POTATO GENE RESOURCES

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Chuño, the oldest form of potato processing

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A major form of food security in the Andean societies such as the Inca empire (Figure 1) was the development of chuño, a freeze-dried product which is at least 2,000 years old. The procedure utilizes the occurrence of nighttime freezing temperatures in June and July in the Andean region. Tubers are exposed to freezing temperatures for three or four nights. They thaw out during the day and are then trampled by foot (Figure 2) to remove the moisture and allowed to dry in the sun.

Figure 1. At its height of development, the Inca empire was more than 3000 km long. © Weebly.

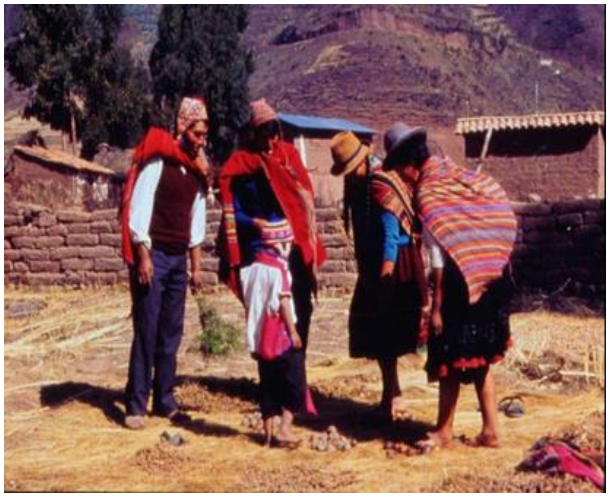

Figure 2. Family on the Altiplano trampling potatoes with their bare feet. © International Potato Center.

There are two types of chuño: chuño blanco (white) and chuño negro (black) (Figure 3). In the preparation of chuño blanco the tuber skins are also removed, and the tubers are washed in a stream. The chuño processing methods remove most of the glycoalkaloids (bitter tasting natural compounds which confer resistance to insects and diseases). This is an important feature because it facilitates the consumption of otherwise bitter potatoes that, because of their frost resistance, can be grown at high altitudes. Capable of being stored for a year or longer, chuño occupied a very important place in the Andean societies and made human life in the Andes above 3,800 metres possible. It was collected as taxes from the peasants and

disbursed from imperial storehouses to labor gangs for building roads, waging war, erecting monuments, and sustaining all the other aspects of imperial civilized society in the Altiplano. It was transported by llama convoys to lower valleys and coastal towns and used by populations from higher altitudes to barter for products from lower elevations. In the high Andes chuño was the "fuel of the empire." It was the indispensable food for labor gangs; without it nothing resembling Andean civilization could have arisen.

After the Spanish conquest chuño was used to feed the slaves in the infamous silver mines of Potosí (located in what is now Bolivia). This, in turn, allowed a flood of silver from the Spanish Empire in the Americas to upset prices in Europe. The resulting inflation, a.k.a. Price Revolution lasted from app. 1501-1650. Thus, the cultivation of potatoes changed the world's history for the first time, initially on a merely American scale, then quite literally worldwide!

Figure 3. Black and white chuño. Source: Fremen Tours, La Paz, Bolivia.

Icelandic Red Potato

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The Crop-Climate project has as one of its objectives to uncover and preserve the agro-biodiversity of Canadian potatoes (see www.heritagepotato.ca). Over the years, the Crop-Climate project has collaborated with citizen farmers and gardeners to disperse and trial potato varieties across the country and in the process encountered little known varieties grown in the nooks and crannies of our vast land. The Fredericton Research and Development Centre of Agriculture and Agri-Food Canada has been a partner in our initiatives providing seed tubers through the Canadian Potato Genetic Resources gene bank. The project has donated a few varieties to the program too. We describe a newly uncovered and productive potato variety grown on a small farm in the hinterland of northeast Ontario from a genetic lineage previously unrepresented in the Potato Genetic Resources gene bank.

In addition to uncovering and preserving potato biodiversity in Canada, our project has also focused on potatoes for northern climates as part of food sustainability in the face of climate change (see Northern Climates tab in our website, and Potato Gene Resources Newsletter No 28 (2021/2022), Electronic versions available at The Government of Canada Publications website). Iceland has a thriving potato culture and potatoes have been grown there for at least 250 years. We wondered whether any Icelandic varieties had come to and been grown in Canada. Bob Whillans of Haley Station, Ottawa Valley, Ontario answered our call and sent us tubers of a potato he knew as Icelandic Red.

