**A Beginner’s Guide to Fruit Tree Rootstocks**

**Rootstocks : Background and History**

It is well known that rootstocks are used for tree size control but we may need to remind ourselves of their other benefits. They have other specific influences such as winter hardiness, early yield, good fruit size, phytophora and collar rot resistance, replant disease tolerance and mildew and woolly aphid resistance. The one thing they all have in common is that they produce a uniform stand of trees.

Breeding - East Malling Research and the John Innes Institute Research station in Kent led the world in rootstock breeding beginning in 1922. Releases started in the '30s (MI series), followed by the '50s (MM series) and the '60s (M series). Sadly this time scale is not acceptable to government funded research these days and rootstock breeding has ceased in this country. Even the ‘new’ M116 apple rootstock arriving on the scene in the next few years was actually bred in the 1960s. However, rootstock breeding continues all over the world and the single purpose is to improve fruit yield, quality and disease resistance, the latter becoming so important with the reducing use of chemicals.

Rootstock mechanism - The exchange of influences between rootstock and scion are quite complex and in some cases still unexplained. Growth hormone, auxin, cytokinin and gibberelin exchanges between the rootstock and scion all play their part in influencing vigour, flower inducement and other benefits.

Propagation - All rootstocks themselves are produced by vegetative means with apples and pears from stoolbeds or layers and stone fruit rootstocks from hardwood cuttings or layers. Latterly some of the more recent introductions are produced by *in-vitro* techniques (tissue culture) to hasten production in the early stages. The Gisela series of new cherries and various new French plum rootstocks such as Plumina® and Jaspi® are produced this way, in fact they are more difficult to produce by conventional means. M116 has also proved difficult to root on stoolbeds and is being propagated by tissue culture.

New rootstocks - There are some very exciting types arriving on the scene from various parts of the world. Most of these achieve exceptional yields combined with equally exciting varieties of good disease resistance and quality. A good example of this is the Gisela series of rootstocks for cherries. Not only is there good size control but also very early production of viable flower that sets fruit even in the second year. This is impressive if compared with Colt where it was quite normal to have to wait for 7 or 8 years for a reasonable crop.

Trees on their own roots - There are some benefits of growing trees on their own roots and this has a keen following in some circles. There appear to be marginal improvements in flavour, keeping quality and disease resistance. This is very subjective and worthy of more study. However, many of the benefits of rootstocks would not be realised with own root trees. The most difficult problem is tree growth control. There are a few naturally low vigour, heavily spurred varieties that perform well on their own roots (Greensleeves, Spur Golden Delicious, Falstaff to name a few) but so many that would produce timber rather than fruit! Triploids would be the most difficult of all which if unattended would delay cropping for many years. Propagation is also more difficult and there would be no benefit of the rootstock influence of disease and pest resistance; an example being woolly aphid in the MM series.

Anchorage - There have been recent observations on the stability of M25 and its ability to anchor well enough in standard orchards. It appears that these reports are isolated but do raise some interesting observations. On sites where this has occurred the trees affected are generally planted as a full standard tree and have started to crop very early in life. One of the benefits of M25 is its ability to produce fruit from an early age. This often demands too much of the young developing root system in the first few years causing ‘wind rocking’. Fruit thinning and/or heavy pruning may be necessary – see below.

Pruning, staking and soil and site selection - When any tree is lifted from the nursery (especially 2 years or older) most of its roots are left behind and it is important to balance this by pruning the tree hard before the onset of growth otherwise the head of the tree is disproportionate to the limited root system that can support it in the first year. It is always worth remembering that choice of site and soil is important. Sometimes in our eagerness to plant an orchard (commercial or traditional) we often ignore the need to use the very best soils and aspect.

**Apples**

**M.27 – Extremely dwarfing.** Produces a tiny tree, usually less than 1.8m with a maximum spread of 1.8m. Used for step overs, dwarf bush trees, pyramids and patio pot bush trees. Usually needs permanent support (2m stake) due to exceptionally poor anchorage. Needs careful cultivation and only suitable for fertile soil – will not tolerate neglect! Intolerant of drought and waterlogging. Must be kept weed free. Particularly useful for vigorous triploid cultivars such as Bramley’s Seedling, Blenheim Orange, Crispin, Jonagold etc. but not suitable for weak cultivars. Fruits from a young age, but will only live for around 20 years. Average yield 4-6Kg for a bush. Susceptible to woolly aphid and fireblight and resistant to powdery mildew and crown rot.

