

ANCESTRY OF APPLE SELECTIONS AT THE UNIVERSITY OF SASKATCHEWAN
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Abstract

Since the mid 1960's, 30,297 seedlings from controlled crosses have been evaluated in our apple breeding program. Young seedlings were selected following artificial freezing in a deep freezer or natural conditions in a nursery where -40C lows are common each winter. Only 8717 seedlings showed superior cold hardiness and were selected for field planting. From this population, 68 advanced selections have been propagated for further study. The most important parents for producing advanced selections were Brookland and Haralson, which contributed 28.4 and 23.7%, respectively. Tracing ancestry revealed the most important founders to be Heyer 12, McIntosh, Ben Davis, and Malinda which contributed 17.6, 14.6, 12.2, and 11.8%, respectively. An additional 13 founders contributed 20.85% while up to 11 accessions contributed 22.9% through open pollination. Nine of the 51 cultivars developed through the Prairie Fruit Breeding Co-operative contributed 66% of the genepool. The twenty cultivars developed at the University of Saskatchewan between 1923 and 1960 have not resulted in promising offspring and make up only 0.4% of the genepool of advanced selection. Wild species have contributed less than 2.0% while cultivars of Russian origin contributed 23.8%. 56 of the advanced selections are third generation crosses while 12 are fourth generation. None of the advanced selections have inbreeding in their lineage. Hardiness and fruit size was emphasized in previous generations. In the current generation those two attributes are more common and selection has been for fruit quality and storage life.

Introduction

The apple breeding program at the Univ. of Saskatchewan takes place in Zone 2 and is probably the coldest location in North America where apples are bred at a public institution. Identifying the founders and parents of advanced selections could be useful for others breeding apples in cold climates and for broadening the genetic base of prairie-hardy apples.

Materials and methods

Over the last 15 years, 68 advanced selections were selected from the apple breeding program at the University of Saskatchewan. Much of this material resulted from crosses since 1960 by either S. H. Nelson, C. Stushnoff, or R. Sawatzky at Saskatoon. The University of Saskatchewan also received seeds and seedlings from the Prairie Fruit Breeding Co-operative, of which it was an active participant (Ronald, 1978). Records showed that 30,297 seedlings were grown but only 8717 plants were field planted for fruit evaluation. Screening for cold hardiness was done in a nursery that commonly had

-40C lows each winter or with artificial freezing tests (Stushnoff,1982). Advanced selections were chosen based on cold hardiness, productivity, and fruit quality.

The ancestry of U. of Saskatchewan advanced selections was compared to earlier lists of recommended varieties for the Canadian prairies (Saunders,1911; Patterson, 1936; Patterson, 1960; Ronald, 1978). Lineage was traced using various references (Anonymous, 1991; Beach et. al., 1905; Downing, 1870; Patterson,1936; Thomas and Wood,1897) to obtain a list of founders and intermediates. The founders were classified according to origin. A Microsoft Excel (version 97 SR-1) spreadsheet was used to calculate percentages and generate graphics.

Results and discussion

The ancestry of the advanced selections from the University of Saskatchewan could be traced to 15 cultivars and two wild species with a 23% contribution from open pollination (Table 1). An additional 25 cultivars had been intermediate parents with Brookland and Haralson providing the largest contribution to the gene pool (Table 2).

Many selections from the U. of Saskatchewan breeding program have been derived from releases from the Prairie fruit breeding co-operative. Very few have lineage derived from earlier U. of Sask. varieties. While all recommended apple cultivars in 1911 had wild species as one of their parents (Saunders, 1911), wild species contributed less than 2% of the germplasm for current selections (Fig. 1.).

Russia is the only European country to which Prairie apples of any era could be directly traced. It seems likely Russian cultivars were preferable to wild species or crabapples as a source of cold hardiness in breeding programs. As domesticated apples are not native to North America, the apples that originated in Canada or the US may have their origins from other European countries. Earlier introductions of Russian cultivars had poor keeping quality (Beach et al., 1905) and it is generally known that older prairie apples varieties also have a short storage life. It seems likely the founders from chance seedlings and open pollinations were a source of improved fruit quality for more recent advanced selections. This could explain the increased importance of founders from North America.

