

Project title: Evaluation and development of new rootstocks for apples and pears – new work on new plantings

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[The results and conclusions in this report are based on an investigation conducted over a one-year period. The conditions under which the experiments were carried out and the results have been reported in detail and with accuracy. However, because of the biological nature of the work it must be borne in mind that different circumstances and conditions could produce different results. Therefore, care must be taken with interpretation of the results, especially if they are used as the basis for commercial product recommendations.]

AUTHENTICATION

We declare that this work was done under our supervision according to the procedures described herein and that the report represents a true and accurate record of the results obtained.

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GROWER SUMMARY

Headline

- Nine Canadian apple rootstock selections have been obtained for evaluation with a combination of 'Gala' and 'Braeburn' scions and three *Pyrus* and four quince pear rootstock selections for pear are being propagated for evaluation with 'Conference'

Background and expected deliverables

A review of AHDB Horticulture-funded rootstock research projects (project TF158) acknowledged that there was a strong need for new or improved rootstocks for apples, pears, plums and cherries that are dwarfing, precocious, high yielding and offer some measure of drought tolerance. The report recognised that rootstocks are a vital part of the currently used growing systems for tree fruits but those currently used in tree fruit production have been grown for decades and all have some limitations. Breeding programmes in the UK and abroad have generated a number of promising rootstocks in recent years, which are becoming increasingly available to growers. The report recommended that UK trialling of promising UK and overseas material should continue and that technology transfer should be improved. This work was then undertaken in AHDB Horticulture project TF172 (*Evaluation and development of new rootstocks for apples, pears, cherries and plums*).

This project is a continuation of AHDB Horticulture project TF172 but focusing only on apple and pear rootstocks. The main aim of the project is to acquire, evaluate and develop new apple and pear rootstocks in UK growing conditions, which are produced by breeding programmes both at EMR and abroad. This project provides continuity of the trialling of fruit tree rootstocks at EMR, looking for rootstocks of intermediate vigour between M27 and M9 and a replacement for M26 in apple, and in pear a rootstock with increased dwarfing using quince or preferably *Pyrus*.

Selection and release of improved rootstocks to the industry will be of benefit. The introduction of new rootstocks with increased precocity and yield and with fewer requirements for chemical or mechanical growth control, will have a huge impact on the profitability of UK orchards.

Summary of the project and main conclusions

Nine selections of Canadian apple rootstocks, selected for winter hardiness, disease resistance, dwarfing habit, precocity and ease of propagation, were grown on following grafting with 'Braeburn' and/or 'Gala'. The trees for trial have been selected and will be planted in 2014. The selections were from a breeding program initially in Morden, Manitoba then transferred to St-Jean-sur-Richelieu, Quebec and comprised: SJM15, SJM127, SJM167, SJM188, SJM189, SJP84-5217, SJP84-5231, SJP84-5162 and SJP84-5174. These were grafted alongside M9, M26, M27 and MM106.

Seven promising rootstock selections (three *Pyrus* and four quince) from the East Malling Rootstock Club are being propagated for trial with Conference.

Financial benefits

It is too early in the project for any financial benefits to be apparent, although a selected *Pyrus* rootstock would be of great benefit to the industry as this would overcome many incompatibility problems and remove the need for an interstock.

Action points for growers

- There are no action points at present.

SCIENCE SECTION

Introduction

A review of AHDB Horticulture-funded rootstock research projects (project TF 158) acknowledged that there was a strong need for new or improved rootstocks for apples, pears, plums and cherries that are dwarfing, precocious, high yielding and offer some measure of drought tolerance. The report recognised that rootstocks are a vital part of the currently used growing systems for tree fruits but those currently used in tree fruit production have been grown for decades and all have some limitations. Breeding programmes in the UK and abroad have generated a number of promising rootstocks in recent years, which are becoming increasingly available to growers. The report recommended that UK trialling of promising UK and overseas material should continue and that technology transfer should be improved. This work was then undertaken in AHDB Horticulture project TF 172 entitled 'Evaluation and development of new rootstocks for apples, pears, cherries and plums'.

This new project is a continuation of AHDB Horticulture project TF 172 but focusing only on apple and pear rootstocks. The main aim of the project was to acquire, evaluate and develop in UK growing conditions new apple and pear rootstocks produced by breeding programmes both at EMR (funded by the East Malling Rootstock Breeding Club or EMRBC) and abroad. This project provided continuity of the trialling of fruit tree rootstocks at EMR, looking for rootstocks of intermediate vigour between M27 and M9 and a replacement for M26 in apple and in pear a rootstock with increased dwarfing using quince or preferably *Pyrus*. The specific objectives were:

Apple

- To select and develop apple rootstocks with intermediate vigour between M27 and M9, which perform well in the nursery and which produce precocious and consistently abundant yields of high quality fruits of the marketable size grades.
- To select and develop a replacement rootstock in the M26 vigour category, which does not suffer from burr knotting, poor calcium uptake or physiological disorders in the scion fruit. This rootstock should also induce precocious and abundant yields of high quality fruits.

- To select and develop dwarfing rootstocks for apple which exhibit improved resistance to drought (weed competition), replant disease and soil borne diseases (e.g. collar/crown rot).

Pear

- To select and develop quince rootstocks more dwarfing than Quince C (EMC) with improved precocity of cropping.
- To select dwarfing *Pyrus* rootstocks that are easy to propagate, and that induce good yield precocity/productivity.

Selection and release of improved rootstocks to the industry will be of benefit as the introduction of new rootstocks with increased precocity and yield, with fewer requirements for chemical or mechanical growth control, will have a huge impact on the profitability of UK orchards.

