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Better rootstocks for apple trees

Frank Melville

J. E. L. Cripps

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BETTER ROOTSTOCKS FOR APPLE TREES

Malling Merton rootstocks have given the best results in ten years' trials with apple rootstocks on Stoneville Research Station and on growers' properties.

By F. MELVILLE, Assistant Chief, Horticulture Division and J. E. L. CRIPPS, Research Officer, Plant Research Division

THE type of rootstock used imparts important characteristics to an apple tree. Tree size and stability, cropping characteristics, susceptibility to soil-borne pests and diseases and, to some extent, fruit quality are all affected by the choice of rootstock.

To study these factors an apple rootstock experiment was planted at the Stoneville Research Station in 1960.

Subsequently, seven additional trials of a more restricted nature were planted on growers' properties in the South West to assess the reaction of the rootstocks to different environmental conditions.

Complete assessment can only be made on a long term basis but growers intending making new plantings will be interested in the progress to date.

Range of stocks

Fourteen apple rootstocks are included in the experiment at Stoneville and a more restricted selection on growers' properties. Of those tested, only six of the new clonal rootstocks are considered of interest to growers and these are described briefly below, together with the three stocks in general use locally.

Local rootstocks

Northern Spy

Northern Spy rootstock was the mainstay of the Western Australian apple industry for many years, but a shortage of stock material and the prevalence of virus infection have restricted its use over the past 20 years. It produces trees with moderate vigour, which crop heavily and imparts the ability to bring fruit up to size under adverse conditions. It is best known for its immunity to woolly aphid attack and was originally introduced for this purpose.

Pomme de Neige

Pomme de Neige stock was originally selected from a small group of Pomme de Neige seedlings chosen for their good root development. It is very vigorous and trees crop well if handled properly, but it does not have the ability of Northern Spy to size fruit. A root grafting technique is almost invariably used to propagate orchard trees.

Seedling

Seedling stocks provided an answer to the shortage of stocks in Western Australia in the early 1950s, and many well grown orchards have been developed on a variety of seedling stocks. However, seedlings have the disadvantage of producing trees which vary in size and which carry crops of small fruit under conditions of stress. Granny Smith seedlings have been disappointing as a rootstock in the trial at Stoneville because of extreme variability of size and vigour.

Imported clones

All the imported rootstocks dealt with here belong to the Malling Merton (M.M.) series produced at East Malling and Merton Research Stations in England and selected from crosses with Northern Spy for immunity to woolly aphid.

M.M. 103

M.M. 103 was produced by crossing Northern Spy with Ben Davis. It is a vigorous rootstock which, under good management, produces a large spreading tree with wide angled branches. So far, cropping has only been moderate.
**M.M. 104**

The parentage of M.M. 104 is Malling II x Northern Spy. It produces moderate sized trees which come into cropping early and bear heavily. Its characteristics are not unlike Northern Spy and is satisfactory for all varieties tested.

**M.M. 106**

Parentage of M.M. 106 is Northern Spy x Malling I. Under Western Australian conditions, trees on this rootstock come into bearing very early carrying some fruit in the second or third year.

Under average conditions, it tends to produce small trees but initially growth is moderate and under ideal conditions, substantial sized trees develop. Growth can be severely restricted if cropping of young trees is not controlled or management is not of a high standard.

Granny Smith trees on M.M. 106 develop few lateral branches and as a result lack density and are often one sided. Much better results are obtained with Yates, Golden Delicious and Delicious.

**M.M. 109**

Parentage of M.M. 109 is Malling II x Northern Spy. M.M. 109 confers early bearing on the scion although the tree is vigorous and under good management will grow to a considerable size. Laterals form readily to provide a good supply of fruiting wood. This rootstock has cropped heavily and performed well in all trials and for all varieties.

**M.M. 114**

Parentage of M.M. 114 is Northern Spy x Malling XII. This has proved the most vigorous of the English rootstocks at Stoneville but by present day standards, is considered too large. It has cropped quite well although slower than other stocks to come into full crop.

**M.M. 115**

Parentage of M.M. 115 is Northern Spy x Ben Davis. With Granny Smith as the scion, it produces trees of moderate vigour but with other varieties it produces larger trees. Cropping has been good.

**Cropping and tree size**

A comparison between Granny Smith trees on the nine rootstocks is given in the table showing differences in cropping and tree size. All figures represent the average per tree.

With Granny Smith as a scion, M.M. 114 makes larger trees than Pomme de Neige, and M.M. 103 is similar in vigour but trees on M.M. 109 are slightly smaller (column 4). M.M. 104 and M.M. 115 produce trees more equivalent to Northern Spy while M.M. 106 is the least vigorous of the rootstocks described. However, M.M. 106 is a little more vigorous with Red Delicious or Yates as the scion and appears to be well suited to these two varieties as well as Golden Delicious.

