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Research Branch | Direction générale de la recherche

Potato Gene Resources Newsletter

Potato Research Centre

Number 10 **December 2003**

Congo: A Versatile Blue-Fleshed Heritage Potato Variety with Many Names

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Agriculture and Agri-Food Canada
Potato Research Centre

Potato varieties with pigmented flesh had a special place in the Andean Indian civilizations. In addition to their use as food, potatoes with pigmented flesh were used to obtain dye to make colourful clothing. Potatoes with pigmented flesh were apparently also used in religious ceremonies. Thus, such potatoes have a very special place in the history of this crop.

Recent investigations among several blue-fleshed varieties at the Potato Research Centre have provided strong evidence that the following varieties are genetically identical to each other:

- Congo
- British Columbia Blue
- McIntosh Black
- River John Blue
- Sharon's Blue

This discovery prompted a further study of the literature regarding blue-fleshed potatoes. In addition to the above synonyms, the literature records several more names of varieties which are reported to be equivalent of Congo. Scientific fingerprinting would have to be done before it can be concluded that these are definite synonyms but their similar phenotypes certainly point in that direction. These include All Blue, Blue Congo, Congo Blue, Purple Congo, Nova Scotia Blue and Himalayan Black[2] .

[1]Retired

[2]Another blue-fleshed variety, Négresse, with the synonyms of Vitelotte and Vitelotte Noire is, on the basis of the descriptions by Bourget (1) and by the European Cultivated Potato Database (3), quite different from Congo.

In the early part of the 20th century synonyms presented a major problem to the potato industry. It was very easy to simply rename an old variety and make it appear like a new one. This was especially the case with popular varieties. So, in a sense one could possibly measure a variety's success by the number of synonyms it had! In the UK the problem of synonyms was so big that in 1919 the National Institute of Agricultural Botany appointed a Potato Synonym Committee to sort out the mess. In 1920 the famous Dr. Salaman became the chairman of this committee. In his well-known history book (7) he

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.

The Newsletter may now be accessed through a link on the Potato Research Centre website at http://www.agr.gc.ca/science/fredericton/index_e.htm

Le Bulletin est également disponible en français.
To receive the newsletter, please contact:
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mentions some of the struggles which his committee had to endure before the problem of synonyms was finally solved. In his variety book (6), Salaman devoted an entire chapter to "Synonymity." In addition to synonyms the British potato industry also faced the problems of three major diseases: late blight, potato leaf roll virus and wart. The initiation of a seed potato certification system was a great aid in solving several of these diseases (especially wart) as well as the problems of synonyms. Today virtually all developed countries have rigorous seed potato certification systems which include the prevention of synonyms among officially registered cultivars. However, synonyms obviously still occur among garden varieties because the strict registration standards which are applied to commercial varieties do not apply to garden varieties. The web site of the Canadian Food Inspection Agency (2) includes the following approved garden varieties as of Dec. 3, 2002: All Blue, Congo, British Columbia Blue, MacIntosh Black, Nova Scotia Blue, River John Blue and Sharon's Blue. A similar situation existed at one time with the Russet Burbank variety. Of the many synonyms, the name Netted Gem was the longest to survive but today, as result of a rigorous registration system, only the Russet Burbank name is recognized. Is it necessary to resurrect the above-mentioned "Potato Synonym Committee" of the 1920's for today's garden varieties?

In addition to synonyms it appears that there is also a problem with homonyms with the Congo variety. This also is an ancient problem. The name of a popular variety was often applied to other varieties. Thus the name of a popular variety could be used to sell seed potatoes of less popular ones, at (higher) prices similar to those of the established varieties.

The European Cultivated Potato Database (3) lists two varieties called Congo. One of these which, as per personal communication by Ms. McCreath of the Scottish Agricultural Science Agency - SASA - to HDJ, originated in Great Britain around 1918 and has white flowers. The other one, for which the country of origin is given as Sweden, is recorded as having light blue flowers.