Acknowledgements:

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Fig. 1. Origin of founders of prairie apples of different eras. Based on Saunders (1911), Patterson (1936, 1960), Ronald (1968) and advanced selections of the University of Saskatchewan fruit-breeding program.

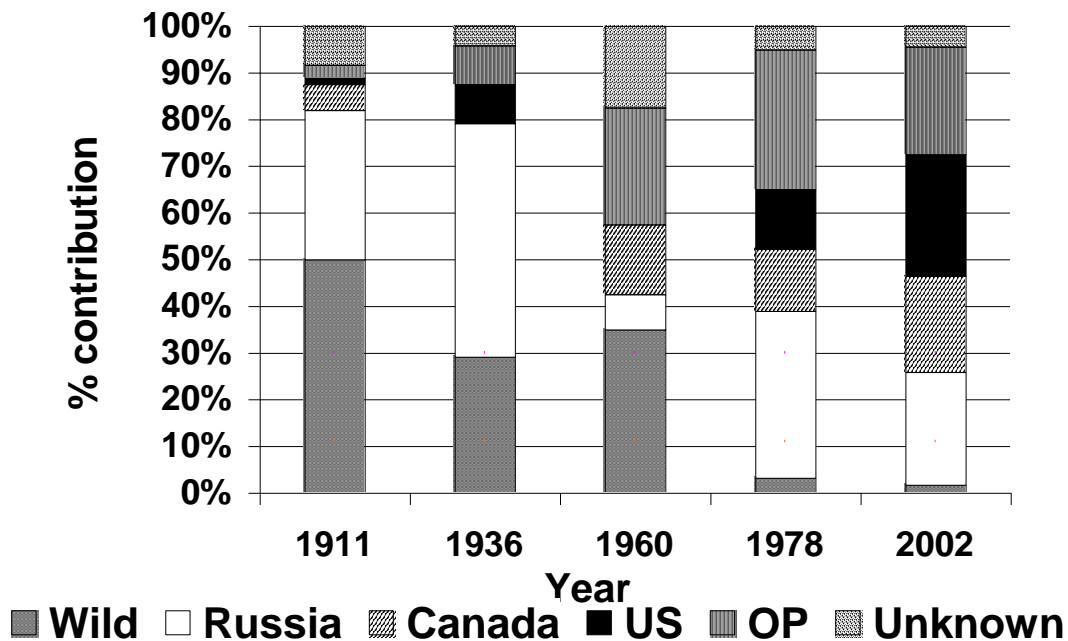


Table 1. Founders of recent advanced selections at the University of Saskatchewan.

Founders	% contribution
Open pollinated	23.1
Heyer 12	17.6
McIntosh	14.6
Ben Davis	12.2
Malinda	11.8
Lankford Beauty	4.2
Blushed Calville	3.8
BE6027	3.0
Duchess	2.5
Minn#1527	1.7
Pioneer #60	1.5
<i>M. robusta</i>	1.4
EE1-2	0.8
Lasiuk#2	0.8
Golden Reinette	0.4
Grimes Golden	0.4
<i>M. baccata</i>	0.3
Broad Green	0.3

Table 2. Intermediate parents of recent advanced selections of the University of Saskatchewan.

Parents	% contribution
* Brookland	28.4
Haralson	23.7
Lobo	9.1
Melba	8.5
* Westland	6.8
* Goodland	6.4
Rescue	6.1
* Norland	5.3
* Morden #359	4.5
* September Ruby	3.8
SK Prairie Sun	3.8
Dr. Bill	3.4
Minn #1728	3.4
Patten Greening	3.2
* Parkland	3.0
Wealthy	2.8
Melred	2.3
Patten	1.7
Breakey	1.5
Honeygold	1.5
* Pioneer #10	1.1
* 58-303	0.8
Golden Delicious	0.8
Wedge	0.8
Columbia	0.4

* Cultivars from the Prairie Fruit Co-op Program