Trees on M.M. 109 are well ahead in the total amount of fruit produced since the inception of cropping (column 3) and also retain the lead on an annual yield basis (column 2). M.M. 114 is still second to Granny Smith production from various rootstocks

<table>
<thead>
<tr>
<th>Rootstock</th>
<th>Crop 1969/70 in pounds per tree</th>
<th>Total crop since planting in pounds per tree</th>
<th>Tree size height x width in metres 1970</th>
<th>Total crop divided by height x width x 100</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.M. 109</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M.M. 104</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M.M. 106</td>
<td>432</td>
<td>1737</td>
<td>15·72</td>
<td>1·105</td>
</tr>
<tr>
<td>M.M. 115</td>
<td>393</td>
<td>1556</td>
<td>15·37</td>
<td>1·012</td>
</tr>
<tr>
<td>Northern Spy</td>
<td>365</td>
<td>1386</td>
<td>15·01</td>
<td>0·99</td>
</tr>
<tr>
<td>Pomme de Neige</td>
<td>498</td>
<td>1942</td>
<td>21·42</td>
<td>0·897</td>
</tr>
<tr>
<td>M.M. 114</td>
<td>617</td>
<td>2069</td>
<td>24·65</td>
<td>0·839</td>
</tr>
<tr>
<td>M.M. 103</td>
<td>430</td>
<td>1793</td>
<td>21·79</td>
<td>0·823</td>
</tr>
<tr>
<td>Seedling</td>
<td>336</td>
<td>1293</td>
<td>16·01</td>
<td>0·808</td>
</tr>
</tbody>
</table>

(1 metre = 39·37 inches)
M.M. 109 in spite of its much larger size, but in time no doubt size will tell.

An economic assessment of a rootstock must take into account crop size in relation to tree size which gives a measure of tree efficiency which in turn can be related to production per acre. This has been done by dividing the total crop by a factor for tree size for each rootstock in column 5. Again, M.M. 109 is in the lead but M.M. 104, 106 and 115 have also given creditable performances. The Granny Smith seedling stock has produced very variable tree size and given the poorest result.

Anchorage
Of the Malling Merton series, M.M. 103, 114 and 115 are very well anchored, M.M. 104 and 106 are satisfactory, but young trees on M.M. 109 often need support against the wind until they develop an adequate root system. The problem disappears when the trees come into bearing. In the trial at Stoneville, Pomme de Neige was also unstable in the early years.

Virus content and woolly aphis resistance
All rootstocks in the Malling Merton series are free from apple mosaic and certain other viruses but this advantage disappears immediately contaminated scion wood is used for budding or grafting. Extreme care must be exercised in the choice of propagating material.

The M.M. stocks are also resistant to attack by woolly aphis as is Northern Spy, although this resistance is not transmitted to the scion variety.

Nematode resistance and re-planting
All the imported rootstocks appear much more resistant to nematode attack than Northern Spy which is very susceptible. They are also more resistant than Pomme de Neige. For this reason, vigorous members of the series such as M.M. 109 are particularly suited for use as rootstocks for apple trees to be re-planted on the sites of old orchards.

Effects on fruit quality
The Malling Merton rootstocks have inherited the Northern Spy's ability to bring fruit up to size in varying degrees. M.M. 106 is the equal of and for Yates is better than, Northern Spy; while M.M. 104, 109 and 115 perform well and show some superiority over seedlings.

M.M. 106 promotes earlier colour in red varieties and this characteristic is shared to a lesser extent by M.M. 109. In the case of Yates, M.M. 106 has consistently produced larger and better coloured fruit which ripens slightly earlier than on Northern Spy.

Storage trials conducted over two years indicate that certain stocks slightly increase susceptibility of Granny Smiths to bitter pit and scald. Seedling and M.M. 103 are the worst in this regard.

There appears to be no beneficial effect from rootstocks on pre-harvest drop of Jonathans.

Effects of management
Although rootstocks influence eventual tree size, the influence of management is also important.

Factors such as early and heavy cropping, competition from grass and weeds, lack of moisture and inadequate fertiliser reduce vigour and by such means a comparatively small tree can be produced on a vigorous rootstock. Conversely, a tree of reasonable size can be grown on a dwarfing rootstock by total fruit removal when young, freedom from weed competition, and adequate irrigation and fertiliser application.

Under Western Australian conditions, it is perhaps easier to slow down tree growth than it is to speed it up, due presumably to dry summers and the apple trees' ability to form fruit buds.

RECOMMENDATIONS
Several years ago three of the M.M. rootstocks (M.M. 104, 106 and 109) were released to nurserymen. Subsequent results have confirmed that these three stocks which give a range of vigour from moderately dwarfing to vigorous are the most promising.

For Granny Smith and Jonathan, growers are recommended to plant on M.M. 104 or 109 stocks. For other varieties, any of the three are suitable, choice depending on the size of tree desired.

One other stock (M.M. 115) is performing well under a variety of conditions. It produces a tree above medium vigour and appears to be a good all-round stock. However, further observation is needed before a final recommendation can be made.