Alan Wilson (9) described a Congo variety which he says goes back to about 1900 as *". . . The tubers are very small and dark and must be harvested on a bright, dry day to stand any chance of finding them in the soil. The taste is insipid and the texture stodgy . . ."* It is not clear but certainly conceivable that the Congo variety described by Wilson is the same as the one which is currently in the SASA collection.

Garrett Pittenger (4) described the Swedish Congo which he had obtained from the Swedish seed saving organization, SESAM via the Seed Savers Exchange in the USA. Mr. Pittenger was very favourably impressed with his sample of Congo. In a comparison between the above description by Wilson with his own observations Mr. Pittenger concluded that "*It seems unlikely this is the same potato, or perhaps grown from stock that has degenerated in vigour.*" Our literature search confirms Pittenger's suspicion that there is more than one variety by the name of Congo.

In spite of the above-mentioned controversies, the Congo variety has stood the test of time. Today it is still a popular salad potato variety in many countries. It is apparently especially popular in the Scandinavian countries (particularly so in Finland where it is served mashed with sour cream). On Jan. 7, 2003 the BBC Internet news showed a dish of purple potato chips made from the Congo variety (by a company in the UK) under the headline "*Blue crisps hit shelves*" with the subtitle "*The crisps are made with no artificial colouring.*" This article further pointed out that this is giving a whole new meaning to the term "blue chip." A computer search for "blue potato chips" resulted in more than ten sites offering this gourmet product on the Internet. It appears that even as a processed culinary, specialty product, the Congo variety has a very bright future!

The Congo variety has also been used in several genetic studies. It was one of several varieties chosen by Salaman in his classic studies on the inheritance of colour and other characters in the potato (5). In his hybridization experiments with Congo (which he did around 1906/1907), Salaman concluded that this variety is male sterile and then proceeded to use it only as a female parent. But even after that he only obtained very few progeny. Congo again caught the attention of researchers several decades later. This time it was the chemical structure of the dark pigment of the flesh which was the major scientific attraction of this variety. The dark blue colour of Congo is an anthocyanin which is derived from malvidin. In the mid 1960's a team of scientists consisting of Drs. Simmonds and Harborne at the John Innes Institute in the UK managed to obtain a haploid (24-chromosome plant) from Congo. This haploid was successfully crossed with a selection of *Solanum phureja* (a primitive cultivated diploid) and the progeny was used to study the biosynthesis of malvidin (8).

The recent emphasis on the positive effects of antioxidants has brought the Congo variety under the scrutiny of scientists at the Potato Research Centre. Antioxidants are nutrients that protect the body against oxidation and undesirable chemical reactions and have been reported to reduce the risk of developing more than 80 diseases as well as slow the aging process. Traditionally blueberries have been a major source of antioxidants. However, potatoes with purple or red flesh represent a potentially more economical source of antioxidants and varieties such as Congo may play a major role in this new development.

Although Congo may not have any or very few descendants, its long life, versatility, many synonyms and contributions to science certainly attest to its value!

Acknowledgements

The molecular fingerprinting analysis by Dr. X. Li is much appreciated. The authors also wish to thank the following staff of the Potato Research Centre for their technical support:
V. Burns, C. Murray, T. Dalton, J. Percy and M. Haroon.

References

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3. European Cultivated Potato Database. http://194.128.220.6/
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Heritage Variety Identification

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People, such as Seeds of Diversity's Garrett Pittenger, most familiar with the diversity of Canada's heritage potato varieties have long suspected that some of the varieties are in fact the same clone or genotype with different names. Similar observations have been made on some of the heritage varieties maintained in the Potato Gene Resources Repository.

