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

Introduction, Classification, Preservation, Evaluation and Distribution of tuber-bearing \textit{Solanum} Species.

2. COOPERATIVE AGENCIES AND PRINCIPAL LEADERS

\begin{tabular}{|l|l|l|}
\hline
\textbf{State Agricultural Experimental Stations} & \textbf{Representative} \\
\hline
Southern Region & Vice Chairman (2001) & J. C. Miller, Jr. \\
Western Region & Secretary (2001) & A. R. Mosley \\
North Central Region & Chairman (2001) & D. S. Douches \\
North Eastern Region &  & A. F. Reeves \\
\hline
\end{tabular}

\textbf{United States Department of Agriculture}

Agricultural Research Service
- Technical Representative: C. R. Brown
- National Program Staff: P. K. Bretting
- Area Director, Midwest Area: A. Hewings
- Cooperative States Research Education & Extension Service: M. Fitzner
- Animal and Plant Health Inspection Service: A. T. Tschanz
- Inter-Regional Potato Introduction Project: Project Leader: J. B. Bamberg

\textbf{Agriculture Canada}

T. R. Tarn

\textbf{Administrative Advisors}

\begin{tabular}{|l|l|}
\hline
Northern Central Region & Lead & R. L. Lower \\
Western Region &  & M. J. Burke \\
Southern Region &  & E. Young \\
Northern Eastern Region &  & D. R. Mackenzie \\
\hline
\end{tabular}
3. PROGRESS AND PRINCIPAL ACCOMPLISHMENTS

A. Introduction of New Stocks

Dr. Spooner, in collaboration with Alberto Salas (CIP, Peru), and Robert J. Hijmans (CIP, Peru), participated in a successful expedition to collect wild species of potato in Honduras from August 27\textsuperscript{th} to September 4\textsuperscript{th}, and Panama from September 5\textsuperscript{th} to September 14\textsuperscript{th}, 2000. This collection trip resulted in 5 new accessions of *Solanum* species.

A total of 24 accessions were assigned PI numbers in 2000, and are now available from the NRSP-6 *Solanum* germplasm collection: 24 in vitro clones, 20 foreign varieties and 4 species.

B. Preservation and Increase of Stocks

In 2000, 147 accessions were increased as botanical seed populations.

This year a total of 876 potato spindle tuber viroid (PSTV) tests were performed on seed increase parents, seed lots and research materials. Germination tests were performed on 1141 accessions, and ploidy determinations were done on 90 accessions.

The spraying of 2,4-D on pollinated flowers to help in fruit retention and seed production looks promising. This fall, two accessions that had no fruit set after thousands of pollinations, produced fruit and seed after spraying the pollinated flowers with 2,4-D.

The Association of Potato Inter-genebank Collaborators (APIC) constructed a database of all wild potato holdings of the potato genebanks in Argentina, Europe, Peru, and the United States. The Inter-genebank Potato Database (IPD) is available on the internet ([www.potgenebank.org/ipd/](http://www.potgenebank.org/ipd/)) and was advertised in a published paper in AJPR Vol.77(6):353-359 covering the inception, importance, and the information available in the IPD.

Comparisons of routinely selected seedling transplants (those being the larger faster germinating plants), to the smaller or slower germinating ones with RAPDs revealed that using only the most vigorous seedlings results in genetic selection.
C. **Classification**

Dr. Spooner continues to resolve problems in taxonomic classification, which impede efficient documentation and use of the germplasm. This year an extensive study was conducted which suggests several species in the series Longipedicellata are not actually significantly different. Insights gained from this and similar studies will allow accessions to be assigned stable species names based on empirical differences.

D. **Distribution**

NRSP-6 distributed 8,433 units of seed, 51 tuber families and 1,074 in vitro stocks to clientele in 18 states of the United States and 17 other countries. Internally, NRSP-6 used 5,259 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.

<table>
<thead>
<tr>
<th>Category</th>
<th>Units</th>
<th>TF</th>
<th>IVS</th>
<th>FSG</th>
<th>TOTAL</th>
<th>PIs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic</td>
<td>4,184</td>
<td>51</td>
<td>838</td>
<td>180</td>
<td>5,253</td>
<td>4,114</td>
</tr>
<tr>
<td>Foreign</td>
<td>4,249</td>
<td>0</td>
<td>236</td>
<td>284</td>
<td>4,769</td>
<td>3,177</td>
</tr>
<tr>
<td>NRSP-6</td>
<td>5,259</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5,259</td>
<td>1,378</td>
</tr>
<tr>
<td>Total</td>
<td>13,692</td>
<td>51</td>
<td>1,074</td>
<td>464</td>
<td>15,281</td>
<td>8,669</td>
</tr>
</tbody>
</table>

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), FSG=Fine Screening Genotypes/(1).
2 Includes chromosome counts, germination tests, ID and Taxonomic check plantings, in vitro maintenance, seed increases, PSTV tests, miscellaneous plantings and NSSL seed backup.

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. **Late Blight Screening**

We produced progeny of elite genotypes within populations (fine screening and recurrent selection to produce parents with the best breeding value). We made an F2 family of these (out crossed with susceptible diploid *tuberosum*) to test the quantitative nature of resistance. We are using *S. okadae*, which has not been accessed for resistance before, as far as we know. Tubers were tested by W. Stevenson (WI) for tuber late blight resistance. We found that tuber resistance doesn't always follow that of the leaf for some of our elite species selections.
2. **Rhizoctonia Screening**
   We provided tubers to D. Carling (AK). *Rhizoctonia* isn't devastating, but there is no way to control it. Good resistance was found in some wild species.

