

Benton Ridge

POTATO
BREEDING SUBSTATION



**Agriculture
Canada**

Publication 5236/E

PUBLICATION 5236/E, available from
Communications Branch, Agriculture Canada,
Ottawa K1A 0C7

Minister of Supply and Services Canada 1988
Cat. No. A53-5236/1988E ISBN: 0-662-15888-1
Printed 1988 3M-1:88

Egalement disponible en français sous le titre
*Benton Ridge, station satellite d'amélioration
de la pomme de terre.*

Cover Photograph: Shepody

This publication was supported by the Export
Expansion Fund No. 071

Also available in French, Spanish, and Portuguese



Benton Ridge Potato Breeding Substation

Located 100 kilometres north of Fredericton on the lower edge of the New Brunswick potato belt, Benton Ridge is the home of Agriculture Canada's national potato breeding program. This substation of the Fredericton Research Station was opened in 1975 and comprises 345 hectares, of which 150 are good arable land typical of the soils used for growing potatoes in New Brunswick. Benton Ridge was designed specifically as a research facility for potato breeding. The land surrounding the field plots is wooded and serves as a buffer, isolating the experimental plots from neighboring farms. Each field plot is laid out in a rectangular module of 0.2 hectare. Permanent roadways separate the modules. The buildings on the station include

- facilities for the storage, grading, and handling of potatoes
- a greenhouse, screenhouse, laboratory, and office
- a machinery shed
- a meeting room.

The Benton Ridge Potato Breeding Substation is operated as an Elite seed farm, and stringent phytosanitary restrictions are in place. Before being allowed onto the substation, all potato material is extensively tested in the laboratories and greenhouse at Fredericton to make sure it is free from disease. Machinery is steam-sterilized before it is driven onto the plot areas. Members of the staff are given protective clothing for exclusive use on the Benton Ridge property. All visitors must put on protective footwear at the building entrance before they can tour the facilities.



History

The first potato cross at Fredericton was made in 1929 (a cross between Green Mountain and Katahdin), but it was 1933 before an official project was established. By 1934 there were 10 000 potato seedlings growing in the field. The original objectives were to breed for resistance to mosaic and late blight. In 1937 breeding for resistance to common scab and potato leafroll virus was added. By comparison, the main goals in 1986 have grown to include breeding for

- resistance to 12 diseases
- early development of tubers
- five characteristics that evaluate the quality of potatoes used for french fries
- stability of yields under stressful conditions
- resistance of tubers to bruising.

In addition, any successful new variety must meet minimal standards for approximately 20 other horticultural and agronomic characteristics.

The Canadian potato breeding program

The program is designed to ensure that Canadian producers have the best possible potato varieties available to satisfy the needs of the various markets. Some potato varieties are bred specifically for sale as fresh produce. Others are bred for processing, seed, or export.

To support this work, research is being conducted in the areas of

- germ plasm resources using both diploid and tetraploid species
- quantitative genetics
- selection methods
- disease resistance evaluation
- screening methods
- tissue culture.

Much of this work is done in the laboratories and greenhouses at the Fredericton Research Station. When required, field tests are conducted at Benton Ridge. The Fredericton Research Station also has strong research programs in the areas of plant pathology, plant physiology, entomology, and engineering. Scientists participating in these programs frequently cooperate with the scientists involved in potato breeding. Test plots for doing research on diseases and pests of potatoes are located at Fredericton, as well as at other research establishments.





Variety development

To develop a new variety, scientists first select parents that are predicted to yield progeny with the desired characteristics. Crosses are made between selected parents. The true seed produced is planted and the resulting seedlings are grown in the greenhouse at Fredericton. The first tubers produced in this container culture are then introduced to Benton Ridge.





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1. The Atlantic Regional Potato Evaluation Committee visits Benton Ridge.

2. Tuber resistance and susceptibility to dry rot.

3. Selection of 100-hill plots.

4. 100-hill plots in blossom.