This was the starting point for some work over the last year to carry out DNA fingerprinting of several groups of morphologically similar heritage varieties. The work is being conducted at the Potato Research Centre, Fredericton, by Dr. Xiu-Qing Li and Muhammad Haroon. Their protocols to distinguish genetically closely-related potato varieties are based on polymerase chain reaction (PCR) of microsatellite DNA regions of the potato genome. To-date they have identified a group of purple skinned, purple fleshed varieties (the Congo Group - Congo, British Columbia Blue, MacIntosh Black, Nova Scotia Blue, River John Blue and Sharon's Blue), a purple skinned, white fleshed group (Purple Chief and Ruby Pulsiver's Bluenoser), and a fingerling group (Banana, Corne de Mouton and Fingerling). Please see the first article in this Newsletter by H. De Jong and A.M. Murphy. The fingerprinting protocols are described in a presentation on "DNA Fingerprinting of Heritage Potato Varieties" by X.-Q. Li*, M. Haroon, J. Seabrook, R. Tarn, A. Murphy, J. Percy, K. Douglass, V. Burns, and B. Stevens, to be made at the North-East Potato Technology Forum in Charlottetown, PE, March 9-10, 2004.

This work is continuing and may bring further changes or additions to the groupings described here. While the DNA fingerprinting has not shown differences within the groups, it is still possible there are smaller differences that are not detectable with current techniques. For this reason, all clones will continue to be maintained in the repository. However, we may consult clients about providing substitutions within groups. For example, we expect to provide Congo as the representative of the "Congo Group" unless it is essential for the client to receive the specific clones.

The Repository and the Seed Potato System

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Potato Gene Resources Repository
Agriculture and Agri-Food Canada
Potato Research Centre

The Potato Gene Resources Repository provides *in vitro* plantlets and greenhouse or field tubers for breeding, research and heritage preservation. While extensively tested for freedom from disease, the plantlets and tubers distributed by the Potato Gene Resources Repository are produced outside the Canadian Seed Certification System and are not eligible for Certification.

The Canadian Seed Potato Certification System operates under the Seed Act and its Regulations. Certification begins with tested plantlets established *in vitro* in a facility accredited for this task by the Canadian Food Inspection Agency. The plantlets are used to produce greenhouse tubers which then go to the field in a limited generation system, at each step meeting strict standards specified in the Regulations.

The Potato Gene Resources Repository is not accredited for seed production by the CFIA.

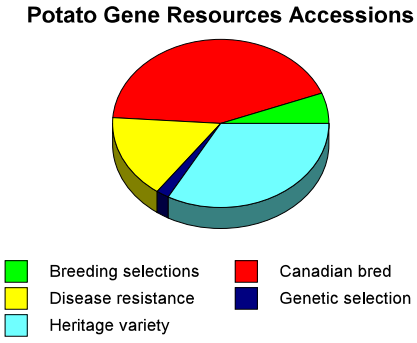
Annual Report 2003
Potato Gene Resources Repository

Jane Percy
Potato Research Centre
Agriculture and Agri-Food Canada

The Collection

1. Holdings

The Potato Gene Resources Repository contains 115 clones. Of this total, 104 are maintained *in vitro*, 11 as tubers only, and 3 *in vitro* and also as tubers. A full listing of accessions may be found on the attached request form.



2. New Accessions

F87084 was added to the Repository in 2003. F87084 has been formerly described and released as germplasm for it's resistances to multiple diseases. For a full description see the AJPR 78(2): 141-149. 2001: De Jong, H., K.G. Proudfoot, and A.M. Murphy. "The Germplasm Release of F87084, A Fertile, Adapted Clone With Multiple Disease Resistances." The Abstract states: "F87084 is a germplasm release that has been developed by conventional breeding methods and can be traced back to very diverse germplasm sources. This clone has excellent female fertility, round-oval tubers and is well adapted to Eastern Canada. The vine maturity is slightly later than that of Kennebec, and the mean marketable yield is 78% of Kennebec. The specific gravity, boil, bake and chip scores are somewhat lower than Kennebec. F87084 is resistant to late blight, *Verticillium dahliae*, early blight, and the pathotypes of wart occurring in Newfoundland. F87084 has extreme resistance to PVYo and PVX. It is also resistant to the potato cyst nematode pathotype Ro1. Progeny analyses indicate that F87084 is duplex for the genes controlling extreme resistance to PVX as well as resistance to the potato cyst nematode (Ro1).