Origins and cultivation of Icelandic Red in Canada

We are the 6th generation on a 150-acre parcel primarily mixed bush typical of Eastern Ontario with about 6 acres (2.4 hectares) of the original farm being maintained for cultivation. The evidence of the importance the potato historically played on this property is visible in the century old potato digger and planter abandoned in the bush by a previous generation.

We have actively participated in cultivating potatoes on this land for half a century. The soil is quite sandy, well drained, and slightly acidic which suits the potatoes and wild blueberries and raspberries which we also cultivate. Over the decades our potato patch has evolved into a much smaller manageable area around a ½ acre. Over the years we have tried close to 40 different varieties currently settling on 7 types that all seem to be drought tolerant and disease resistant with good storage capacity. A variety that meets these criteria is the Icelandic Red.

While visiting a family member in Iceland a couple of decades ago I purchased some potatoes from a local farmer at the Reykjavik farmers' market. Having the family over for a couple of meals I found the table quality good, particularly roasted or fried and the potatoes did not break down in soups and stews. On my return home I found a handful of tubers that had

inadvertently ended up in the pocket of my coat that I was wearing when I purchased the potatoes. Always interested in experimenting with new varieties I planted them in the next season. We generally plant in late April or early May. We found the vines to be larger than most and they continued to grow well into the fall until we had a killing frost. Apart from the Colorado Potato Beetle they didn't experience any issues such as blight or scab. The return from these few potatoes was quite impressive. The yields of clean blemish-free potatoes were large with one hill producing 40, albeit many were quite small.

In respect to the Colorado Potato Beetle our approach to control has evolved significantly over the decades. Historically we have used numerous insecticides that seemed to be less effective each passing year. Even with the periodic use of chemical controls the infestations were getting worse. Seven years ago, we opted for a different approach. Firstly, we reduced our patch to ½ an acre to make it more manageable and we thought that we would try to control the beetles manually by picking them. We literally filled pails with beetles the first year. What we then observed was a lot more bird activity in the patch. We watched birds such as Rose-breasted Grosbeaks, Wild Turkeys along with numerous other species feeding on larvae in the patch. This method, although quite labour intensive, seems to work as each subsequent year the number of beetles appears to be decreasing.

With the success we have had with the Icelandic Red in respect to its apparent resistance to disease and drought tolerance with the added benefit of good storage capacity I felt it would fit with the Crop-Climate program. With an abundance of seed potatoes, I donated them for others to try.

Crop-Climate Project Citizen Scientist Trials

Since Bob Whillans started sharing the Icelandic Red potato, we have added the variety to our citizen-farmer trials and shared them with more than 50 growers across Canada. In our 2019 and 2020 trials, growers compared 3 potato varieties. Icelandic yields varied being productive in some places and yielding poorly in others. Many growers reported that the potatoes were very small, which is typical for this indeterminate variety. Several growers however obtained lots of good-sized potatoes along with the smaller ones. Two of our growers comparing the yield of Icelandic Reds to other trial varieties (Figure 1). Participant feedback was largely positive, and most - but not all - said they would grow the variety again. Growers told us it was very easy to grow, mostly disease free, though some did report a small amount of scab. Participants who wouldn't grow it again were mostly unhappy about the preponderance of small potatoes, with one market gardener telling us that they were not marketable for this reason. On the other hand, another participant said that the small ones reminded them "of the small potatoes at the supermarket" and that they were great on the barbecue. As far as taste and cooking went, participants had generally favourable views, particularly when boiled or roasted. One participant said they were starchier than other potatoes, very good boiled, but "turning to mush" when mashed.

Participant 1: Comparative yield of French Fingerling, Icelandic, and R. Hebda's SP18 TPS cross (Photos courtesy of Elizabeth Borrow, Coldwater ON).

French Fingerling	Icelandic Red	Richard's SP18
		

Participant 2: Comparative yield of Icelandic, Sieglinde, and Ozette-Nootka. (Photos courtesy of Ann Fox, Coldwater, ON)

Icelandic	Sieglinde	OzettečNootka
		

Figure 1: Relative yields of Icelandic Red potato compared to other trial varieties used in the Crop-Climate project.

