Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada
Research Branch | Direction générale de la recherche

Potato Gene Resources Newsletter

Potato Research Centre

Number 8 **December 2001**

What Are The NRBK Selections?

Agnes Murphy
Potato Research Centre
Agriculture and Agri-Food Canada

The eleven NRBK clones are part of an internationally recognized system to identify virulence genes in late blight (*Phytophthora infestans*) isolates and the corresponding genes for susceptibility in potato.

Broadly speaking, resistance to late blight occurs in two forms. Horizontal resistance (also called general or field resistance) results from the effects of several minor genes that delay or reduce disease progression, such that damage levels are acceptable or the frequency of fungicide sprays may at least be reduced. This form of resistance is usually stable against a wide range of pathogen variants. Most potato breeding programs seek this form of resistance.

Vertical resistance (also called specific or major gene resistance) is conferred by the presence of major genes that result in almost total resistance to particular strains of the fungus. In the absence of these specialized races late blight will be effective. The NRBK selections are used to identify the presence of virulence genes in *P. infestans* isolates and are collectively an example of a differential host series.

The origin of this differential series is inextricably linked to efforts by early potato breeders such as Salaman and later Müller. Just after the turn of the last century, the wild hexaploid species *Solanum demissum* was identified as a source of high resistance to late blight and was backcrossed successfully to give rise to the well known W-races. Their use in breeding led to the release of the first cultivars with late blight resistance derived from *S. demissum* in Germany in the 1930's. Incidently, cv. Kennebec released in the USA in1948 resulted from a cross made with a W-race.

Within a short time, the resistance failed as pathotypes of the fungus appeared that were virulent against the major genes. Investigators were soon able to detect differences in isolates and began to categorize them by their reaction to host plants derived from *S. demissum*. To standardize nomenclature, scientists from Scotland, the NL and the USA agreed to compare their systems which led to a proposal for international nomenclature in1953 (Black et al.1953). The system gained acceptance and the host series used to identify major genes is referred to as Black's Differentials - the NRBK selections are the same thing by another name. Eleven major genes derived from *S. demissum* have now been identified; these may occur singly or in combinations. The accurate identification of virulence genes in late blight isolates requires careful inoculation of this series and examination of symptom expression under controlled conditions.

(Continued on Page 2)

Potato Gene Resources Newsletter

The Potato Gene Resources Newsletter is an annual publication of the Potato Gene Resources Repository, Potato Research Centre, Agriculture and Agri-Food Canada. The Newsletter provides information on potato germplasm in the Repository and on issues related to the genetic diversity in the potato. The opinions expressed by authors may not necessarily represent the views of Agriculture and Agri-Food Canada.

Le Bulletin est également disponible en français.
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Table 1. Gene-for-gene system with *Phytophthora infestans*. Dominant major genes, each conveying specific hypersensitive resistance of the host (R-genes), are matched by genes for specific pathogenicity of *P.i.*

Pathotypes of *P.i.* genes for hypersensitivity	0	1	2	1,2 etc.
r	+	+	+	+
R_1	−	+	−	+
R_2	−	−	+	+
R_1 R_2	−	−	−	+
etc.				

+ susceptible; - resistant

From: Ross, H. 1986 Potato Breeding-Problems and Perspectives. “Advances in Plant Breeding.” Supplement 13 to Journal of Plant Breeding. Verlag Paul Parey, Berlin 132p.

The eleven clones of the NRBK series are available from the Potato Gene Resources Repository. Please see the attached Request Form or contact us at percyj@em.agr.ca.

Black, W., C. Mastenbroek, W.R. Mills, and L. C. Peterson. 1953. A proposal for an international nomenclature of races of *Phytophthora infestans* and of genes controlling immunity in *Solanum demissum* derivatives. Euphytica 2(1953): 173-178.

Notes on Heritage Varieties Added to the Gene Resources Collection in 2001

Garrett Pittenger
Seeds of Diversity Canada (SoDC)

1. British Columbia Blue

Origin: British Columbia Blue was originally obtained in 1984 from potato collector Alex Caron.

