Historical Sketch of Pome Fruit Rootstock Work in Canada[1]

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In reviewing the history of pome fruit growing in Canada, certain principles emerge. (1) The merits of the dwarf tree have been known for a long time. (2) the commercially available dwarfing stocks for apple, though far from being completely hardy, are more cold-resistant than those of quince stocks for dwarfing pear. (3) Tree losses could be reduced and orchard performance improved with cold-hardy dwarfing root and trunk stocks that are resistant to diseases such as collar rot and pear decline.

The advantages of dwarf trees planted at high density was well recognized by the beginning of this century (9, 16). But let us go back a little further. The Ontario Fruit Growers' Association was formed in 1859, 115 years ago (15). A prominent Grimsby fruit grower, Charles Edward Woolverton, was a charter member. His son Linus Woolverton, also a fruit grower for 50 years, became recognized as an authority on fruit growing in Canada. He was Secretary for the Ontario Fruit Growers' Association for 17 years to 1903.

For the 10 years prior to the establishment of the Vineland Horticultural station in 1960, Woolverton was inspector of Ontario experiment stations. As secretary of the Ontario Fruit Growers' Association and editor of the Canadian Horticulturist, he served on the Board of Control for the new station (15).

In 1907 Woolverton's first edition of "Fruits of Ontario" was published by the Ontario Department of Agriculture. (15) The successor to this publication is No. 430 Fruit Varieties revised every 5 years by the Vineland staff (2).

In 1910 Linus Woolverton published "The Canadian Apple Growers' Guide" (15). Under chapter 7, entitled Dwarf Apples, he extolls the advantages of dwarf trees as follows:

> "A dwarf apple tree . . . is convenient to reach for all purposes; and can be as thoroughly sprayed as a plum or peach tree. . . . The prominent advantages of growing apples in dwarf trees are as follows: 1. Quick return. 2. All work can be performed from the ground level. 3. Gales cause less injury to the trees and to the crop. 4. All inferior fruit can be thinned out."

Two types of stocks were mentioned, the 'French Paradise' and the less dwarfing 'Doucin'. (Hatton (6) at East Malling had not yet sorted out existing stocks to give them Malling numbers.)

Tree spacings mentioned by Woolverton ranged from 10′ x 10′ to 8′ x 8′ giving tree populations from 435 T/A to 680 T/A with yields of two barrels per tree cited at the latter density on 'Doucin' stock. Woolverton concludes the chapter with:

> "On the whole, however, we have not sufficient data upon which to to base definite advice regarding the growing of dwarf apples, but we may conclude that the 'Paradise' is at present the best available stock, that these may be planted as close as 8′ x 8′, and that fruit grown on them is handsomer and of better quality than that grown on standards.
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> "We would not be understood as advising the planting of dwarf apple trees to any extent, outside the garden, except in an experimental way,

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because it has not been yet demonstrated that they are as profitable as the standard trees."

Would you believe that 60 years elapsed before government researchers in Ontario set out more than a few trial rows of dwarf trees? Not until 1971 did we set out 3000 dwarf trees on 3 acres for a cost accounting study at Vineland.

In 1930, twenty years after Woolverton's book was published, a trial with clonal stocks was planted at the Vineland Station. Emphasis was on the vigorous stocks. The trees on 'M.9' were few in number and planted on one side of the orchard, not a part of the main replicated experiment. The 'M.9' trees were also the first to be removed after 18 years, whereas some of the 'M.16' trees were retained for over 30 years (13).

The next planting of trees on 'M.9' at Vineland was in 1938, a row of 50 trees on a 4 wire trellis (8). Again, the dwarf trees were considered so unimportant that no project number was assigned. About 20 years after this planting went in, at least two large commercial plantings of 'M.9' on wires were planted. Both have become show places. Chudleigh's planting at Milton became the first large scale pick-your-own operations in Ontario. Ernie Rolfe's 20 acre planting at King demonstrated that apples from dwarf trees bring top dollars on the Toronto market. Meanwhile before the Vineland planting was removed after 30 years, yields of 'Delicious' and 'McIntosh' reached and exceeded 1000 bu./A.

Blair, working at Ottawa, reported in 1953 that yields on 'M.9' spaced 10′ x 15′ (290 T/A) were greater on an acreage basis than on seedlings or other clonal stocks for the first 13 years (4). But Macoun (9) had reported a high yielding experimental planting at Ottawa of 'Wealthy' on seedlings at 10′ x 10′.