Characteristics of Icelandic Red

Icelandic Red plants are robust and grow to a moderate size of about 80cm (32”) tall (Figure 2). They produce small white flowers with green stamens (Figure 3). Tubers largely are concentrated under the crown sometimes to a depth of 30 cm (12”) or more. Occasionally there are long stolons (Figure 4) with single potatoes as much as 50 cm (20”) away from the crown. Tuber size varies widely from small nuggets to large potatoes (Figure 4&5) all under a single plant. Small ones are spherical and knobbly with relatively deep eyes. Large tubers tend to be oval with blocky outlines and slightly flattened (Figure 5). Weights range from 0.06 to 0.33 kg (2-12 ounces), typically about 0.15 to .20 kg (5-7 ounces). They are pink-skinned and yellow fleshed sometimes with a faint or prominent pink zone inside the surface (compare Figure 6 to7). They store very well undercool conditions such as in a cool basement. Icelandic Reds have a texture between waxy and floury and very good potato flavour.

Figure 2. Plant of Icelandic Red in the field at the Fredericton Research and Development Centre in 2022.

Figure 3. Flowers of Icelandic red potato, Note the green stamens and healthy leaves. Photo Richard Hebda July 2022.

Figure 4. Typical yield of Icelandic Red plant. Note the long looped stolon in the lower half of the clump. Photo Richard Hebda October 2022.

Figure 5. Tubers of Icelandic Red potato. Photo Richard Hebda October 2022.

Figure 6. Section of large Icelandic Red potato grown by and photographed by Richard Hebda. Although difficult to see in the picture, there is a faint pink zone about 1 cm inside the skin. Compare to Figure 7.

Figure 7. Sectioned tuber of Icelandic Red potato showing pale yellow interior and red markings. (Photo courtesy of Elizabeth Borrow, Coldwater, ON).

Phenology and Growth

The following account describes the phenology of Icelandic Red from a trial planting in Brentwood Bay, Vancouver Island, British Columbia in 2022. The field is flat, near sea level, the soil a silty loam. It had been used for various agricultural crops for more than century, but no potatoes had been grown in this part of the field for many years. Asparagus was growing next to the trial rows. The year 2022 experienced an exceptionally cool and wet spring and the planted tubers were flooded briefly for a couple of days following heavy rain in May. The soil had been cultivated to a shallow depth only once in the spring during a brief dry interval. No watering was applied during the growing season.

Small slightly spouting tubers were planted into trenches below the natural surface on May 6. Tubers were spaced 40-45cm (16-18") apart and placed at depth of 15cm (6"). By June 3 small shoots emerged from all 10 tubers and by June 10 they showed strong growth and development. At this point the plant crowns were hand-hilled under 15cm (6") of soil and all weeds removed. By July 8 the plants were well branched and had flower buds. The first open flowers were observed by July 18 (73 days from planting) and plants were widely covered in bloom on July 29. Plants remained robust well into August, but by August 12 there were no flowers left and no fruits ever formed. Plants started to yellow by August 18 and began drooping so that by September 8 they were mostly brown except for green tips. Tubers were well developed below the soil surface at this time (124 days). By September 21, plants had all died down, tubers had reached full size and could have been harvested but remained in the ground until dug up in late October. The plants and tubers experienced no major diseases or pest damage. The midsummer to fall interval at Brentwood Bay was extremely dry with no rainfall (compared the spring) and it is suspected that the plants would have continued to grow had adequate moisture been provided.

The yield was strong compared to many of the heritage varieties we have trialed. A row 4.2m (14') long of ten plants yielded 9.2 kg (20.3 lbs), (0.92kg (2 lbs) per plant) or 2.2kg (about a 4.9 lbs) per metre of row. The potatoes were widely distributed from the mother tuber ranging up to half a metre away. They were also comparatively deeply placed in the ground many occurring 30cm (12") below the surface.