Description: This variety is part of a "constellation" of large blue-fleshed clones, all of which are very similar, but not apparently identical. They possess in common a vigorous growth, dark green leaves with purple stems, blue flowers, the ability to set seed balls prolifically and apparently undiminished vigor, possibly stemming from field resistance to diseases. The related clones include Sharon's Blue, Nova Scotia Blue (below) and the widely offered All Blue (sometimes referred to as Canadian Purple). A related Swedish clone is Congo, similar but possessing by far the darkest purple or blue skin and flesh color. B.C. Blue is a long cylindrical potato, producing really large tubers under fertile conditions in humus rich soil. In dark soil, it is difficult to see the tubers while digging. The skin, when freshly washed, is electric dark purple in color and the flesh is a mid purple with a white ring just under the skin. I find this one to be an excellent baker, baking lavender inside with a creamy texture and a rich potato taste. There appears to be a moderate resistance to powdery scab, but the bright color of the skin is often spoiled by the silvery scurf that, however, does not affect eating quality. Will Bonsall, Seed Saver's Exchange potato curator, speculated that this one may have *Solanum phureja* ancestry. It is perhaps an odd coincidence that almost all the blue fleshed varieties are associated with Canada, but I have no verifiable documentation about them.

2. Nova Scotia Blue

Origin: Nova Scotia Blue was sent to Heather Apple, SoDC's first president, by Tom Keoughan of Hubbards, Nova Scotia.

Description: For a description of Nova Scotia Blue, please refer to notes on B.C. Blue, to which it is similar, though perhaps a bit smaller. I have seen references to a Nova Scotia Blue that is not a blue fleshed type.

3. Ruby Pulsiver's Blue Noser

Origin: Ruby Pulsiver's Blue Noser was sent to Heather Apple, SoDC's first president, by Ruby Pulsiver of Chester, Lunenburgh County, Nova Scotia. Ms. Pulsiver mentioned to me that she obtained her stock of this maritime heirloom from growers on Tancook Island, Nova Scotia.

Description: This is one of three maritime Canadian "blues" in my collection. The other two are Angelina Mahoney's Blue and Pugh's Purple. They are all "Blue Nose" types: long oval shape, light purple skin with a much darker blue "nose" on the tuber. Flesh is white with blue streaks around the eyes when peeled. I am told that the Nova Scotians were called "Blue Noses" because of this potato that was a big part of their diet. Ruby Pulsiver related to me that this variety was grown commercially on a local scale on Tancook Island and that it was traditionally boiled with salt fish. I find it reasonably productive from my original stock, which is not virus freed. A really nice potato with some potential for local markets with its name recognition and traditional use in the Canadian Maritimes. Pugh's Purple, from Elizabeth Pugh of the Yukon, is a larger and even more vigorous clone.

4. La Crotte d'Ours (Bear Poop)

Origin: La Crotte d'Ours was sent to me by Antoine d'Avignon of Pintendre, Quebec. Antoine obtained it from Mr. Louis-Marie Ouellet of St.-Onesime de Kamouraska, Quebec. Mr. Ouellet was 80 years old in 2000 and had obtained the variety from his grandfather. It is speculated

that it may have originally come from Scotland. It is possible that it may be identical to or related to the Vermont variety known as Purple Cowhorn or Seneca Cowhorn.

Description: La Crotte d'Ours is just the thing to have on hand when the children ask "What's for dinner?". Light purple skin, white flesh, distinctive shape - a long kidney type narrowed at the stem attachment, increasing in size toward the "nose", where it is enlarged and rounded. The tubers have a bit of a curve. Relatively smooth skin. I have not had sufficient stock to cook yet and so cannot comment on its eating quality.

5. La Veine Rose (La Belle Rose)

Origin: La Veine Rose (La Belle Rose) was sent to me by Antoine d'Avigon of Pintendre, Quebec. Antoine obtained it from Mr. Louis-Marie Ouellet of St.-Onesime de Kamouraska, Quebec.

Description: This one is long-oval in shape with a light pink skin. It's distinctive feature is the rose marbling under the skin around the eyes. I have not cooked it yet because of insufficient stock. I am also not sure about its relationship to Early Rose, which does sometime produce some under the skin rose marbling that is expressed when it is grown on clay soil, but not on sandy loam (at least under my conditions).

6. Marc Warshaw's Quebec

Origin: Marc Warshaw's Quebec was obtained by Marc Warshaw of Buckland, Quebec from a local farmer.

Description: If we held a potato beauty contest, this one would be the number one challenger for top place. A long oval potato with white flesh and a vibrantly coloured skin of light ochre with large splashes and blotches of bright dark rose. Relatively smooth and of really good cooking quality boiled. This one has become a local favourite with some Seeds of Diversity Canada members. I named this one after our SoDC member who supplied it to me. It has been grown by his source for many years, but Marc was not able to obtain any verifiable historical documentation on it.