The apparent certainty of winter injury or killing experienced at various intervals in the coldest apple growing districts was reflected in research for more hardy stocks. This research was centered at Ottawa but the winter injury complex affected the thinking of researchers and growers. across the milder parts of Ontario, inhibiting commercial plantings of dwarf trees.

Macoun (9) reported in the *Canadian Horticulturist* in 1901 of resorting to the 'Siberian Crab' as a rootstock on account of its extreme hardiness. Several hardy pear species were also tried for pear.

Davis and Blair (3) reported that the 1933-34 freeze reduced apple production in Ontario and Quebec by 60 to 70 per cent respectively over that of the previous 5 years. There was no mention of root injury in this report. Trunk and crotch injury was so prevalent that the concept of frost-resistant stem builders was popularized by the Ottawa workers. In 1939 Blair (1) observed that collar rot was seldom a problem where hardy rootstocks were used. A search for hardy rootstocks and the use of hardy stem builders became the main thrust of the Ottawa group. The cold hardy 'Anis' and 'Antonovka' seedlings were recommended to replace 'French crab' as vigorous seedling stock for apple. The snow sweeping trials were begun at Ottawa in 1938 and continued for 3 years. After each snowfall the snow cover was swept clean exposing the roots of the trees to frost as it penetrated the soil. By 1941, two-thirds of the Malling stocks were dead and the remainder were very badly injured. 'M. robusta 5' a hybrid selection from 'M. baccata' x 'M. prunifolia' showed no injury.

'Robusta 5' produced as many problems as it was meant to solve. Eventually when the juvenile stage of the clone was lost, it no longer rooted easily in the stool bed. The budding

stock in the nursery was spiny and buddlings tended to blow out, greatly reducing numbers of trees. Frameworking the stocks as stembuilders proved to be a costly and unsatisfactory way to establish an orchard. Most attempts ended in failure. Finally, 'Robusta 5' was found to have an extremely short rest period. Mild spells in winter can start the sap moving from the rootstock into the scion tree. A sharp freeze injures the trunk of the scion variety. 'Robusta 5' is not recommended now except in the coldest districts where the winter is unlikely to be broken by mild spells.

'Robusta 5' was only the first of the Ottawa hardy rootstocks. Another one, '0-524' was thought to be dwarfing but it dwarfed the scion variety only when the latter carried a virus such as stem pitting. From 1949 to 1953 extensive stooling trials were conducted at Ottawa with hardy seedlings collected from countries where severe growing conditions were prevalent. Tested were 8,120 apple, 2,085 pear, 1,921 cherry and 186 plum seedlings. From this material 119 apple, 15 pear, 10 cherry and 3 plum were selected for further tests (3, 4).

During the 1960's, 21 hardy apple clones were selected and numbered 0-1 to 0-21 (10). Estimating their effect on the vigor of the scion variety by the proportion of bark of wood in the roots, 0-1 was expected to be the most dwarfing and 0-20, the most vigorous. 0-3 is the only one that has been released to the trade. It produces dwarf to semidwarf trees, intermediate in stature between 'M.9' and 'M.26'. It is difficult to propagate in the stool bed. Of the remainder of the series, 16 are open pollinated seedlings of *Malus baccata.* 0-1, 0-2, 0-3 and 0-12 are one-half Malling stock and one-quarter *M. baccata.*

The development of a series of so-called hybrid seedling apple rootstocks began at Ottawa in 1961. Six hybrid lines were described and introduced in 1971 (11). Both parents are winter hardy. The orchard performance of the Ottawa hybrids is unknown. It is unlikely that they will be widely planted because of the cost of seed production. The seed must be produced from controlled pollination either by hand pollinating emasculated blooms, or by growing pairs of parent trees in isolation.

In 1958, fruit tree rootstock recommendations in Ontario were first put in the form of an extension circular entitled "Dwarf Fruit Trees for Orchard Use." Under the same publication number, 334 the 4th revision (1974) is entitled "Rootstocks for Fruit Trees" (7). There has been a dramatic change in the concept of tree spacings in the intervening 16 years, such that now up to three times as many trees may be planted on 'M.9' or 'M.7' than formerly.

D. V. Fisher (5) was one of the outstanding early advocates of high density plantings in British Columbia. In that province also D. L. McIntosh classified the Malling and Malling-Merton stocks according to their resistance to collar rot *Phytophthora cactorium.* Workers in Nova Scotia have publicized the seedlings of 'Beautiful Arcade' as an apple rootstock.

