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# HYBRID SEEDLING ROOTSTOCKS FOR APPLES

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Efficient apple production depends on satisfactory tree growth and productivity, both of which are greatly influenced by the rootstock. Therefore, factors of prime importance in commercial orcharding are:

- Root winterhardiness
- Trunk hardiness when the scion variety is budded high, at 18 to 24 inches
- Suitable root depth and anchorage so that bearing trees do not require staking
- Tolerance of the latent viruses that are common in most stocks of varieties such as McIntosh and Delicious
- Satisfactory interaction between the scion variety and the rootstock, which results in satisfactory growth of the trees and high yield of marketable fruit.

Injury to apple trees from abnormally low or fluctuating temperatures during very late fall or winter is a hazard each year, particularly in Ontario, Quebec, and New Brunswick. Tree survival, which depends largely on the hardiness of the rootstock and trunk, is critical. Since the orchardist relies on the nurseryman for the propagation of trees at minimal cost, the nurseryman needs an easy and efficient method for producing rootstocks and for budding or grafting them with the scion varieties.

For decades, in Canada and many other countries, seedling apple rootstocks from seed of uncontrolled pollination have been used, mainly because they are simpler to obtain than clonal stocks, which must be propagated vegetatively. Furthermore, depending on their parentage, they may tolerate adverse cultural conditions better than most clonal stocks, and their stronger roots anchor the

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mature trees more firmly. If the seed is collected from orchards that contain only hardy varieties, seedling stocks will be much more winter-hardy than most clonal stocks grown in Canada.

Large quantities of apple seeds were imported from France to North America until about 1935, and seedlings produced from these seeds were known as French Crab seedlings. More recently, seeds from domestic varieties grown in North America have largely replaced imported seeds. Because these seeds are usually from varieties such as Winesap, McIntosh, and Delicious, without controlled pollination, they often have nonhardy parents.

High-density planting is now being practiced in Canada. Success depends on satisfactory control of growth and yield, which can be achieved by careful choice of the root system. Some growers prefer clonal stocks; they believe that since all rooted shoots of the stock are genetically alike, the shoots should be less variable than seedling stocks in the production of fruit.

The Malling rootstocks selected in England and the Malling-Merton rootstocks, which were developed in England, are the best known of the clonal apple rootstocks. Several of these stocks are commonly planted in Canadian orchards, but in the more severe areas they are not winter-hardy. There is need for improved rootstocks that are suitable for Canadian conditions.

Several researchers have shown that under orchard conditions seedling stocks are generally no more variable than clonal stocks.

## HARDY HYBRID SEEDLING ROOTSTOCKS OF KNOWN PARENTAGE

Seedling stocks that have been used in Canada and other countries have been grown from seed of selected varieties, but with uncontrolled pollination. Two parents, even when they have been selected for their combined tree type, hardiness, and other factors, may produce progeny that do not perform well because of the complex inheritance of the most important rootstock characters. Since Canadian fruit growers continue to plant trees on seedling roots, the need for a systematic program for selecting parents for the production of hybrid rootstocks has been apparent.

The development of a series of hybrid seedling apple rootstocks began at Ottawa in 1961. Sufficient progress has been made to warrant introduction of six hybrid stocks. They are identified as Ottawa Hybrid 1 (Heyer 12 × *Malus robusta* 5), Ottawa Hybrid 2 (Osman × Heyer 12), Ottawa Hybrid 3 (*M. robusta* 5 × Antonovka), Ottawa Hybrid 4 (Osman × *M. robusta* 5), Ottawa Hybrid 5 (Osman × Antonovka), and Ottawa Hybrid 6 (Heyer 12 × Antonovka).

The Ottawa Hybrids are tolerant of the latent viruses commonly found in commercial apple varieties, as determined by their inoculation with donor buds containing known viruses such as stem pitting, brown line decline, rubbery wood, and chlorotic leaf spot. Also, their performance in the nursery row, particularly for

rate of growth and morphology, has been satisfactory.

Tests with McIntosh and similar apples for compatibility of scion variety and rootstock have not been carried beyond the nursery-tree stage, but these Ottawa Hybrids appear to be satisfactory. Although the hybrids have not been used in yield tests with McIntosh, they should be as suitable as the seedling stocks now being used. However, it must be emphasized that they have not been evaluated on the basis of mature-tree production.

## WINTERHARDINESS TESTS

In developing these hybrids, several hardy parents were used in a crossing program to select the most desirable combinations. An artificial test of their reaction in the Ottawa portable low-temperature chamber (Proc. Amer. Soc. Hort. Sci. 84:131-136. 1964) has shown that the six hybrids are extremely hardy.

They were compared with the very hardy Ottawa clonal rootstock *Malus robusta* 5, which is the hardiest clonal rootstock now in use in Canada. The Ottawa Hybrid rootstocks ranked high in winter survival (Table 1) and were superior to the seedlings produced by seed from uncontrolled pollination of Antonovka. Similarly, the hybrids were superior in winterhardiness to Delicious open-pollinated seedlings and other seedling stocks used in the tests, as well as to the clonal rootstock Malling 26.

