New Rootstocks for the Nursery Industry©

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In driving through the urban landscape one notices that not all trees perform equally well; in particular some of the more popular ornamentals are some of the worst offenders. Crabapples for one are subject to a myriad of problems such as suckering, diseases, and insects. Typically in the past ornamental plants have been budded or grafted, but even in moving toward own root propagation of trees this only solves one problem and arbitrarily at that — the problem of suckering. Any suckers that do grow up are the same as the top of the plant and will not then overgrow the budded part of the tree thus making it less desirable. Problems of ornamental plants and in particular the Roseaceae, tend to mimic fruit trees, so why not take a leaf out of the fruit tree grower's books, where similar problems have been addressed by scientific institutions backed by industry dollars researching and developing new plants. I would like to talk to you today about seven rootstocks namely: *Prunus cerasifera* H-29C (syn. *P. myrobalan* H–29C), *Pyrus* 'Old Home' × Farmingdale 97, *P.* 'Old Home' × Farmingdale 333, *Malus* Budagovsky 118, *M.* Geneva 11, *Prunus* Krymsk™ 1, and *P.* Kryms™ 5. *Prunus cerasifera* cultivars, such as 'Krauter's Vesuvius', 'Vesuvius', 'Newport', and 'Thundercloud', typically are produced on the West Coast of the U.S.A. by chip budding. Cutting production is not that prominent, and the reason being is that mass producers of trees use this system of growing because it is easier to produce a tree from a vigorously growing single bud, than expend the labor involved in choosing a shoot from many when dealing with 20,000 of one cultivar. The more decisions that one's labor force has to make, or the more times that a plant needs its root suckers removed becomes an issue.

The rootstock of choice for purple-leaf plums was *P. cerasifera* grown from seed. This plant is a somewhat shrubby grower at best that has a lot of lateral branches and exhibits a lot of genetic variation. Even grading the seedling stocks before planting to strict specifications of height and caliper does not rule out this effect. Seedlings planted out in the spring could vary in height from 18 to 48 inches by the time of budding in early August. This effect becomes even more pronounced in the 2nd year of growth when plants may vary from 4 ft unbranched whip to a 6 ft , $^{3}/_{4}$-inch-caliper tree with a full head. As a side, bar-fruiting plum also exhibit a similar growth pattern.

In the 70s, the University of California, Davis, introduced a clone of *P. cerasifera* named H–29C, the H standing for heat-treated to remove viruses. The major advantages are the following. As a very vigorously growing clone much more uniformity was exhibited and therefore a larger percentage of saleable trees produced. Imagine if all your sales are for 5- and 6-ft branched trees and 80% of your crop makes up to this size, whereas on seedling *P. cerasifera* only 50% makes up to this size, then the improvement is self evident. Secondly suckering is almost eliminated, again going back to labor and large volumes of trees. Hardwood cuttings are used to propagate *P. cerasifera* H-29C (Myro H–29C). These are taken in January and February, trimmed to 10 inches long, bundled in 100s, and treated with 2000 ppm IBA. They are then plunged into peat moss and callused in a warm room at 65 ºF. When callusing is complete they are placed into cold storage awaiting spring planting in raised beds.

Production of fruiting pear in orchards has shown a tendency to be susceptible to fire blight and to pear root aphid. This is also true of ornamental pears. Research commenced in the 1920s at Oregon State University under the guidance of Professor Frank Reimer. He investigated oriental pear species *P. betulaefolia* and *P. calleryana* finding only a few seedlings of *P. calleryana* to be resistant. However, lack of winter hardiness in the root zone caused him to focus elsewhere. He obtained a fire-blight-resistant clone from an area of Illinois where fire blight was prevalent called 'Old Home', as it was from the Old Home place. This plant however was sterile. A second resistant strain was obtained from Farmington, Illinois, and subsequent crosses were made producing the 'Old Home' × 'Farmingdale' (OH×F) stocks resistant to fire blight. Lyie Brooks from Carlton Nursery Co. investigated this research in the 1950s and obtained seed from the Summerland Research Station in Summerland, British Columbia, Canada. Five hundred original plants were produced from this seed and a number of selections made and evaluated. Both Oregon State and the U.S.D.A. were involved in the testing process. Three criteria were investigated, fire blight resistance, pear root aphid resistance, and resistance to pear psylla which was a causal factor in pear decline.

Ornamental pear rootstocks commonly used in the industry are *P. communis*, obtained from the canneries, and is a hodge-podge of genetic material — *P. calleryana* and *P. ussuriensis*. *Pyrus ussuriensis* is susceptible to fire blight but is winter hardy, *P. calleryana* is more resistant to fire blight but not hardy. Two selections of the OH×F crosses are also commonly used: OH×F 333 and OH×F 97, these are both semi-standard. Again from a nursery industry point of view uniformity, ease of propagation, and ease of transplantability are important. Hardwood propagation of the OH×F series of rootstocks is very similar to that of Myro H–29C. It is transplanted twice, once from propagation and secondly from the hardwood bed to the budding row. The resultant root system is much more fibrous. Many of us have seen April planted ornamental pears still sitting without new foliage in early June. This is less prevalent with these clonal rootstocks.

The history of crabapple rootstocks can be described as many and various. The most commonly used rootstock for crabapples is still a domestic seedling coming from cannery waste. On the East Coast this is primarily 'McIntosh' and on the West Coast 'Golden Delicious'. These two rootstocks come with all the problems of their parents. If any of you have grown budded crabapples, one of the biggest drawbacks is the rootstock suckering that occurs. Because of this there has been a move from West Coast nurseries to the East Mailing Long Ashton series of rootstocks, namely EMLA 106 and EMLA 111. Most crabapples will bud on these and suckering is reduced. There is, however, a problem with overgrowth of the graft union. Another EMLA rootstock coming to the fore is M25. I question the wisdom of these rootstocks for the upper part of the U.S.A. as EMLA 9 is only hardy to -9 ºC at which point tissue damage occurs.

