

Future Orchards 2012

Intensive Pear Production in Australia: Why we need more rootstocks

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January 2009

There is no doubt that one of the underpinning factors for success in any intensive production system is the use of dwarfing rootstocks that restrict vigour (accommodating higher planting densities), induce early bearing and increase yield efficiency (usually a measure of yield by trunk cross sectional area).

For many years the Australian pear industry has only had one choice of rootstock - the vigorous seedling *Pyrus calleryana* D6 (D6). Whilst this rootstock is suited to traditional low density production it has proved to be more difficult in higher density systems where its' strong vigour inevitably causes headaches.

The focus on intensive production as the way to ensure long term competitiveness of the Australian pear industry means that we need to move away from D6. It is essential that Australian growers have access to a range of more suitable rootstocks that allow for intensive pear production across a variety of growing conditions.

If we look at the pear production regions around the world we can see that there are a range of rootstock options available for intensive production and a vast bank of knowledge on their management requirements.

What rootstocks exist and who is using them?

Whilst the rootstocks used for intensive production around the world are yet to reach the dwarfing capabilities similar to those found in apple, experience demonstrates that there are still more suitable options available than seedling.

Most European pear species (*Pyrus communis*) are propagated on pear (*Pyrus*) or quince (*Cydonia oblonga*) rootstocks. It is generally accepted that quince rootstocks are more precocious, productive and efficient than the pear rootstocks. This does not mean, however, that they are the most suitable choice for all conditions and this is why there is still a heavy dependence on *pyrus* rootstocks in some regions.

Quince Rootstocks

There are a range of quince rootstocks that are used for pear production, mainly:

- BA29
- Sydo
- Quince A

- Quince Adams
- Quince C

Generally growing conditions will determine which specific selection is used. This is evident when looking at European pear production where the preference changes between regions.

BA29 is the most vigorous quince and is slightly stronger than Sydo and Quince A which are approximately 60-75% of seedling. However all generally have similar yield efficiency. These rootstocks are often preferred for 'harsher' conditions eg. less fertile soils, soils with high lime or pH content (causing lime induced chlorosis), drier conditions. BA29 is most tolerant to lime induced chlorosis and pear decline than Quince A or Sydo and is therefore more suited to sites where it is a problem. It has also demonstrated better compatibility with European pear cultivars – however there are still some issues.

Quince A, BA29 and Sydo are all recommended for densities between 1500-3000 trees/ha and are common in the pear production regions of Spain, Portugal and France. BA29 is also the main pear rootstock used in New Zealand for densities of 600-1000 trees/ha.

Quince C is the least vigorous of all the quince rootstocks and generally has the best yield efficiency. Quince Adams is slightly more vigorous than Quince C but has similar yield efficiency. Adams is often favoured over Quince C for its supposed ability to produce better fruit size (Wertheim 1998). These are recommended for densities of above 2500-3000 trees/ha and are commonly used in areas with highly fertile soils such as the Netherlands, Belgium and Italy.

In more recent years three other promising quince clones have emerged - Quince EMH (developed at East Malling in the UK), C132 (a selection from the Caucasus region of Russia) and Eline® (a Romanian selection sourced from Fleuren Nurseries in the Netherlands). These rootstocks have reportedly demonstrated similar performance to Quince C in terms of vigour control and yield efficiency (Johnson *et al.* 2005; Webster 1998, Maas 2006). In some trials they have exhibited traits that may make them more attractive than Quince C such as improved fruit size (EMH and C132) and reduced russetting (Eline®).

The major management challenges associated with quince rootstocks are its lack of winter hardiness, low tolerance to lime induced chlorosis and incompatibility with major European pear cultivars. This often means that they are considered unsuitable in some production regions and therefore pear (*pyrus*) rootstocks are preferred.

Pear Rootstocks

Whilst seedling still make up a large proportion of existing plantings on pear rootstocks (particularly in North and South America) there are a selection of clonal (i.e. vegetatively propagated) more dwarfing pear rootstocks that are being planted.

OHF – 'Old Home' x 'Farmingdale'

The OHF rootstock series are favoured in North America due to their tolerance to low temperatures and the poor history associated with quince performance. There are a

number of rootstocks in this series with OHF 97 the predominant selection planted followed by OHF 40, 69, 87, 217, 333 and 513 (Mielke 2008). These rootstocks have a varying range of vigour and yield efficiency but are generally considered more invigorating and less precocious than quince.

The Horner series of rootstocks have also been developed through open pollination of some OHF selections. These rootstocks are undergoing trials which to date have indicated potential for more precocious and productive rootstocks (Mielke and Sugar 2004).

BP Series

In South Africa the BP series of rootstocks, namely BP1 and BP3 have dominated plantings over the past 20 years. BP1 rootstocks have shown a vigour similar to Quince A and BA29 and good yield efficiency (Webster 1998). However, they are highly susceptible to pear decline and fireblight which has particularly limited their use in Europe.

There has recently been a trend in South Africa towards the use of quince rootstocks (particularly on blush varieties) but with careful management of nutrition and irrigation. In trials with various scion cultivars under a range of growing conditions generally quince rootstocks resulted in smaller trees and higher yield efficiencies than BP1 rootstocks (Du Plooy *et al.* 2002). Blush varieties have been found also to have better colour and slightly higher TSS than those on BP rootstocks ((Du Plooy and van Huyssteen 2000, Roberts *et al.* 2008). This may be associated with better light distribution.