7. Northern White (White Northern)

Origin: Northern White (White Northern) was obtained from potato collector Alex Caron of Snowball, Ontario.

Description: Northern White is a large white skinned, white fleshed variety with a smooth skin and very shallow eyes. My stock is a bit old and the size may not be up to potential. I would be interested in seeing what the capability of this clone is when grown from cleaned up stock seed. The relatively smooth-skinned tubers and shallow eyes recall a number of British potato clones.

8. Straight Banana

Origin: Straight Banana was sent in 1994 to the Potato Node by Evelyne Smetaniuk of Fort St. John, B.C. Mrs. Smetaniuk produced Straight Banana by continually selecting the straightest tubers at harvest each fall over a ten year time period.

Description: Straight Banana has been a poor grower for me, perhaps because of accumulated viruses and the consequent reduced vigor. It produces straight tubers of somewhat fingerling shape but without any curve. Smooth light tan skin and white flesh. I have never had sufficient stock to test its cooking quality.

Annual Report 2001

Jane Percy
Potato Research Centre
Agriculture and Agri-Food Canada

The Collection

1. Holdings

The Potato Gene Resources Repository contains 111 clones. Of this total, 100 are maintained *in vitro*, 11 as tubers only**,** and 3 *in vitro* and also as tubers. Eight clones were added to the Repository this year. A full listing of accessions may be found on the attached request form. Table 1 lists the number of clones in each of the Repository categories. Canadian Bred clones also used as Disease Resistance Checks are included in the former category.

Table 1. Summary of Potato Clones

Repository Categories	Number of Clones
Breeding selection	6
Canadian bred	48
Disease resistance check	18
Genetic selection	2
Heritage variety	37
Total	111

2. New Accessions

Eight heritage varieties were entered into the Repository following virus-freeing. The varieties are British Columbia Blue, La Crotte d'Ours, La Veine Rose, Marc Warshaw's Quebec, Northern White, Nova Scotia Blue, Ruby Pulsiver's Blue Noser, and Straight Banana. These new accessions are available *in vitro* from Potato Gene Resources.

The joint Agriculture and Agri-Food Canada/Seeds of Diversity Canada project to virus-free those heritage varieties recommended and priorized by Seeds of Diversity Canada is ongoing. As a result, 27 heritage varieties clones have been entered into virus-freeing programs.

3. Evaluations

This year 29 heritage varieties were grown in 12 hill plots, replicated twice, at the Potato Research Centre, Fredericton. The varieties were photographed and evaluated for vigor, stem and flower color, presence of seed balls, maturity and yield. Cooking quality and tuber dormancy will be evaluated over the winter and tuber descriptions obtained. This information will be entered into our Repository database and reported in future issues of the Potato Gene Resources newsletter. Several of the varieties have now been evaluated over a 3 year period.

4. Management

Potato clones which have been in the Repository for more than five years, are being tested for viruses, including Red La Soda virus, and PSTV, as part of the ongoing commitment to maintain a disease free collection.

Forty-eight *in vitro* clones have been grown in the field permitting plants and tubers to be evaluated for trueness-to-type.

5. Requests to the Repository

Twenty- two requests for clones were received in 2001. Sixty-eight clones were distributed *in vitro* and 76 as field grown tubers. Green house grown minitubers were not produced this year. In previous years, minitubers in excess of our needs were offered for distribution to clients. The reported uses of the potato clones requested from Potato Gene Resources in 2001 are shown below in Table 2.

Seven requests were received from the province of New Brunswick, 5 from Quebec, 2 from Prince Edward Island and 1each from Nova Scotia and Newfoundland. There were 5 requests from the U.S. and 1 from the Netherlands.

The most requested clones in 2001 were AC Brador and Pink Fir Apple with 5 requests each.

Table 2. Summary of Request by Purpose

Purpose of Request	Requests	Clones
Breeding	1	1
Research	9	74
Heritage demonstration	2	16
Heritage evaluation	8	43
Heritage preservation	2	10
Total	22	144

Table 3 (on the next page) lists the total number of requests received in the years 1997 through 2001. The number of clones provided, whether the request was fulfilled by minituber/tuber or *in vitro* material and the purpose of the request are also included.