OAC Royal Gold was added to the Repository in 2003. It was derived from the cross Caribe X Rose Gold made at Guelph in 1986. It is further described in the paper "OAC Royal Gold : A New Potato Cultivar With Purple Skin and Yellow Flesh." AJPR 75: 179-180. 1998. S. T. Ali-Khan, G. R. Johnston, R. Coffin, V. Currie, J. Wilson, A. McKeown, and W. Langenberg. The Abstract states: " OAC Royal Gold is a purple skin yellow fleshed potato cultivar with oval shaped tubers. It produced high specific gravity and boil and bake scores when evaluated at three sites over three years in Ontario. Having an unusual combination of skin and flesh color, Royal Gold would be most suitable in niche markets."

OAC Ruby Gold was added to the Repository in 2003. It was selected from a cross W729R (Rhinered-female parent) X G7010-19RY (Rose Gold) made in 1981. It is further described in the paper "OAC Ruby Gold: A New Red-Skinned Yellow Fleshed Table Potato" AJPR 73: 301- 304. 1996. S. T. Ali-Khan, G. R. Johnston, R. Coffin, V. Currie, J. Wilson, A. McKeown, and W. Langenberg. The Abstract states "OAC Ruby Gold is a new potato cultivar with red-skin and yellow flesh. Tubers are oblong in shape. When evaluated over three years at three sites in Ontario, it had higher specific gravity and culinary quality than Chieftain. OAC Ruby Gold has the same maturity and slightly lower yield that Chieftain. It is recommended for fresh market use in Ontario."

OAC Temagami was added to the Repository in 2003. It was selected from cross W729R (Rhinered-female parent) X G7010-19RY (Rose Gold) made in 1981. It is further described in the paper "OAC Temagami: A New Red-Skinned White Fleshed Table Potato Cultivar. " AJPR 73: 305- 308. 1996. S. T. Ali-Khan, G. R. Johnston, R. Coffin, V. Currie, J. Wilson, A. McKeown, and W. Langenberg. The Abstract states: "OAC Temagami is a new potato cultivar with red skin and creamy white flesh. Tubers are round in shape. When evaluated over three years at three sites in Ontario, it had higher specific gravity and culinary quality than Chieftain. OAC Temagami has the same maturity and comparable yield to Chieftain. It is recommended for fresh market use in Ontario."

OAC Royal Gold, **OAC Ruby Gold**, and **OAC Temagami** were developed at the University of Guelph in the co-operative breeding program supported by Agriculture and Agri-Food Canada, Department of Horticultural Science and Ontario Ministry of Agriculture, Food and Rural Affairs.

3. Evaluations

All heritage varieties received over the past several years have been evaluated in the field, therefore no field trials were conducted this year. Newly acquired heritage accessions are being grown to produce minitubers prior to field trials in the future.

Heritage varieties were evaluated for boiled and baked cooking quality. Appearance, texture, flavor, sloughing, and discoloration were scored.

This information will be entered into our Repository database and into GRIN-CA, and reported in future issues of the Potato Gene Resources newsletter. Several of the varieties have now been evaluated over a 3-year period.

Thirteen heritage varieties were evaluated in Newfoundland for reaction to wart by Steve Wood, CFIA.

As well, potato varieties are being evaluated on an ongoing basis for yield and wart resistance by George Brinson of Newfoundland.

DNA fingerprinting techniques have been used by scientists at the Potato Research Centre, AAFC, to compare several heritage varieties.

4. Management

Disease testing of new in vitro accessions and clones which have been maintained in vitro for five years was completed. Seventy-six clones were grown in the greenhouse and tested in 2003. Extra minitubers from the greenhouse growout will be offered to PGR clients.