**M.9 – Dwarfing.** A very productive rootstock but with very poor anchorage and not very hardy. Needs permanent support as the roots are very brittle and provide poor anchorage. Needs good soil and must be kept weed free. Can reach 2-2.5m with 2.5m spread. Ideal for cordons, dwarf bush trees and pyramids. Fruits from 2-3 years. Average yield 11-32 Kg for bush or 3-3.5Kg for restricted forms. Susceptible to fireblight and crown gall and resistant to powdery mildew and crown rot.

**M.26 – Semi-dwarfing.** A good all-round rootstock, ideal for average conditions. Anchorage is only fair and so requires permanent support on most sites, unless soil is deep and fertile when stake can be removed after 5 years. Will not cope with heavy clay soils. Tolerates drought but not water-logging. Good for Minarettes, bush, cordons and two and three-tier espaliers where space is limited. Can reach 2.5-4.3m with 3.7m spread. Fruits from 2-3 years. Average yield 15-30 Kg for bush, 3-3.5Kg for cordon and 11-18Kg for 3-tier espalier. Susceptible to woolly aphid and fireblight and resistant to powdery mildew and crown rot.

**M.116 – Medium.** A relatively new rootstock, not much in evidence yet but probably destined to become widespread. 10% less vigorous than MM.106 – reaching around 4m. Resistant to phytophthora and woolly aphid.

**MM.106 – Semi-vigorous.** Common rootstock for most cordons, fans and espaliers and for half-standards and bushes. Copes with poor garden soils, especially light ones. Tolerates drought but not water-logging. Has excellent anchorage and staking after first 3 years is only required on exposed sites. Reaches 5-6m with 4.5m spread. Some susceptibility to powdery mildew and crown/collar rot and resistant to woolly aphid and fireblight. More productive than MM111. Fruits from 3-4 years. Average yield 25-50 Kg for bush/half-standard and 11-18Kg for 3-tier espalier.

**MM.111 – Vigorous.** Suitable for half standards and small standards – reaching 6 -7m with 6m spread. No staking needed after first 2 years due to its excellent anchorage. Copes with most soils and will tolerate drought and water-logging. Can produce large number of suckers which must be removed. Slightly susceptible to powdery mildew and fireblight and resistant to woolly aphid and collar rot. Average yield 45-180 Kg.

**M.25 – Very vigorous.** Ideal for full and half standards. Excellent anchorage and no staking is required after first year. Reaches 6-7m tall by 6m spread. Tolerates just about all soil conditions. Fruits from 8-10 years. Susceptible to woolly aphid, otherwise has good disease resistance. Average yield 90-180+ Kg.

**Pears**

**Quince ‘C’ (QC) – Dwarfing.** Reaches 2.5m with up to 5.5m spread, needs permanent staking. Slightly earlier cropping than Quince ‘A’, after around 4 years. Used for small bushes, Minarettes, cordons, step overs, small espaliers and patio pots. Unsuitable for poor soils and very intolerant of calcareous and/or dry soils. Produces good quality fruits but best for vigorous cultivars. Produces root suckers which must be removed. Resistant to Woolly Pear Aphid, Crown Gall, and Pear Decline. Susceptible to Fireblight, Fungal Leaf Spot and Bacterial Canker.

**Quince Eline – Dwarfing.** Similar size to QC but more productive and very hardy. Produces smoother fruit with less russetting.

**Quince ‘A’ (QA) – Semi-dwarfing.** Reaches 3+m with up to 6m spread, needs staking for at least 5 years. The ideal rootstock for bushes, large fans and espaliers and cordons on poor soils but very intolerant of calcareous and/or dry soils. Also used for half-standards. Crops after around 5 years. Produces large numbers of root suckers which must be removed. Resistant to Woolly Pear Aphid, Crown Gall, Collar Rot, Pear Decline and Powdery Mildew. Susceptible to Fireblight, Fungal Leaf Spot, Bacterial Canker and Honey Fungus.

QA (and to a lesser extent QC) can have poor compatibility with some cultivars such as Conference and Williams’; these are often double-worked with a compatible interstem (another variety grafted between the rootstock and the scion) such as Old Home.

**Pyrodwarf - Vigorous.** Predominantly (but not exclusively) a perry pear rootstock. Produces a robust tree up to 4+m. Fruits earlier than Pyrus communis. No staking needed after first 3 years.

**Pyrus communis – Very vigorous.** Used for standards and half-standards. Reaches 8-12m. Has good anchorage and no staking is needed after first 2 years. Good graft compatibility, high productivity (starts fruiting after around 7 years) and tolerates all soil conditions. Tends to be disease prone although its vigorous qualities will often ameliorate the effects. Resistant to Pear Decline and Honey Fungus.

**Pyrus Kirchensaller – Very vigorous.** A recent Pyrus communis selection, similar in characteristics and rapidly replacing it.