3

4

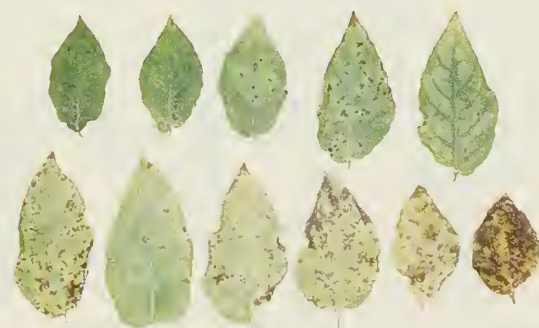


5. Harvest of 16-hill plots.

6. Variation in leaf resistance to late blight.

7. Potatoes Canada visits Benton Ridge.

5



6



7

Single-hill plantings

Each year approximately 60 000 new seedlings are introduced into the breeding program and are grown in plots containing a single hill. At harvest, 10–15% are selected for further evaluation.

Four-hill and 16-hill plantings

Seedlings retained from the single-hill plantings are grown the subsequent year in plots containing four hills, and those surviving this evaluation are planted the year after that in plots containing 16 hills.

100-hill plantings

Approximately 200 of the original 60 000 individuals survive 3 years of field evaluation. These are planted in 100-hill plots during their fourth year in the field. Of these, approximately 100 survivors are given permanent “F” numbers. The “F” stands for Fredericton, and the first two digits identify the year the individual was first grown in the field. At this stage, the crop is large enough to allow extensive evaluation of yield, quality, and disease resistance.

Regional and national evaluation

The seedlings produced at Benton Ridge next have to be evaluated in all the potato-growing regions across Canada. Scientists with the federal and provincial governments and at the universities cooperate with the plant breeders to assess the potential of candidate varieties. They carefully compare the new varieties with established varieties and with new selections being developed by other breeders in Canada and the United States. Trials to determine acceptance by consumers, as well as pilot runs in processing plants, are an integral part of the evaluation. Truly outstanding performers are proposed to the Seed Division of Agriculture Canada for registration and release to the commercial potato industry.





Variety introduction

All seedlings in advanced stages of evaluation are entered into the Elite seed system so that when a decision is made to introduce a variety, virus-tested seed of Elite status is available without delay for distribution to the industry.

Varieties bred at the Fredericton Research Station

The first variety was released in 1951. By 1986 the breeding program had released 23 varieties alone or jointly with collaborators elsewhere in Canada and, in one instance, in the United States. Important varieties, with the year in which they were introduced, are briefly described on the next page.



- **Keswick 1951**

A mid season variety with early tuber development, excellent as fresh produce. High resistance to late blight. Ideal for home gardeners and market gardeners alike.

- **Belleisle 1974**

A late variety with good appearance, excellent for boiling and baking. Resistant to late blight, common scab, skinning, and bruising.

- **Jemseg 1978**

An early fresh-market variety, with excellent appearance, good for boiling. Moderate resistance to common scab and high resistance to several virus diseases.

- **Shepody 1980**

A mid season variety. Long, shallow-eyed tubers. Excellent yielding. Excellent quality for use as french fries. Excellent for boiling and baking.

- **Acadia Russet 1981**

A late, lightly russet-skinned medium-sized variety. Excellent for boiling and baking. Resistant to leaf roll.

Professional staff at Benton Ridge

The scientists working on potato breeding at Benton Ridge are shown in our photograph. From left to right they are

- Agnes M. Murphy, B.Sc., M.Sc.
Disease screening
- T. Richard Tarn, B.Sc., Ph.D.
Project Leader; Breeding and genetics
- George C.C. Tai, B.Sc., M.Sc., Ph.D.
Quantitative genetics
- Henry De Jong, B.A., M.Sc., Ph.D.
Diploid breeding and genetics





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Canada