Implications of Propagation Techniques on Landscape Performance

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According to its Constitution, the I.P P.S. is made up of people "actively engaged in plant propagation". Many of us could be called plant producers as well as plant propagators But few, if any of us are landscape architects, landscape contractors, or urban foresters. We are concerned with propagating and producing plants, and not with using and maintaining them. Plant propagation, not plant performance, is our interest But the way we propagate a plant can have a long term effect on its ultimate performance in the landscape.

The fact that understock choice affects landscape performance in trees has long been known Budding *Acer rubrum* cultivars onto *A rubrum* seedling understock produces trees which exhibit a 30 to 40% frequency of delayed incompatibility. These incompatible trees snap off cleanly at the bud point, but often not until they reach 3- or 4- inch stem diameter. This problem has been almost eliminated from the nursery trade by propagating *A. rubrum* cultivars on their own roots by cuttings or micropropagation.

Flowering crabapples have been traditionally propagated by budding onto domestic apple seedlings (*Malus pumila* [syn *M. sylvestris*]). In the landscape, unsightly understock suckering is the usual result. We have tested a number of clonal understocks and found that EMLA 111 and EMLA 106 almost completely eliminate the suckering problem These understocks produce a tree of slightly smaller mature size and may induce the tree to fruit more heavily at an earlier age. The early fruiting may cause a slight reduction in caliper growth in the nursery.

Recently, some nurseries have begun producing crabapples on their own roots from softwood cuttings. These plants tend to produce fewer suckers as well, but the long term anchorage, soil adaptability, and disease resistance of these root systems is unknown. Recently, *Malus* 'Red Jewel' has been found to be *Phytophthora* susceptible on its own root, while budded plants have not shown this problem.

Pyrus calleryana cultivars are grown by budding onto a variety of understocks. *Pyrus calleryana* seedlings, *P. ussuriensis* seedlings, 'Bartlett' seedlings and Old Home x Farmingdale clonal rootstocks have been used. Trees budded onto 'Bartlett' seedlings have developed a reputation of being short-lived on the U.S. east coast, but are successful in the Northwest. It is suspected that on the east coast, where fireblight is relatively common, the disease moves into the rootstock and kills it. Old Home x Farmingdale rootstocks are fireblight resistant and generally successful, but we have observed incompatibility of certain combinations when grown under stressful conditions We are still evaluating these for long term landscape success Both *P calleryana* and *P ussuriensis* have been quite successful *Pyrus ussuriensis* is hardier and *P calleryana* has the best proven tolerance of drought, flood and urban conditions. At this point, we choose to use *P. calleryana* seedlings, but continue to evaluate the others.

Amelanchier cultivars are grown by cuttings, micropropagation, and budding onto a number of understocks. I recently examined failing *Amelanchier* sent to us from a customer The *Amelanchier* were purchased from another nursery, which had budded them onto *Sorbus aucuparia*. We have tested this combination and found that the trees are compatible at first, then die within a year or two. Most *Amelanchier* cultivars appear compatible and do well on *Crataegus phaenopyrum*, but each cultivar should be evaluated. Our production is from micropropagation. Although slower growing in the nursery, these plants are successful. Most *Amelanchier* are grown as multi-stem in the landscape Own-root plants have the advantage that their suckers are identical to the desired cultivar.

Flowering cherries can be propagated by softwood cuttings, by budding, or by grafting onto *Prunus avium*. Some cherry cultivars do not root well, but for those that do, own root plants seem to be superior They produce faster growth with a reduced incidence of root rot, although this will probably vary by cultivar.