**Plums, Damsons, Gages and Mirabelles**

**VVA-1 / Krymsk 1 – Dwarfing.** VVA-1, also known as Krymsk 1, is a new dwarfing rootstock for plum trees. It was developed in Russia and released in 2004. It is related to *Prunus cerasifera*, the Cherry Plum - a species of plum which is naturally quite small.

VVA-1 is important because it offers the potential to produce a smaller plum tree than the Pixy rootstock which has hitherto been the most dwarfing rootstock available for plum trees. Whilst Pixy (see below) is a valuable rootstock, it still produces a relatively large tree, typically around 2.5m - 3m in height, putting it in a similar category to the apple M26 rootstock. VVA-1 is thought to be more comparable to the apple M9 rootstock, and should produce a mature tree of around 2.7m height.

VVA-1 also induces precocity, in other words the new tree will start to fruit at a younger age in its life, around 2-3 years instead of the more usual 3-4 years. It also offers the advantage over Pixy of producing fruit of a good size, similar to fruits produced using the semi-vigorous St. Julien rootstock.

The main disadvantage of VVA-1 is that there is relatively little experience of its performance outside of research stations. It has the potential to be a great rootstock for gardeners looking to fit plums, gages, and damsons into a small space. Probably requires good fertile soil, no weed competition and watering in dry weather. Probably requires staking for at least 5 years.

Recommended planting distance is 2.5m apart in rows 3.6m apart. Suitable for bush, pyramid and small fan forms.

**Pixy – Dwarfing.** Ideal for small bushes in gardens and suitable for pyramids, cordons and fans. Reaches 1.8 - 3m with a spread of up to 3m and needs permanent support. Needs very fertile soil and regular weeding. Intolerant of drought. Fruits from 3 years. Resistant to bacterial canker and very resistant to silverleaf.

**Plumina ® (Ferlenain) - Semi Dwarf.** A French selection with similar tree size to Pixy but improved fruit size. Grows strongly in the first few years and then settles quickly into regular cropping. Some suckers.

**Jaspi ® - Semi Vigorous.** A french stock, untested as yet but with St Julien 'A' vigour and good resistance to root aphixiation in wet situations.

**Wavit – Semi-vigorous.** Is a clone of Prunus domestica ‘Wangenheim’. It was selected from a seedling population at nursery Schreiber (Austria) because of its positive characteristics. It combines the well known qualities of ‘Wangenheims Seedling’ with good fruit size and the advantages of a clonal rootstock (excellent uniformity in the nursery and in the orchard).

Trees on Wavit start cropping early (with standard training and management from the 3rd/4th year on) and produce regularly high yields. Besides good fruit size, the accelerated fruit ripening is of great advantage.

The grafting unions are hardly visible and trees do not need support.

Suckers have not been observed up to now. Wavit has a fine root system with some strong main roots and is very winter hardy. 30% less vigorous than St. Julien ‘A ‘

**St.Julien ‘A’ (SJA) – Semi-vigorous.** Useful rootstock for Minarettes, large pyramids, fans, bushes, half-standards and small standards. If garden soil is less than ideal then only use this rootstock. Tree reaches 3-4 m with a spread of up to 6m. Needs staking for first 3 years. Can produce suckers which must be removed. Fruits relatively young. Tolerant of drought and fairly tolerant of water-logging. Resistant to honey fungus but susceptible to bacterial canker.

Also the most common rootstock for almonds, peaches, nectarines and apricots for which it is suitable for pyramids, bushes, fans and half-standards.

**Brompton – Vigorous.** Used for standards, no staking required after first 3 years due to very good anchorage. Tolerant of water-logging and heavy soils. Reaches to 4m. Very resistant to root knot nematode but susceptible to bacterial canker, plum pox and very susceptible to silverleaf.

**Cherries**

**Gisela 5 & Tabel – Dwarfing.** Commonly used in commercial orchards but also good for bush trees in gardens and patio pots and for cordons, pyramids, fans and Minarettes. Restricts tree to 1.8 – 3m, i.e. around 60% of Colt. Needs permanent staking unless in a pot.

**Colt – Semi-vigorous.** A very fruitful rootstock with trees reaching 4-5m. Useful for bushes, half-standards, small standards and large fans.

**F.12.1 – Very vigorous.** Used for standards with the tree reaching 5+m.

**Apricots/Peaches/Nectarines**

**Torinel – Semi-dwarf.** Restricts tree to 3m. Produces heavier crops of larger fruit. Apricots are also commonly found on St. Julien ‘A’ (see above).

**Krymsk 86 – Medium.** More tolerant of heavy, wet soils with better anchorage.

**Medlars and Quinces**

Usually only available on Quince ‘A’ (see above). Grown as bushes or half-standards.

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