One additional observation is pertinent concerning hardiness. In the previous year the first Icelandic Reds were planted in a nearby garden. The yield was relatively modest, and not all the potatoes were dug up from this clayey site. Typically, a few potato tubers survive in the ground over our mild winters on the Saanich Peninsula, though we had hard frost in February that briefly penetrated the ground to 5 cm (2"). Almost all the tubers of the other varieties left in the ground over the winter in the same patch rotted or froze whereas Icelandic Reds survived in a healthy condition!

Genetics

We compared this potato to the European Potato data base and on-line descriptions and as far as we can tell it is the same as a variety Raudar Islenskar, though there are differences (https://www.europotato.org/Raudar Islenskar). We also know that the original tubers came directly from Iceland. Raudar Islenskar is widely grown and highly valued in Iceland.

Being a new variety to the Canadian Potato Genetic Resources gene bank tubers were analyzed by Fredericton Potato Resources Research Centre using SNP DNA techniques. The Results were surprising. Molecular characterisation was conducted using high-density, genome-wide markers based on single nucleotide polymorphism (SNP). It was based on a panel of 3,614 high-quality markers from the SolCAP SNP array which has been found useful to to assess relationships among germplasm and fingerprint potato varieties (Douches et al 2014). Cluster analysis was conducted to group individuals based on the marker-based dissimilarity index so that individuals with similar characteristics are gathered into the same cluster. Results are presented in Figure 8 and indicate a close relationship with another heirloom variety of unknown origin, Black Mignon. Black Mignon (Figure 9) is sometimes called "Cups". Choiseul et al (2008) mention a variety called 'Red Cups' with similar characteristics that was first recorded in Ireland in 1808. The position of Icelandic Red on the dendrogram in relation to Black Mignon (also known as Cups) suggests a possible parental relationship.

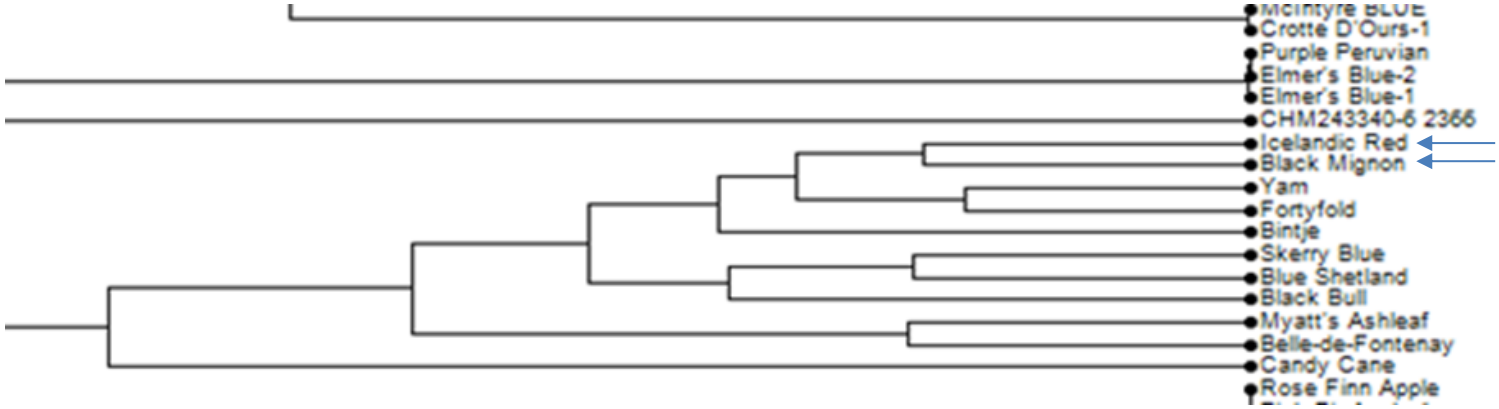

Figure 8. Position of Icelandic Red on the dendrogram tree obtained by Ward's minimum variance hierarchical clustering method.

Figure 9. Tubers of Black Mignon (also known as The Cup) (image from the Canadian Potato Gene Resources, Fredericton, NB). Note the similarity to Figure 6 and faint pink blush inside the skin of the sectioned tuber.

Considering the solid yields, storage qualities, apparent disease resistance and potential hardiness of this potato it may be a reliable variety for Canada's north and for breeding new cultivars for garden and small market use.