Materials and methods

Propagation of apple trees by grafting the cultivars 'Braeburn' and 'Gala' onto a range of rootstocks was carried out in February 2013. Nine Canadian apple rootstock selections (SJM15, SJM127, SJM167, SJM188, SJM189, SJP84-5162, SJP84-5174, SJP84-5217, SJP84-5231) and four controls (M9, M26, M27 and MM106) were used. The SJM and SJP84 series were selected for winter hardiness, disease resistance, dwarfing habit, precocity and ease of propagation.

In order to avoid future problems in data interpretation, root samples of all the rootstocks were taken prior to planting and DNA analysis is being carried out to ensure that all tree under the same label are indeed clonal and that all the control rootstocks are 'true-to-type'.

Hardwood cuttings of the quince and *Pyrus* rootstocks selected from EMRBC trials that had failed to root in 2012-13 were retaken in 2013.

Results

Apple

Twenty combinations of scion/rootstocks were produced in 2013 (Table 1). These included four controls (M9, M26, M27 and MM106) and three selections (SJM167, SJP84-5117, SJP84-5174) that were grafted with both cvs. 'Braeburn' and 'Gala', three selections (SJM127, SJM188, SJP84-5162) with cv. 'Braeburn' only and three with cv. 'Gala' only (SJM15, SJM189, SJP84-5231). Seven replicates of each combination were available for planting in a trial in 2014, and the experimental design for this trial shown in Figure 1.

Table 1. Rootstock/scion combinations for apple trial available for planting in 2014

Rootstock	Scion cv.	Rootstock/scion combination	Key (for Fig 2)
M9	Braeburn	M9 Braeburn	1
M26	Braeburn	M26 Braeburn	2
M27	Braeburn	M27 Braeburn	3
MM106	Braeburn	MM106 Braeburn	4
SJM127	Braeburn	SJM127 Braeburn	5
SJM167	Braeburn	SJM167 Braeburn	6
SJM188	Braeburn	SJM188 Braeburn	7
SJP84-5217	Braeburn	SJP84-5217 Braeburn	8
SJP84-5162	Braeburn	SJP84-5162 Braeburn	9
SJP84-5174	Braeburn	SJP84-5174 Braeburn	10
M9	Gala	M9 Gala	11
M26	Gala	M26 Gala	12
M27	Gala	M27 Gala	13
MM106	Gala	MM106 Gala	14
SJM15	Gala	SJM15 Gala	15
SJM167	Gala	SJM167 Gala	16
SJM189	Gala	SJM189 Gala	17
SJP84-5217	Gala	SJP84-5217 Gala	18
SJP84-5231	Gala	SJP84-5231 Gala	19
SJP84-5174	Gala	SJP84-5174 Gala	20

Figure 1. Trial design for 2014 planting of apple rootstock/scion combinations (numbers within the grid relate to rootstock/scion combinations with a key to these shown in Table 1)

		Row						
		1	2	3	4	5	6	7
Block	1	11	17	16	15	1	7	3
		5	10	20	9	14	4	12
		6	8	13	19	18	2	7
	2	16	15	6	11	20	18	17
		1	12	14	8	4	3	2
		9	13	5	10	19	1	11
	3	13	20	10	14	15	6	4
		18	5	8	16	3	17	9
		7	19	12	2	10	19	1
	4	17	4	11	5	16	15	13
		14	7	3	12	2	20	6
		8	9	18	1	17	5	10
	5	12	18	9	20	8	13	19
		4	16	2	6	7	14	15
		3	11	17	4	6	10	8
	6	20	14	1	3	11	9	16
		15	2	7	18	13	12	5
		19	3	15	17	5	11	18
	7	10	1	19	7	12	16	14
		2	6	4	13	9	8	20

Pear

Hardwood cuttings of three *Pyrus* and four Quince selections (Table 2) that had shown promise in EMRBC trials were taken in 2012-13 and 2013-14. Unfortunately, we did not obtain sufficient individuals of each rootstock at the same age to set up a robust trial, thus a large scale rooting test will be carried out in 2014-15, including a few other potentially promising selections from the EMRBC programme, as well as control genotypes (i.e. EMA and EMC).

Table 2. Number of rooted cuttings of *Pyrus* and quince rootstocks

Rootstock	Number of rooted cuttings		
	2012-13	2013-14	Total
<i>Pyrus</i> PQ 34-3	2	5	7
<i>Pyrus</i> PQ 34-6	12	0	12
<i>Pyrus</i> PQ 35-2	0	5	5
Quince PQ 5-12	0	0	0
Quince PQ 5-13	0	0	0
Quince PQ 5-16	0	6	6
Quince PQ 5-18	4	0	4

Discussion

Although nine Canadian apple rootstocks were obtained there were insufficient numbers of some of these selections to be grafted with both scion varieties. However each rootstock will be represented within the trial to be planted in 2014 with at least one scion. Being planted in the same experiment, we will also be able to determine the effect of rootstock-scion interaction for those rootstocks available with two scions.

Propagation attempts continued for seven promising selections from the EMRBC (three *Pyrus* and four quince). Unfortunately, we do not yet have sufficient individuals of each rootstock (at the same age) for adequate trialling. However, this provides us with the opportunity to consider the inclusion of a few additional selections from the EMRBC programme as well as looking to include selections from other breeding programmes such as the one in IRTA (Spain).

Conclusions

- Nine selections of Canadian apple rootstocks, selected for winter hardiness, disease resistance, dwarfing habit, precocity and ease of propagation were grown on following grafting with the scion cultivars 'Braeburn' and/or 'Gala'. The trees for trial have been selected and will be planted in 2014.
- Seven promising rootstock selections (three *Pyrus* and four quince) from the EMRBC are being propagated for trial with cv. 'Conference'.