3. **Antioxidant Screening**
   A grant to Dr. L. Phlak at Madison was funded through the potato CGC to check wild species for antioxidants. Potatoes do not have the highest antioxidants, but considering the amount of potatoes eaten per capita, a little increase could have more total beneficial effect than high antioxidant fruits eaten sparingly and infrequently.

4. **Glycoalkaloids Screening**
   We conducted fine screening for glycoalkaloids on families selected for high foliage/tuber differential. We screened 27 individual plants from within elite families with high average foliage/tuber differences. Two of the plants had very broad segregation such that the foliage glycoalkaloid levels were 25-40 times the tuber levels. The prospects of selecting germplasm with insecticidal glycoalkaloids deposited only in the foliage look good.

5. **Cold Genetics, Breeding and Physiology**
   We continued recurrent selection for good tuber characteristics in hybrids of *tuberosum* with extremely cold hardy species. A homemade freezing apparatus seems to be working well, giving quite reproducible results that fit with known species standards. This is necessary because now that we have good tuber type and early maturity, Sturgeon Bay is no longer a useful site to differentiate cold hardiness in the field. We were able to find that we can still recover high levels of cold hardiness despite having heavily selected for early maturity and tuber type.

6. **Tuber Calcium Accumulation**
   Tuber calcium has been shown to be closely associated with resistance to important storage rots and other tuber quality traits. We grew tubers of replicated F2 segregating population of parents that were extremely high and low calcium accumulators when grown under a low calcium environment. Beautiful segregation between the parental extremes was observed. This material should be very useful for researching the genetics and physiology of high tuber calcium (related to tuber quality and disease resistance). Another plus is that we are testing some very promising shortcuts to the laborious analysis protocol that may result in faster, cheaper testing and more reproducible results. We tested field tubers from Weslaco TX for comparison to winter pot-grown results and got a nice correlation (85%) with pot-grown tubers.

7. **Hormone Mutants**
   We extracted DNA for markers to tag GA dwarfing allele in segregating families. Dr. K. Hosaka observed a similar dwarf in the haploid extractor 1.22 and Dr. J. Valkonen in Sweden has a new publication describing a GA dwarf in the variety *Pito* (he called it "pito"). We are doing crosses to see if these two others are really the same as, or allelic to *gal* we described. We found a new mutant in the topiary seedlot of *infundibuliforme*. This has been sent to Jeff Suttle at NDSU to check hormone physiology.
F. Inter-genebank Collaboration

The Association of Potato Inter-genebank Collaborators (APIC) was formed in 1993 to assemble a database of potato germplasm available around the world and to initiate collaborative research projects. Below are some of the projects currently in progress.

1. **Comparisons of reputed duplicates in US and VIR genebank with RAPDs.**
   Differences are small but significant. Scientists should not assume that data generated for items under the same name in the two genebanks are completely interchangeable.

2. **Import of rescued seeds from Poland.**
   Imported over 100 samples of unique VIR genebank accessions that were rescued (seed increased) under a special cooperative USDA/FAS project in Poland (coordinated by Chuck Brown).

3. **Visit wild potato populations in New Mexico.**
   A remarkable observation: Our characterizations of sites may be very poor when based on a single visit. 2000 was reputed to be a very dry year. Only places where potatoes were unusually abundant in 1999 were visited. In some, potatoes could hardly be found. In others they were abundant. The reverse has been observed in a "good" year.

4. **"Anasazi Jamesii rebreeding project".** Based on the idea that we might be able to recapture the hypothetical potatoes selected by the Anasazi, we have done one cycle of selection for larger and less bitter tubers of several accessions collected in the southwestern United States.

G. Visitors From Other Countries

Dr. Roy Parfitt South Africa
Mr. Helun Singsit India
Dr. Agnes Murphy New Brunswick, Canada

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.

Four cultivar releases were published in the American Journal of Potato Research in 2000: ‘Russet Legend’, ‘Century Russet’, ‘AC Stampede Russet’, and ‘Umatilla Russet.’ All are known to have wild species in their pedigrees.
Section 6 lists 89 papers, 30 abstracts, and 4 theses which report the use of NRSP-6 Solanum introductions this year.

5. WORK PLANNED FOR 2001

Dr. Spooner will participate in a collecting expedition to Paraguay, Brazil, and Uruguay in 2001.

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.

We will continue APIC inter-genebank projects researching the status and dynamics of genetic diversity in the collection using RAPDs, and to strengthen ties with sister genebanks around the world.

6. PUBLICATIONS ISSUED DURING THE YEAR

A. Publications issued by NRSP-6 Personnel


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


Estrada, N., C. Nustez, S. Tinjaca, and J. Gabriel. 2000. Cruzabilidad entre Solanum stoloniferum y Solanum palustre, dos especies silvestres de papa. XVIII Reunion, Asociacion Latinoamericana de Papa (ALAP), Habana, Cuba. (Abstract)


Nusstez, C. and N. Estrada. 2000. Hibridos interespecificos con Solanum phureja, de alto valor agronomico para Colombia. XVIII Reunion, Asociacion Latinoamericana de Papa (ALAP), Habana, Cuba. (Abstract)


C. Theses Reporting Research with NRSP-6 Stocks


7. APROVED

_____________________________________________  __________________________
D.S. Douches, Chairman, Technical Committee  Date

_____________________________________________  __________________________
R.L. Lower, Lead Administrative Advisor  Date