Apple Rootstocks for Colder Climates

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Apple growers of the Champlain Valley and similar northern apple-producing regions have not been able to obtain the advantages offered by size limiting clonal rootstocks because those stocks commercially available have not been adequately hardy.

Experiment stations with breeding programs aimed at development of hardy, dwarfing, easily propagated clones superior to the best now available include the Skierniewice station in Poland, the Michurin Institute in the USSR and the New York State Agricultural Experiment Station. In the Polish program, collar rot resistance is a major criterion, with tree-size control, easy propagation, and mid-winter hardiness all firm requirements (1, 11). The USSR efforts center on winter hardiness, dwarfing capacity, easy propagation, and good production characteristics (2, 6, 7, 10). Our Geneva program is aimed at developing lines resistant to or tolerant of collar rot, fire blight, woolly apple aphids and limited soil drainage, and having improved hardiness, tree-size control, and nursery qualities. In addition to these three active programs, the now inactive breeding projects of the Canadian Department of Agriculture at Ottawa and the Ontario Horticultural Research Institute at Vineland have produced a number of candidates which are still under test (5, 8).

In England, the rootstock breeding program of the East Malling Research Station has not been directed toward production of hardy stocks. However, the hardy German stock 'M.16' was used in some of the crosses made 40 years ago, and the very hardy *Malus robusta* No. 5 ('Robusta 5') is being used in the present project (9).

Some recent selections from these several programs offer promise for use in northerly regions.

'Robusta 5' is assumed to be a hybrid of *M. baccata* x *M. prunifolia,* introduced by the Ottawa Research Station in 1947. Varieties on 'Robusta 5' commence fruiting early and production is heavy. Unfortunately, trees on this stock are too vigorous for the orchard of the future, except for some soil types and possibly under spur-type scion varieties (3).

'Robusta 5' is reportedly resistant to collar rot, to fire blight (9), to apple scab, to powdery mildew, and to woolly apple aphids (9). The stock has been virus-sensitive in British Columbia, but not in the East. 'Robusta 5' is rather difficult to root in the stoolbed. 'M.26' is the hardiest stock introduced from the East Malling breeding program. 'M.26', a cross of 'M.16' x 'M.9', induces early hardening in the fall and late initiation of growth in the spring. Trees on 'M.26' stock are about ⅓ of standard size, begin bearing very early, and are quite productive. At least with the more vigorous varieties, trees on 'M.26' require staking 3). On sites which are excessively well drained, irrigation may be necessary. A serious deficiency of 'M.26' is its susceptibility to fire blight; trees 2- to 5-years old appear to be especially subject to girdling at the bases by blight lesions 4). The stock is also susceptible to woolly apple aphids and perhaps to collar rot. It is difficult to propagate

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in the stoolbed, but is otherwise a fine nursery subject 3). Even with its shortcomings, 'M.26' definitely has a place as a stock for 'McIntosh', spur-type 'McIntosh', and spur-type 'Delicious', providing the grower will exercise caution in limiting fire blight infection in the orchard.

'Ottawa 3' is a new hardy stock from the Canadian Department of Agriculture, a seedling of 'Robin' x 'M.9'. Preliminary testing indicates that 'Ottawa 3' is similar to 'M.26' in its tree-size control and in induction of early, heavy fruit production (8). This stock is quite resistant to collar rot and appears to be less susceptible to fire blight than is 'M.26'. It is susceptible to woolly apple aphids. We have found 'Ottawa 3' even more difficult than 'M.26' to propagate in the stool bed and by nurse-root grafting; we have had no success with softwood cuttings or leaf-bud cuttings under intermittent mist.

The Budagovsky stocks come from the breeding program of the Michurin Institute near Moscow, USSR. The United States Department of Agriculture has introduced 'Budagovsky 9' as 'P.I. 324523' and 'Budagovsky 118' as 'P.I. 308157'. 'Budagovsky 9' is slightly less hardy than 'Robusta 5', is evtremely resistant to collar rot (1), and appears moderately resistant to fire blight. It is susceptible to woolly apple aphids; 'Budagovsky 9' is as difficult to propagate as 'Ottawa 3' and is a rather weak grower in the nursery. At the present time, 'Budagovsky 9' is infected with at least 4 viruses, including stem-pitting and rubbery wood; this virus content can be lethal for 'Idared' and debilitating for 'Golden Delicious', and we reeommend that the present virus-infected clone not be introduced commercially.

'Budagovsky 118' is about as hardy as 'Robusta 5'; it is a good rooter in the stool-bed and a fairly good nursery subject (2, 7). 'Budagovsky 118' is virus free. It is susceptible to woolly apple aphids; its disease susceptibilities are not yet determined.

Both 'Budagovsky 9' and 'Budagovsky 118' exert tree-size control similar to that of 'M.26'; production is said to be excellent on both stocks. Both have distinctive foliage and reddish wood, characteristics helpful to the nurseryman. Tree anchorage is marginal on 'Budagovsky 9', probably acceptable on 'Budagovsky 118' (2, 7).

From Poland the selections 'P-I', 'P-II', and 'P-XVI' are about as hardy as 'Common Antonovka', which is the seed parent of the series. All are quite resistant to collar rot (1), but at Geneva we have found them to be susceptible to woolly apple aphids, to apple scab, to powdery mildew and to fire blight. 'P-XVI' is said to be about as dwarfing as 'M.9'. while 'P-I' and 'P-II' are considerably more vigorous. All are relatively easy to propagate in the stoolbed; 'P-I' and 'P-II' appear to be good nursery subjects, but 'P-XVI' is a weak grower (11).

Availability—'Robusta 5' and 'M.26' are readily available in commercial channels, but none of the newer stocks are expected to enter commercial circulation until about 1976. Budwood for nuclear stocks of 'Ottawa 3' and 'Budagovsky 118' will be obtainable from New York State Fruit Testing Cooperative Association, Geneva, N.Y., in time for budding season, 1974; a very few maiden trees of these two clones grafted on seedling roots will be available for trench-layering in March, 1975.

In summary, 'Budagovsky 118' and 'Ottawa 3' appear to be the most promising hardy, size-limiting stocks soon to be commercially available for the Northland. Although 'Robusta 5' is otherwise an outstanding rootstock, its excessive vigor limits its future value; in general, 'Robusta 5' should be used under spur-type varieties only. Despite its susceptibility to fire blight, 'M.26' is the best stock now commercially available for medium-high density plantings in the North.

It is best used under 'McIntosh', spur-type 'McIntosh', and spur-type 'Delicious'.

Rootstock breeding programs in Poland, Canada, the USSR, and at Geneva, N.Y. are attempting to develope stocks with still more improvements; inherent resistance to fire blight is a top priority objective.

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