This rootstock is in Australia and currently in the APFIP pear rootstock trial site.

Pyrodwarf

Pyrodwarf was developed in Germany and reportedly has a vigour 50% lower than *Pyrus Calleryana D6* (between MA and MC) and good graft compatibility with European and some Asian pear varieties. Some of its positive traits include low development of lime induced chlorosis, tolerance to water logging and medium susceptibility to fireblight (Du Plooy *et al.* 2002; Jacob 1998; Jacob 2006). It doesn't appear to have been widely adopted to date, and is considered too vigorous for intensive production in many European regions. There has not been widespread data on its performance under a range of conditions.

This rootstock has been introduced in Australia and will be included in future in the APFIP pear rootstock trial. This should yield information about its performance in local conditions.

Pyriam

Pyriam was developed by INRA in France through open pollination of 'Old Home'. It is regarded as a potential replacement for BA29 in south-east France. It induces slightly higher vigour than BA29 but has demonstrated equal yield efficiency (Du Plooy *et al.* 2002; Simard and Michelesi 2002). In French trials it has also shown good graft compatibility with "Williams" and good propagation abilities.

Fox Series

Fox 11 and Fox 16 are two of the fox series which have plant variety rights. Fox 11 has a vigour similar to BA29 and is recommended for tree densities between 2000-2500 trees/ha (Wertheim 1998). It also has good compatibility and tolerates high alkalinity. Fox 16 has vigour slightly greater than BA29 and it has drought tolerance but is less tolerant of high alkalinity than Fox 11.

BM2000

BM2000 originated in Australia as a result of open-pollination of likely parents 'Williams' and 'Packhams'. It is described as having medium vigour compared to D6. There is little data regarding precocity, productivity and yield efficiency in the literature.

This rootstock is currently in the APFIP pear rootstock trial site

Will rootstocks solve all our problems?

Although the use of more dwarfing rootstocks such as quince has resulted in the ability to plant at higher densities, experience from around the world has shown that vigour control is still an issue.

In many regions growers still need to use combine a number of management techniques to try and maintain the balance between vigour and cropping. This includes rootpruning, stem incisions and limb bending as well as the application of chemicals such as Regalis® and Gibberellin.

It is important therefore that growers understand the management requirements of a rootstock from day 1 in order to get the best out of their system. This can only occur through trial and commercial experience.

What are we doing in Australia?

The APFIP pear rootstock trial site is providing data on the performance of BP1, BM2000 and Quince A for 'Packhams', 'Williams' and 'Corella' (Table 1 and 2). So far the yield data for 'Williams' and 'Packhams' indicate that BP1 and BM2000 are less vigorous than D6 and have a better yield efficiency.

The Quince A rootstocks are 2 years behind the BM2000, BP1 and D6. Comparing their trunk cross sectional area in their second leaf (2008) with the other rootstocks at the same age (2006) shows that they have a similar level of vigour to BM2000 for the 'Williams', D6 for the 'Packhams' and BP1 for the Corella (Table 3).

There is no harvest data available for quince at this stage. The 'Corella' have also failed to produce any yields.

Table 1: Influence of rootstock on yield, tree vigour (TCSA) and yield efficiency in 2008 for 'Williams' at the APFIP rootstock trial site in the Goulburn Valley

System	Rootstock	TCSA 2008 (cm²)	Yield /tree (kg)	Yield efficiency (kg/cm²)	Projected Yield (t/ha)
Open Tatura Trellis (OTT)	BM2000	12.66	10.78	0.85	29.63
	D6	16.39	5.52	0.34	15.17
	BP1	9.85	4.62	0.47	12.69
Central Leader (CL)	BM2000	20.57	14.95	0.73	23.69
	D6	23.93	9.67	0.40	15.33
	BP1	18.66	6.54	0.35	10.36

Table 2: Influence of rootstock on yield, tree vigour (TCSA) and yield efficiency in 2008 for 'Packhams' at the APFIP rootstock trial site in the Goulburn Valley

System	Rootstock	TCSA 2008 (cm²)	Yield /tree (kg)	Yield efficiency (kg/cm²)	Projected Yield (t/ha)
Open Tatura Trellis (OTT)	BM2000	15.77	8.15	0.52	22.40
	D6	29.31	8.39	0.29	23.07
	BP1	14.80	6.28	0.42	17.27
Central Leader (CL)	BM2000	21.37	13.49	0.63	21.38
	D6	29.22	8.87	0.30	14.05
	BP1	22.23	10.41	0.47	16.49

Table 3: Trunk cross sectional area in 2nd leaf on central leader

Variety	Rootstock	TCSA (cm ²) 2 nd Leaf
Williams	BM2000	11.430
	D6	12.246
	BP1	10.676
	Quince A (2008)	11.618
Packhams	BM2000	11.838
	D6	13.219
	BP1	11.901
	Quince A (2008)	13.094
Corella	BM2000	8.792
	D6	11.461
	BP1	10.488
	Quince A (2008)	10.582

(2008- Quince A, 2006- BM2000, D6, BP1)

Where do we go from here?

The pear industry must continue to make rootstocks a priority both in terms of improving availability and developing the skills and knowledge of how to manage them for optimal performance.

The APFIP pear rootstock trial in the Goulburn Valley is one vital resource that is providing information to the industry. There is however, scope for much more work in this area.

It is time to put D6 out to pasture and focus on rootstocks that can ensure maximum potential for intensive pear production in this country.

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