Workers in adjacent states of New York and Michigan continue to influence the history of rootstocks in Canada. The comprehensive hardy dwarf apple rootstock breeding program presently under J. N. Cummins at Geneva may accomplish what Ottawa and Vineland programs failed to do. A project in breeding hardy dwarfing apple rootstocks started in 1959 at Vineland was discontinued in 1970.

In pears, the 'Old Home' x 'Farmingdale hybrids', seed of which originally came from Summerland, B.C., were tested and publicized by West-

wood in Oregon. They now are being grown commercially in Oregon and Washington and offer a valuable approach to hardy, decline-resistant size-controlling pear rootstocks.

Literature Cited

1. Blair, D. S. 1939 Present status of apple rootstock and double-working trials in Eastern Canada. *Sci. Agr.* 20:150-154.
2. Bradt, O. A., Hutchinson, A., Ricketson, C. L., Tehrani, G., 1974 *Fruit Varieties,* Ont. Min. Agr. & Food publ. 430: 100 p.
3. Davis, M. B. 1950 Progress Report 1934-48. *Hort. Div. Can. Agr. Res. Sta., Ottawa.* 259 p.
4. Davis, M. B. 1955 Progress Report 1949-53. *Hort. Div. Can. Agr. Res. Sta., Ottawa, Ont.* 205 p.
5. Fisher, D. V. 1966 High Density Orchards for British Columbia Conditions. *Can. Agr. Res. Sta., Summerland, B.C.,* SP38:29 p.
6. Hatton, R. G. 1930 Stock: Scion relationships. *Jour. Roy. Hort. Soc.* 55:169-211.
7. Hutchinson, A. 1974 Rootstocks for Fruit Trees. *Ont. Min. Agric. & Food Publ.* 334:22 p.
8. Hutchinson, A. 1970 Dwarf apple trees on 'M.9' rootstock: a 30-year trial. *Rept. Hort. Res. Inst. Ont.* 14-18.
9. Macoun, W. T. 1901 Central Experimental Farm Notes. *The Canadian Horticulturist* 24:100-101; 435-455.
10. Spangelo, L. P. S. 1965 Introduction numbers for Ottawa apple rootstock selections (Private Communication).
11. Spangelo, L. P. S. 1971 Hybrid Seedling Rootstocks for Apple. *Can. Dept. Agr.* Publ. 1431.
12. Spangelo, L. P. S., Fejer, S. O., Leuty, S. J., and Granger, R. L. 1974. Ottawa 3 clonal apple rootstocks. *Can. J. Pl. Sci.* 54:601-603.
13. Upshall, W. H. 1943 Malling stocks and French crab seedlings as stocks for five varieties of apples III. *Sci. Agr.* 23:537-545.
14. Upshall, W. H. 1958 Dwarf Fruit Trees for Orchard Use. *Ont. Dept. Agr. Circ.* No. 334, 5 p.
15. Woolverton, L. 1906 The Fruits of Ontario, *Ont. Dept. Agr.* 275 p.
16. Woolverton, L. 1910 The Canadian Apple Grower's Guide, Wm. Briggs, Toronto. 264 p.

The Performance of 'Suncling' Peach on Four Peach Seedling Rootstocks[1]

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The peach rootstock trial initiated in 1966 on a fruit farm of sandy loam near Fennville, Michigan, has been completed. The clingstone variety 'Suncling' was budded onto peach seedlings of 'Ambergem', 'Babygold 5', 'Babygold 7' and 'Suncling'.

Uniform trees of these combinations were planted in order to obtain an appaisal of orchard performance. Up to 80 trees each were planted, but only 11 uniform trees were available of 'Suncling'/'Babygold 7'. The survival count of the latter is not valid, but is included in Table 1.

The trees that died were found to have cankers on the branches, often on the southwest side of the trunk. A commercial pest spray program was conducted so that peach borer injury was not associated with tree loss.

From tree survival counts in the orchard, indications were that seedlings of 'Suncling', 'Babygold 5' and 'Ambergem' were similar in response, using one scion variety (Table 1). No abnormal graft union behaviors were observed with any of these combinations.

'Suncling' peach seedlings have cer-

[1]This peach rootstock trial was carried out in cooperation with the grower, and Norman Reath and Jim Breinling of the Gerber Products Company, Fremont, Michigan.

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