Repository Items of Interest

Communication

• Thirty-one requests for information about the Repository, the availability of clones, clone descriptions and pedigrees, and techniques for handling *in vitro* material were received.
• A listing in the Seeds of Diversity Canada Seed Exchange Directory as well as personal communications indicate that virus-free clones from the Repository are being distributed among people interested in preserving potato diversity.
• The annual Potato Gene Resources newsletter has a distribution of 202.

Displays

• A display of Potato Gene Resources clones, was prepared for the Atlantic Plant Tissue Culture and Biotechnology Workshop which was held in Fredericton July 31- August 1. A selection of *in vitro* and greenhouse grown potatoes designed to highlight the diversity of the material in the Repository, was displayed.

Potato Gene Resources Repository newsletters with request forms were also available.

Table 3 Compilation of Requests to Potato Gene Resources 1997-2001

Year	Requests	For breeding or research	For heritage evaluation or preservation	Total clones provided	Provided as minitubers/tubers	Provided *in vitro*
1997	7	3	4	64	27	37
1998	10	5	5	62	30	32
1999	20	10	10	113	29	84
2000	25	9	16	142	93	49
2001	22	10	12	144	76	68
5 year total	84	37	47	525	255	270

Potato Research Centre Website

The Potato Research Centre website: **http://res2.agr.ca/fred/home/index.htm** offers an overview of the mandate, resources, and achievements of the Centre. The research studies being conducted at the Centre as well as the staff associated with those studies are highlighted. Links to the Potato Research Network and to other agriculture and potato related websites are also available.

Personnel of the Potato Gene Resources Repository Potato Research Centre

Richard Tarn - Potato Breeder
Jane Seabrook - Plant Physiologist
Agnes Murphy - Plant Pathologist
Trudy Dalton - Potato Breeding Technician
Jane Percy - Potato Gene Resources Technician
Robert Horsman - Foreman, Benton Ridge Substation
Katheryn Douglass - Potato Propagation Technician
Donna Wilson - Plant Pathology Technician
Andrew Gardner - Greenhouse Person
Steven Allaby - Greenhouse Person
Danny Burnett - Greenhouse Person
Sylvia Holder - Greenhouse Person

Heritage Potato Accessions - 2001

British Columbia Blue

Crotte d'Ours

La Veine Rose

Marc Warshaw's Quebec

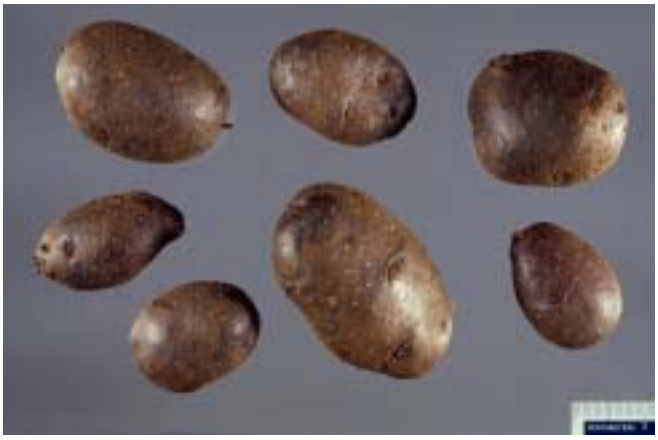
Descriptions of the potato varieties shown on this page appear in the article "Notes on Heritage Varieties Added to the Gene Resources Collection in 2001" by Garrett Pittenger

Photos by Roger Smith

Heritage Potato Accessions - 2001

Northern White

Nova Scotia Blue



Ruby Pulsiver's Blue Noser

Straight Banana

Descriptions of the potato varieties shown on this page appear in the article "Notes on Heritage Varieties Added to the Gene Resources Collection in 2001" by Garrett Pittenger

Photos by Roger Smith

POTATO RESEARCH CENTRE
POTATO GENE RESOURCES REPOSITORY – AVAILABLE CLONES, DECEMBER 2001

Clones are available as *in vitro* plants, as tubers (*), or as either *in vitro* plants or tubers (†) as indicated. Two test tubes or two tubers (as available) of each clone will be shipped at the cost of client. Clones have been tested and found negative for PVA, PVM, PLRV, PVS, PVX, PVY, PSTV, BRR and bacterial contamination.