References

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Acknowledgements

We are grateful to Gretchen Bauta and the W. Garfield Weston Foundation for their ongoing support for the Crop-Climate Project.

We thank Kladia Robertsdottir-Lewis of Victoria for information on the history of the potato in Iceland.

A decade of participatory breeding of organic and ecological potatoes in Canada

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To meet the challenges of organic and eco-responsible potato production, it will be important to develop varieties that are resistant to diseases and pests, perform well under reduced input conditions, and meet consumer needs. Varieties that meet these criteria will allow a significant reduction in inputs for both organic and conventional producers.

Despite the industry's focus on varietal development, the supply of potato varieties adapted to organic management is almost non-existent in Quebec and the rest of the country. The probability of such varieties emerging from a traditional genetic improvement program under conventional crop management is low.

One avenue for developing cultivars suitable for organic and eco-responsible production is participatory breeding, which involves farmers, plant geneticists, and agricultural stakeholders in the varietal creation process (Colley et al., 2021). Scientists look after cross-breeding and, if necessary, the first year of propagation. Farmers focus on selection according to their criteria and preferences. Finally, the stakeholders assist them in the process with networking and equipment.

Figure 1: Ken Laing of Orchard Hill Farm, Ontario, in front of his potato breeding plot. Photo: Michelle Carkner.

Participatory plant breeding offers a number of benefits, including risk sharing, diversified breeding environments and selection for organic or ecological production techniques. It is particularly well suited for local or specialty markets (Figure 1).

In the potato industry, the Netherlands has taken the lead in fully developing the potential of participatory breeding. In 2009, of the 409 potato varieties planted for seed potato production, almost 75% were bred in the Netherlands. Half of these Dutch varieties were bred by farmer-breeders and *hobby breeders*, covering 44% of the total area planted in seed potatoes. The Netherlands stands out for its network, collaborative cultivation and fair royalty sharing (Figure 2).

Figure 2: Farmer-breeder and researcher in the Netherlands. Photo: Louis Bolk Instituut.

The Dutch model suggests the potential of plant breeding for research centres and seed companies which have a variety development program in Canada. Although participatory plant breeding is internationally recognized and scientifically validated, many questions remain when it is time to release new potato cultivars.

SeedChange and the farmers who participate in its programs, which are often organic and diversified vegetable farms, have no experience with the regulatory and commercial aspects of seed potatoes. Despite the development of new cultivars that meet the requirements of the farmers we work with, the challenge lies in navigating the variety registration and intellectual property framework, being able to evaluate plant lines under organic conditions (Figure 3) and finding commercial partners for certified seed production.

Before a new variety can be marketed, the following issues must be addressed: Under what conditions should a variety be registered on the List of Garden Varieties or, conversely, go through Variety Registration with the Canadian Food Inspection Agency (CFIA)? How should royalties from these varieties, if any, be shared between the hybridizer, or the institution they are associated with, and the farmer-breeder? To what extent can seed evaluation and production be done in an organic or eco-responsible manner? Finally, what production and profitability thresholds should be considered by the seed company?

Figure 3: Organic potato trials at CETAB+ of farmer-breeder lines (2017). Photo by Laura Howard.

SeedChange has been addressing these issues in order to equip its farmer-breeder cohorts, whom it has been advising since 2013 (Figures 1, 4, and 5). SeedChange has published a first guide on this topic, referenced at the end of the article. As part of the participatory breeding cohort with the Consortium de recherche sur la pomme de terre du Québec (CRPTQ), which began in 2021, SeedChange is initiating a worksite and consultation project on the release of new varieties developed by farmer-breeders. A virtual information session has also been organized to frame these discussions.

In terms of marketing, the preferences of the breeder and the institution which they are associated with is a key factor. In fact, SeedChange has worked with many breeders, namely Agriculture and Agri-Food Canada (2013–2015), a retired independent hybridizer (2016–2017), and then the CRPTQ (2022–2023). Each of these partners addresses the multiple issues associated with marketing in different ways.

Another factor that must be considered is the context of the potato industry at the provincial level. In particular, each province has its own regulations regarding the maximum production threshold before mandating the use of certified seed, which can vary from 0.8 ha in Nova Scotia and 1 ha in Quebec to 8 ha in Prince Edward Island.