## GROWTH CHARACTERISTICS

The dwarfing capacity of these hybrids is not known, but it is believed that when they are grafted with McIntosh or a similar variety they will produce trees of nearly normal size.

## GENERAL RECOMMENDATION

The Ottawa Hybrid seedling rootstocks 1 to 6 have been selected because of their winterhardiness and general suitability as nursery trees, and they are recommended for use by nurserymen and commercial apple growers who want to have trees on seedling rootstocks. The Ottawa Hybrids should be especially valuable in areas where hardiness is of prime concern.

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TABLE 1. Winter survival ratings for the Ottawa Hybrids and for alternative rootstocks

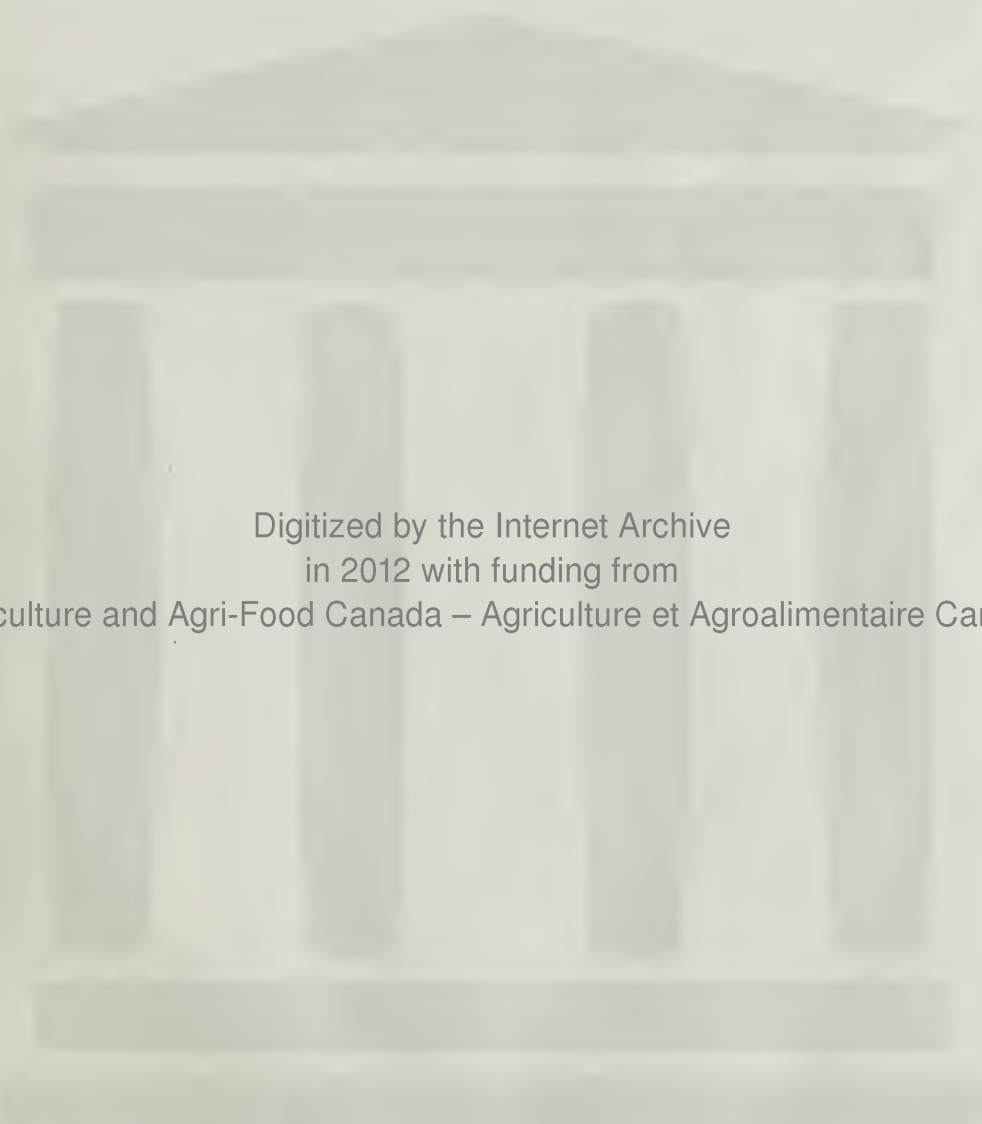
Rootstock	Winter survival rating*
Ottawa Hybrid 1	306
Ottawa Hybrid 4	300
Ottawa Hybrid 3	278
Ottawa Hybrid 2	266
Ottawa Hybrid 5	260
<i>Malus robusta</i> 5 (clonal)	249
Ottawa Hybrid 6	242
Antonovka open-pollinated seed (from St. Clothilde, Que.)	215
Antonovka open-pollinated seed (from Ottawa, Ont.)	202
Delicious open-pollinated seed (from Smithfield, Ont.)	(162)
Malling 26 (clonal)	(160)

\*The ratings are summarized from 10 experiments where *M. robusta* 5 was the control. Not all rootstocks were in all experiments. The bracketed figures were adjusted by reference to *M. robusta* 5 to put them on the same scale as the figures for the other rootstocks. The higher the value, the better the winter survival.

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