In recent years East Mailing Long Ashton has lost government funding in the U.K. and been forced to move into private industry. They have found themselves playing catch up in the development of new roots with the Belgians and the French. In the 1950s Russian scientists Budagovsky and Stepanov started to develop new apple rootstocks at the Michuinsk College of Agriculture. They added one additional factor in the mix; the fact that the presence of anthocyanin in the plant helped protect again stress. One of these stocks, Budagovsky 118 or B118, proved

to be very cold hardy, produced a well-anchored tree, and performed in most soils. In freezing studies bare roots did not exhibit tissue damage until –18 ºC. This test subjected plant to a 1 ºC lowering every 8 h followed by a week at certain predetermined temperatures and then examined the roots for tissue damage. This rootstock shows very strong apical dominance with little or no side branching and makes a very useful tall standard rootstock. It resists powdery mildew, scab, and collar rot. The performance of crabapples both in the 1st and 2nd years after budding is self-apparent. Uniformity is greater and caliper is increased. As a 2-year branched tree the caliper of the 6- to 8-ft grade is uniformly $1^{1}/_{4}$ inch instead of 1 inch. This is true of all the white-flowering crabapples and the majority of red types.

Another point of note from the Willamette Valley growers of Oregon is the appearance of a disease that is becoming more and more prevalent — aerial *Phytophthora*. It appears as a canker during the winter on the stems of ornamental pears and crabapples and is fatal to the plant. As a personal note I observed this disease on plants shipped to the Midwest from the West Coast over 25 years ago. A number of 'Spring Snow' crabapples had broken off half way up the stem upon lining out and upon examining the breaks, they had occurred at an area of a large black canker. Conversation with Richard Regan from Oregon State University's Willamette Experiment Station where research has been done into this form of *Phytophthora* revealed that it is much more prevalent on white-flowering types and in particular 'Spring Snow'. Another point of interest is that 'Dolgo' crabapple, seedlings of which are now becoming popular as a rootstock, is the parent of 'Spring Snow'. This would indicate to me a step backward in rootstock selection.

An apple rootstock that may prove to be of interest is *M.* Geneva 11. Developed in the 1970s as a cross between *M.* ×*robusta* #5 and *M. domestica* M26, it was selected for *Phytophthora* and fire-blight resistance by Cornell University. It has shown no incompatibility to the major fruit cultivars and shows all the characteristics of M26 as a dwarfing rootstock. Fire blight usually hits the top of a tree and is translocated downward. It will remain in the tree and if the roots are susceptible will kill the tree the following year. Own-root crabapples have not had their root systems tested by cultivar for resistance to fire blight and this could be problematic for some cultivars. Geneva 11 could therefore prove to be useful in certain areas and for certain cultivars.

Propagation of these plant cultivars is performed by stool bed or sawdust layers. Plants are planted in rows at an angle of 60° and an in row spacing of 4 inches. Row spacing is 5 to 6 ft. In the spring of the second season the plants are laid over and pegged down or tied horizontally. The resulting lateral branches grow as upright sprouts. These are mounded with Douglas fir sawdust to about 10 inches deep, the tops straightened, and the air pockets removed. The plants are watered with an inch of water weekly, fertilized, and kept free of disease and insects. Rooting occurs at the basal 3 to 4 inches of the stem in damp sawdust. The sawdust is pulled back in the winter and rooted plants are harvested by a sickle-bar style of mower.

Finally I would like to talk about two rootstocks from Krasnodar region of Russia, located about 2 h southeast of Moscow. *Prunus* as we all know can be quite the adventure in propagation. Budding can be very much hit or miss, some years good and some year's bad, but on average a 75% take can be quite successful. Cutting production again produces variable results and the resulting trees can vary in the nursery rows from 2–6 ft. Disease problems of the rootstocks often preclude Midwest and

East Coast nurseries from growing these trees as bareroot liners. I would also like to mention that quality trees that are either in their 1st or 2nd year exhibit a good taper from bottom to top and are not a cylinder of the same diameter.

VVA 1 or Krymsk™ 1 is a rootstock from the Krymsk breeding station introduced by Gennadyi Eremin. It is a hybrid of *P. tomentosa* and *P. cerasifera* that dwarfs 40% to 50%. It has precocious fruit set and therefore a heavy bloomer in the early years. It is tolerant of wet soils and those of up to a pH 8, but not of dry soil types. A big fibrous root system produces good anchorage. This selection should prove to be a very useful rootstock for the small urban landscape that is very hardy and useful for ornamental plums, flowering apricots, and flowering peaches. Bud stands over the past 2 years have been 90% plus takes. Propagation by hardwood cuttings has been very precocious and easy to root.

A second rootstock, VSL 2, is a hybrid between *P. fruticosa* and *P. lannesiana* and has been released to the industry by Varieties International as Krymsk™ 5. It reduces tree size by 50% and performs in a similar manner to Gisela 5 (a German root stock). It is sucker free, very cold hardy, and compatible with sweet and sour cherries. Budding trials with Kanzan cherry (*P.* 'Kanzan'), Yoshino cherry (*P.* ×*yedoensis*), and *P.* 'Shirotae' (syn. 'Mount Fuji') have been very promising over the past 2 years, showing no incompatibility and 90% plus takes. Propagation by softwood cuttings and tissue culture are preferred.

In summary attention needs to be paid to both the top and the bottom of the plant in producing a high quality ornamental tree liner for the nursery industry and I hope these new cultivars fuel some interest along those lines?