Figure 4: Members of the Gaïa Solidarity Cooperative in the apple selection plot. Source: Gaïa Cooperative.

Figure 5: Harvesting and selecting potatoes with the family at La Prucheraie farm. Photo: Myriam Beaulieu.

In Quebec, seed production is governed by three distinct factors: the specifications of the certification program, the Crop Health Protection Act and the Regulation respecting the cultivation of potatoes.

Differences in provincial contexts are also evident in the availability of organic seed. While Alberta, Manitoba and Ontario have companies offering organic seed, Quebec does not have any yet.

The most desirable scenario for the farms we work with is to reproduce their potatoes themselves and sell the potatoes to their customers for consumption. The only requirement is to use a glycoalkaloid toxicity test, which can cost anywhere from $185 to $650, and to receive lab results indicating less than 20 mg/100 g.

This option satisfies the majority of our program participants. However, it has several disadvantages. The risk of virus propagation increases after five to seven years of breeding. There is also the risk of mixing lots at harvest or in storage by mistake. Breeding is restricted to this farm because the seed potatoes cannot be distributed. If the participant loses it, years of work can be lost, which explains the importance of having the tissue culture maintained by a designated partner.

Given these disadvantages, farmer-breeders and stakeholders who support them need to develop innovative solutions and partnerships in order to release new potato cultivars. This requires more dialogue among the farmer-breeders and collaboration with the other links in the chain.

Accelerating climate change and consumer demand for a crop that reduces its environmental footprint are two good reasons to invest in participatory plant breeding. After 10 years of experimentation, it is time for the Canadian potato genetics and seed potato industry to seize the opportunity offered by organic and eco-responsible farms in research and variety development, to develop an organic trial network and to participate in marketing partnerships.

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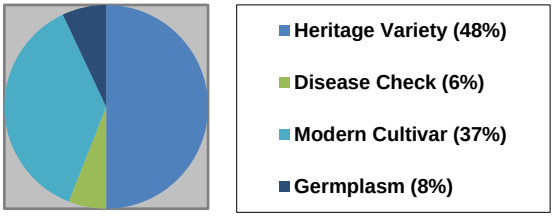
Annual Report 2022

The Canadian Potato Genetic Resources
Sylvia Steeves and Benoit Bizimungu

The Collection

1. Holdings

The Canadian Potato Genetic Resources (CPGR) is a node of Plant Gene Resources Canada (PGRC) and holds 194 clones within its genebank. All these clones are maintained *in vitro*, and 140 accessions were grown in the field for seed multiplication or maintenance at our Benton Ridge Potato Breeding Substation, Benton, New Brunswick. A full listing of accessions may be found in the request form. The following chart illustrates the types of clones in each category.



2. New Accessions

- There were 2 new accessions added to the genebank in 2022.

- Machado Farm Isla (CN# 124023)

  Machado Farm Isla was donated by Curzio Caravati (for Rick Machado) and it was provided to the Canadian Potato Genebank through Seed Savers Exchange (Decorah, IA, USA). It produces oval-oblong tubers and has been selected in California for its tolerance to drought and heat (Curzio Caravati: personal information).

- Cooperation 88 (SP328) (CN# 124024)

  Cooperation 88 (SP328) was donated to the Canadian Potato Genebank by Peter VanderZaag (Sunrise Potato Storage Ltd., Ontario, Canada). It was selected in China from cross made in the Philippines using germplasm from the International Potato Center (CIP). Cooperation 88 has durable late blight resistance and excellent vegetative growth, and is one of the most widely grown cultivars in the world. It also possesses high resistance to PVY and resistance to PLRV. It produces large and blocky reddish pink tubers, with light yellow flesh and low reducing sugars, suitable for chips and French fry processing in addition to good eating quality characteristics. Cooperation 88 has very late maturity under Canadian long day growing conditions. (sources: C88 popularity in Southwest China - International Potato Center (cipotato.org); DOI 10.1007/s12230-010-9174-z; Peter VanderZaag: personal communication)

3. Evaluations

- Nine accessions were grown in an evaluation trial at the Fredericton Potato Research and Development Centre. Two replications of fifteen hills were planted on June 15, 2022 and harvested on October 5, 2022. The accessions were as follows: 'Atlantic', 'CH72.03', 'Chieftain', 'Carola', 'Superior', 'Black Bull', 'Shepody', 'Congo' and 'Candy Cane.'. The field evaluation plots are useful for morphological and agronomic evaluation, specific gravity measurement and photographs documentation.

