. tuberosum* cv. Atlantic and *S. chacoense* tuber and leaf] alkaloids using internal standardization and capillary gas chromatography. J. Ag. and Food Chemistry 40(11):2186-2191.

Levy, David and Richard W. Veilleux. 1994. Screen for Heat Tolerance Among Complex 4x-2x Potato Hybrids in Israel. Am. Potato J. 71(10):68l. (Abstract)

Levy, David, Edna Fogelman, Alexandra Levine, and Itzhak Yehoshua. 1994. Tuberization In Vitro and Dormancy of Potato (*Solanum tuberosum* L.) Microtubers. Am. Potato J. 71(10):680-681. (Abstract)

Liu, C. A. and D. S. Douches. 1993. Production of haploids of potato (*Solanum tuberosum* subsp. *tuberosum*) and their identification with electrophoretic analysis. Euphytica 70(1-2):113-126.

Lojkowska, E. and M. Holubowska. 1992. The role of polyphenol oxidase and peroxidase in potato tuber resistance to soft rot caused by *Erwinia carotovora.* J. Phytopathology 136(4):319-328.

Lojkowska, Ewa and Arthur Kelman. 1994. Comparison of the effectiveness of different methods of screening for bacterial soft rot resistance of potato tubers. Am. Potato J. 71(2):99-113.

Longtine, C. A., E. B. Radcliffe, F. I. Lauer, and D. W. Ragsdale. 1994. Use of exotic *Solanum* germplasm to incorporate multiple-pest resistance in potato. II National Integrated Pest Management Symposium, 2:185, Las Vegas, Nevada.

Longtine, Craig, Edward Radcliffe, Florian Lauer, and David Ragsdale. 1994. Use of Exotic *Solanum* Species For Control of Green Peach Aphid, Potato Leafroll Virus, and Potato Virus Y. Am. Potato J. 71(10):682-683. (Abstract)

Love, Stephen L. 1994 Ecological risk of growing transgenic potatoes in the United States and Canada. Am. Potato J. 71(10):647-658.

Lynch, D. R. and G. C. Kozub. 1993. Effect of canopy size and shape on the tuber yield of sixteen potato genotypes. Annals of Appl. Bio. 123(1):93-103.

Lynch, D. R., C. Schaupmeyer, L. M. Kawchuk, T. R. Tarn, B. Rex, J. Holley, D. Waterer, J. Panford, and M. K. Pritchard. 1994. AC Ptarmigan: An early maturing potato cultivar with good chipping and fresh market quality. Am. Potato J. 71(6):387-393.

Maas, David L. and David S. Douches. 1994. Comparison of FDR- and SPR-Derived 4x Progeny. Am. Potato J. 71(10):685. (Abstract)

Martin, Robert R. 1994. Genetic engineering of potatoes. Am. Potato J. 71(5):347-358.

Misra, J. B., S. K. Anand and P. Chand. 1991. Evaluation of *Solanum tuberosum* ssp *andigena* germplasm for tuber yield, dry matter and protein contents. Narendra Deva J. Ag. Res. 6(1):103-107.

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7. **APPROVED**

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