5. Requests to the Repository

Twenty-nine requests for clones were received in 2003. Two hundred and thirty-two clones were distributed: sixty-one clones *in vitro,* and one hundred and seventy-one as field grown tubers. The reported uses of the potato clones requested from Potato Gene Resources in 2003 are tabulated below.

Purpose of Request	Requests	Clones
Breeding	2	7
Research	10	116
Heritage demonstration	2	39
Heritage evaluation	11	63
Heritage preservation	4	7
Total	29	232

Thirteen requests were received from the province of New Brunswick, 4 from Ontario, 3 from Prince Edward Island, 2 each from Nova Scotia, Newfoundland, and Quebec and 1 from Alberta. There were 2 requests from the U.S.A.

Crotte d'Ours was the most requested clone in 2003.

Five Year Compilation of Requests to Potato Gene Resources 1998 – 2003

Year	Total Requests	Requests for Breeding or Research	Requests for Heritage Evaluation or Preservation	Total Clones Provided	Clones Provided as Minitubers / Tubers	Clones Provided *In Vitro*
1999	20	10	10	113	29	84
2000	25	9	16	142	93	49
2001	22	10	12	144	76	68
2002	32	13	19	218	148	70
2003	29	12	17	232	171	61
5-year total	128	54	74	849	517	332

Repository Items of Interest

Communication

- Requests for information about the Repository, the availability of clones, clone descriptions and pedigrees, and techniques for handling *in vitro* material were received throughout the year.

- The annual Potato Gene Resources Newsletter has a distribution of 215.

- Newsletter #9 was listed on the weekly checklist of the Depository Services Program, Communications Canada, October 31, 2003. It may be viewed at http://publications.gc.ca in Weekly Checklist 03-44 (October 31, 2003) Departmental Publications, Agriculture and Agri-Food Canada, Research Branch. Future newsletters will also be published in the Weekly Checklist.

- The newsletter may now be accessed through a link on the Potato Research Centre website at http://www.agr.gc.ca/science/fredericton/index.htm.

Displays

- Potato Gene Resources clones, were presented during the "Display of 2003 Potato Selection Releases", held in Fredericton in February. A selection of *in vitro* potatoes as well as minitubers and field tubers, designed to highlight the diversity of the material in the Repository, was displayed. Potato Gene Resources Repository newsletters with request forms were also available.

- Potatoes, from the Repository, were displayed at the Canadian Museum of Nature in Ottawa as part of AAFC's contribution to a multi-departmental exhibit, marking the International Day for Biological Diversity (May 22). Fourteen potato varieties, chosen to reflect the diversity of the holdings, were shown. A handout was also available. Don Leger, Science Communications Advisor, Biodiversity Theme (Environmental Health National Program), and Brenda Kostuik, Assistant Manager, Biodiversity Knowledge Information Network (BKIN), planned and co-ordinated the activities. Please see photo below.

Visitors

- Tina Lewis of the Crop Diversification Centre North, Edmonton, Alberta, visited the Repository in February to discuss *in vitro* maintenance techniques and long-term storage protocols.

Travel

- In January, Jane Percy attended the National Work Planning meetings of the Biodiversity Theme (140), in Ottawa.

Potato Research Centre Website

The Potato Research Centre website: http://www.agr.gc.ca/science/fredericton/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.

Plant Gene Resources of Canada

Canada's Plant Germplasm System is a network of centres and people dedicated to preserving the genetic diversity of crop plants, their wild relatives and plants present and unique in the Canadian biodiversity. The system plays a significant part of Agriculture and Agri-Food Canada's commitment to the Canadian Biodiversity Strategy in response to the Convention on Biological Diversity.

The Plant Gene Resources of Canada (PGRC) website located at http://pgrc3.agr.ca/ includes information on PCRC and the multi-nodal system of germplasm conservation in Canada as well as opportunities to search for germplasm on the Genetic Resources Information Network-Canadian version (GRIN-CA).