- In addition to the evaluation trial, 17 accessions were grown in a single replication of ten hills at the Fredericton Potato Research and Development Centre for demonstration purposes. The accessions were as follows: 'Banana', 'Beauty of Hebron', 'Candy Cane', 'Christmas Island Rose', 'Congo', 'Crotte D'ours', 'Elmer's Blue', 'Burbank', 'F87084', 'Haida', 'Keswick', 'Lenape', 'Lumpers', 'Ozette', 'Mark Warshaw's Quebec', 'Shepody' and 'Yukon Gold'.

4. Management

- Passport data for 167 PGR accessions is available online at the Genetic Resources Information Network-Canadian Version (GRIN-CA). GRIN-CA may be accessed through the Plant Gene Resources of Canada website. New information will be posted on the new GRIN- GLOBAL portal as it becomes available.

- Disease testing of accessions includes: i) regulatory testing by a CFIA-accredited lab and ii) in-house testing:

- i) Regulatory disease testing was completed by Agricultural Certification Services located in Fredericton, NB in November. All new accessions are tested before introduction into the genebank collection whereas existing *in vitro* accessions are re-tested on a ten year rotational cycle. 17 clones were grown from tissue culture in the potato breeding greenhouse and tested for: PVA, PVM, PLRV, PotLV, PVS, PVX, PVY, and PSTV. All clones tested negative for associated diseases. In addition, all accessions were grown out in the greenhouse for distribution and field increase and tested for tuber borne BRR disease. All samples tested negative for associated diseases. Extra mini-tubers are available for distribution in the spring of 2023.

- ii) All *in vitro* clones were tested in-house once during 2022 for bacterial and fungal contamination using Potato Dextrose Broth and Richardson's Broth. All clones currently in the Genebank are negative for bacterial and fungal contaminants.

- Safety Backup: A total of 1118 micro-tubers were harvested from 191 of the genebank accessions in 2022. Approximately half of the micro-tubers were sent to AAFC Plant Gene Resources of Canada, located in Saskatoon, SK, in October 2022 as safety duplication back-up. The viability of the collection is protected by this remote storage location arrangement. A technician at AAFC Plant Gene Resources of Canada, continues to monitor the micro-tubers in Saskatoon. The remaining micro-tubers are stored at the Fredericton Potato Research and Development Centre.

5. Distribution

- Accessions within Canadian Potato Gene Resources fall under The International Treaty on Plant Genetic Resources for Food and Agriculture, which requires recipients to sign a Standard Material Transfer Agreement (SMTA), before any material is transferred. Any and all material shall only be utilized, or conserved for training/education, research, and breeding purposes for food and agriculture. All request forms include the SMTA. For more information and assistance in determining whether your plans fall into this agreement visit: The International Treaty on Plant Genetic Resources website. By accepting shipment of the requested material, recipients accept all terms and conditions of the SMTA. Recipients names will be submitted to the Governing Body of the Treaty.
- Twelve requests for 524 units from 70 accessions were received in 2022. Clonal distribution categories are as follows:
- 59 units of *in vitro* plantlets, 363 units of field grown tubers, and 102 units of greenhouse grown mini-tubers. 'Glenwood Red' was the most requested accession in 2022.

Distribution of Clones by Purpose – 2022

Purpose of Request	Number of requests	Number of units	Number of Accessions	*In vitro* plantlets	Field tubers	Mini-tubers
Research	6	404	31	50	285	69
Teaching or Demonstration	1	41	12	5	33	3
Evaluation	5	79	27	4	45	30
Total	**12**	**524**	**70**	**59**	**363**	**102**

Requests by Destination – 2022

Destination	Number of requests
New Brunswick	5
Quebec	3
Ontario	2
Alberta	1
British Columbia	1
Total	**12**

Five-Year Compilation of Clone Distribution for Potato Gene Resources 2018-2022

	Request purpose				Units distributed			
Year	Research	Education	Conservation	Total	Field tubers or mini-tubers	*In vitro* plantlets	Total	Accessions
2018	20	3	0	23	335	50	385	90
2019	19	3	0	22	244	234	478	211
2020	3	0	0	3	0	43	43	21
2021	21	1	0	22	176	276	452	259
2022	11	1	0	12	465	59	524	70
Total	**78**	**10**	**0**	**82**	**1220**	**665**	**1882**	**651**

Repository Items of Interest

Communication

- In addition to the requests for clones, many requests for information about the genebank, the availability of clones, clone descriptions and pedigrees, and techniques for handling *in vitro* material were received throughout 2022.