CLONE	PURPOSE	CLONE	PURPOSE
ABNAKI*	CK	KESWICK	CC
AC BELMONT	CC	KIFLI	HV
AC BLUE PRIDE	CC	LA VEINE ROSE/LA BELLE ROSE	HV
AC BRADOR	CC/CK	LENAPE†	BR
AC CHALEUR	CC	LIBERTAS*	CK
AC DOMINO	CC	LUMPERS	HV
AC NOVACHIP	CC	MacINTOSH BLACK†	HV
AC RED ISLAND	CC	MANOTA*	CC
ACADIA RUSSET	CC	MARC WARSHAW'S QUEBEC	HV
ANGELINA MAHONEY'S BLUE	HV	MCINTYRE BLUE	HV
ANSON	CC	MIRTON PEARL	CC
AVON	CC/CK	MRS. MOEHRLE'S YELLOW FLESHED	HV
BANANA	HV	MOURASKA	CC
BATOCHE	CC	MYATT'S ASHLEAF	HV
BELLEISLE	CC	NRBK 01 to NRBK 11	CK
BLUE MAC	CC	NIPIGON	CC
BLUE SHETLAND	HV	NISKA	CC
BRIGUS	CC	NORTHERN WHITE	HV
BRITISH COLUMBIA BLUE	HV	NOVA SCOTIA BLUE	HV
CAIN'S IRISH ROCKS	HV	PINK FIR APPLE	HV
CALICO	HV	PINK PEARL	CC
CANDY CANE	HV	PURPLE CHIEF	HV
CANSO*	CC	RAMBLING ROSE	HV
CANUS*	CC	RARITAN	CC
CARIBE	CC	RED GOLD	CC
CARIBOO	CC	RICHTER'S JUBEL	CK
CARLTON	CC	RIDEAU	CC
CHINOOK	CC	RIVER JOHN BLUE	HV
CONESTOGA	CC	ROSE GOLD	CC
CONGO	HV	ROYAL KIDNEY	HV
CORNE DE MOUTON	HV	RUBY PULSIVER'S BLUENOSER	HV
CROTTE D'OURS	HV	SABLE	CC
CUPIDS	CC	SAGINAW GOLD	CC
DONNA	CC	SHARON'S BLUE	HV
DORITA*	CK	SHEPODY	CC
ERAMOSA	CC	SIBERIAN	HV
F58050	BR	SIMCOE	CC
F66041	BR	SKERRY BLUE	HV
F79055†	CK	SLOVENIAN CRESCENT	HV
F79070	CK	STRAIGHT BANANA	HV
FINGERLING	HV	TOBIQUE	CC
FORTYFOLD	HV	TRENT	CC
FUNDY	CC	USDA41956*	BR/CK
GRAND FALLS	CC	USDA X96-56	BR
GREEN MOUNTAIN*	CK	WHITE PONTIAC*	GL
HAIDA	HV	WHITE RURAL NEW YORKER*	HV
HINDENBURG*	CK	YAM	HV
HUNTER	CC	YORK	CC
HURON	CC	YUKON GOLD	CC
JEMSEG	CC/CK		
JOGEVA YELLOW ESTONIAN	HV		
K113-1	BR		

CODE FOR PURPOSE – BR - Breeding Clone; CC - Canadian Bred; CK - Disease Resistance Check ; GL - Genetic Clone; HV - Heritage Variety; *Available only as tubers; †Available *in vitro* or as tubers

More detailed information on clone characteristics, including disease reactions, is available on request.

Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

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POTATO RESEARCH CENTRE
POTATO GENE RESOURCES REPOSITORY REQUEST FORM

Name _____ Date _____

Organization _____

Mailing address _____

_____ Postal Code _____ Country _____

Shipping address _____

_____ Postal Code _____ Country _____

Telephone _____

Fax _____

E Mail _____

Clones requested: (Please refer to available clones listed on reverse)

1. _____
2. _____
3. _____
4. _____

(Please list additional clones on a separate sheet).

Preferred date of receipt: (Please allow at least 5 weeks) _____

For our records, would you please state the intended use of the requested clones research, breeding, evaluation, or **specify** another use) _____

_____

G Clone descriptions required?

G Import permit attached if Phytosanitary Certificate required?

_____ Courier account number or alternate shipping arrangements

Please send this form to:

Potato Gene Resources Repository
Agriculture and Agri-Food Canada
Potato Research Centre, P.O. Box 20280
Fredericton, New Brunswick
Canada E3B 4Z7
Attention: Jane Percy
Telephone: (506) 452-3260
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Canada