Some of the most puzzling problems of deciduous landscape plants are due to adult-juvenile phase changes. Most tree cultivars are propagated in the adult phase. Traditional budding and grafting techniques generally perpetuate the phase of the stock plant. The process of micropropagation causes a change toward the juvenile phase In some plants this causes no problem, in some it is beneficial, but in others it creates problems for landscape use

The first instance we documented was in "thornless" cultivars of *Gleditsa triancanthos* propagated by the traditional T-budding technique Although there is certainly a degree of genetic control over thorn production, the phase of the plant is most directly in control. Thorniness is a juvenile condition. Adult growth (branches high on a mature tree) are generally thornless. Heavy pruning and the resulting lush growth can initiate a change toward the juvenile phase. We have found that repeated heavy pruning of scion orchard trees can change these stock trees to the juvenile phase After a number of repeated shearings, trees budded from older scion orchards will begin to produce thorny plants. Like a living oxymoron, as the trees become older they become more juvenile. Table 1 shows the results of scion source on thorniness of 'Skyline' honeylocust whips in two production locations.

Table 1. The effect of shearing and age on thorniness of 'Skyline' honeylocust whips from two production locations

Sunset Farm	
Age scion block (years)	Whips with thorns (%)
2 (field-grown trees)	10
8	23
10	33
14	41
Independence Farm	
Age scion block (years)	Whips with thorns (%)
2	0
8	19
10	23
14	26

The most frequent source of phase changes in plants is in those that have been micropropagated. Several years ago, we began trials with micropropagated flowering crabapple cultivars. We had better transplant survival and growth with these than we had experienced with softwood cuttings. We were very happy with them until the trees branched and we took a close look at them. We found a significant percentage of these crabapples were thorny, a condition we had never seen in budded plants (Table 2). At that time, the plants were 4 to 5 years out of culture Thorniness is a juvenile condition in *Malus*. It had been brought on by propagation technique, and it had not gone away. It is unknown how long these plants would maintain the juvenile, thorny state after planting in the landscape.

Table 2. Thorns produced by micropropagated flowering crabapples, 4 to 5 years after leaving the micropropagation lab.

Cultivar	Thorns present (%)	Heavily thorned (%)
Zumi Calocarpa	100	22
Royalty	100	15
Snowdrift	96	10
Radiant	89	9
Spring Snow	34	2
Centurion	20	2

To follow up on this juvenile phase change, I tried an experiment budding *Malus* 'Royalty' from traditional and micropropagated sources onto the same understock (EMLA 111). The one year trees from the two sources are quite different, with the comparison shown in Table 3. Thorns are generally expressed on the branching that occurs the second year after budding. I will evaluate for this next year.

Table 3. Comparison of one year budded *Malus* 'Royalty' from traditional and micropropagated sources on the same understock

Feature	Budded trees	Micropropagated
Height	5 ft	6 ft
Branches	3	9
Branch angle	60°	90°
Branch orientation	45° upward	90° horizontal
Largest leaves	4 in.	3½ in
Spurs	no	yes
Color	purple	less purple
Leaf gloss	glossy	less glossy

The final example of propagation technique influencing landscape performance is in *Betula pendula*. *Betula pendula* 'Youngii' is a weeping plant. If not staked up, a budded plant would grow flat on the ground. It produces a plant with an extremely slender stem that will not support itself until two to three years old.

Micropropagated 'Youngii' trees grow straight and develop strong caliper. I estimate they produce a tree twice as tall with five times the stem caliper in one year in the nursery, when compared to budded plants. This is a great advantage for commercial production. But in the landscape, we observe that these trees continue to produce tall leader growth and do not weep gracefully as we expect from 'Youngii'. However, hard pruning to a downward growing lateral will put an end to the central leader, and by the time the plant reaches 3- to 4-inch stem caliper, it is behaving the way a weeping tree should The weeping habit is a characteristic of the adult phase. It can be restored by a combination of plant size, time, and pruning to a weak lateral branch.

In practice, the landscape performance of trees is governed primarily by the genetics of the cultivar. But in certain plants, the propagation technique used can have an impact for years to come on the plant's form and potential for success. We must look to the landscape occasionally to view the performance of the plants we propagate, then in some cases, take a second look at our propagation technique.