- The annual Potato Gene Resources newsletter has a distribution list of approximately 400 recipients.

- The current newsletter and several back issues may be accessed on the Weekly Checklist of Government of Canada Publications.

Meetings and Miscellaneous Information

- Dr. Benoit Bizimungu (curator) and Sylvia Steeves (technician) attended (virtually) the Plant Germplasm Operations Committee (PGOC) and Curator Workshop organized by the United States Department of Agriculture (USDA), June 14-16, 2022.

Donor Agreement

- Donors wishing to provide plant material to Agriculture and Agri-Food Canada (AAFC) for the purpose of research, conservation and distribution by Plant Gene Resources of Canada must complete a "donor agreement". Decisions on accepting material into the Canadian Potato Genebank are up to the discretion of the curator, Dr. Benoit Bizimungu (Benoit.Bizimungu@agr.gc.ca.ca).

Visitors

- August 16, 2022 – Dr. Amina Abed, breeder from Consortium de recherches sur la pomme de terre du Québec (CRPTQ), Pointe-aux-Outardes, QC visited the Potato Genetic Resources Genebank.

Research Scientist and genebank curator Dr. Benoit Bizimungu (left) explaining the genetic diversity maintained in the genebank collection and presenting heritage varieties. Dr. Amina Abed (right) from CRPTQ in Point-aux-Outardes, QC.

- August 16, 2022 – Dr. Christine Noronha, Acting Director (DRDT) for Charlottetown-Fredericton Research and Development Centres also visited the Potato Genetic Resources Genebank.

Dr. Christine Noronha, Acting Director for Charlottetown-Fredericton Research and Development Centers (left) observing in-vitro plantlets from the Potato genebank repository presented by Research Scientist and genebank curator Dr. Benoit Bizimungu (right).

Fredericton Research and Development Centre Website

- The Fredericton Research and Development Centre is custodian of the Canadian Potato Genetic Resources. The Fredericton Research and Development Centre website offers an overview of the Centre's mandate, resources and achievements along with research studies being conducted at the Centre and the staff associated with those studies.

Plant Gene Resources of Canada

- Plant Gene Resources of Canada (PGRC), the national Canadian genebank, preserves, characterizes and distributes plant genetic resources for food and agriculture. PGRC is based on collaboration between AAFC Research Centres and people dedicated to preserving the genetic diversity of crop plants and their wild relatives. PGRC plays a significant part of AAFC's commitment to the Canadian Biodiversity Strategy in response to the Convention on Biological Diversity and the International Treaty on Plant Genetic Resources.

- The Plant Gene Resources of Canada (PGRC) website includes information on the PGRC multi-nodal system of germplasm conservation in Canada and allows searching for germplasm information on the Genetic Resources Information Network-Canadian version (GRIN-CA).

The Genebank and the Seed Potato System

- The Canadian Potato Genetic Resources 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 are produced outside the Canadian Seed Certification System and are not eligible for certification.

- The Canadian Seed Potato Certification System operates under the *Seeds 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 (CFIA). 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. More information on potato seed certification can be found at the CFIA website.

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The Potato Gene Resources Newsletter is available as an electronic version. If you are still receiving a paper version and wish to receive future Newsletters by e-mail, in pdf (portable document format), please send your e-mail address to: Sylvia.Steeves@agr.gc.ca. We will continue to send the printed Newsletter to those who do not ask to receive it electronically. Maintaining contact with you is important.

Curator's Note

- Despite some restrictions resulting from the pandemic situation, core genebank activities such as germplasm conservation were carried out without interruption. This year, we were able to resume normal activities including germplasm distribution, field evaluations, as well as processing germplasm donations. The Canadian Potato Genebank Facility was also re-opened to visitors.

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