Dr. Ken Richards, Research Manager, Plant Gene Resources of Canada, may be contacted at richardsk@agr.gc.ca

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 - Supervisor
Steven Allaby - Greenhouse Person
Danny Burnett - Greenhouse Person
Sylvia Holder - Greenhouse Person

POTATO RESEARCH CENTRE
POTATO GENE RESOURCES REPOSITORY – AVAILABLE CLONES, DECEMBER 2003

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	KIFLI	HV
AC BELMONT	CC	LA VEINE ROSE/LA BELLE ROSE	HV
AC BLUE PRIDE	CC	LENAPE†	BR
AC BRADOR	CC/CK	LIBERTAS*	CK
AC CHALEUR	CC	LUMPERS	HV
AC DOMINO	CC	MacINTOSH BLACK†	HV
AC NOVACHIP	CC	MANOTA*	CC
AC RED ISLAND	CC	MARC WARSHAW'S QUEBEC	HV
ACADIA RUSSET	CC	MCINTYRE BLUE	HV
ANGELINA MAHONEY'S BLUE	HV	MIRTON PEARL	CC
ANSON	CC	MRS. MOEHRLE'S YELLOW FLESHED	HV
AVON	CC/CK	MOURASKA	CC
BANANA	HV	MYATT'S ASHLEAF	HV
BATOCHE	CC	NRBK 01 to NRBK 11	CK
BELLEISLE	CC	NIPIGON	CC
BLUE MAC	CC	NISKA	CC
BLUE SHETLAND	HV	NORTHERN WHITE	HV
BRIGUS	CC	NOVA SCOTIA BLUE	HV
BRITISH COLUMBIA BLUE	HV	OAC ROYAL GOLD	CC
CAIN'S IRISH ROCKS	HV	OAC RUBY GOLD	CC
CALICO	HV	OAC TEMAGAMI	CC
CANDY CANE	HV	PINK FIR APPLE	HV
CANSO*	CC	PINK PEARL	CC
CANUS*	CC	PURPLE CHIEF	HV
CARIBE	CC	RAMBLING ROSE	HV
CARIBOO	CC	RARITAN	CC
CARLTON	CC	RED GOLD	CC
CHINOOK	CC	RICHTER'S JUBEL	CK
CONESTOGA	CC	RIDEAU	CC
CONGO	HV	RIVER JOHN BLUE	HV
CORNE DE MOUTON	HV	ROSE GOLD	CC
CROTTE D'OURS	HV	ROYAL KIDNEY	HV
CUPIDS	CC	RUBY PULSIVER'S BLUENOSER	HV
DONNA	CC	SABLE	CC
DORITA*	CK	SAGINAW GOLD	CC
ERAMOSA	CC	SHARON'S BLUE	HV
F58050	BR	SHEPODY	CC
F66041	BR	SIBERIAN	HV
F79055†	CK	SIMCOE	CC
F79070	CK	SKERRY BLUE	HV
F87084	BR	SLOVENIAN CRESCENT	HV
FINGERLING	HV	STRAIGHT BANANA	HV
FORTYFOLD	HV	TOBIQUE	CC
FUNDY	CC	TRENT	CC
GRAND FALLS	CC	USDA41956*	BR/CK
GREEN MOUNTAIN*	CK	USDA X96-56	BR
HAIDA	HV	WHITE PONTIAC*	GL
HINDENBURG*	CK	WHITE RURAL NEW YORKER*	HV
HUNTER	CC	YAM	HV
HURON	CC	YORK	CC
JEMSEG	CC/CK	YUKON GOLD	CC
JOGEVA YELLOW ESTONIAN	HV		
K113-1	BR		
KESWICK	CC		

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.

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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) _____

_____

☐ Clone descriptions required?

☐ 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
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Canada