MALUS

International
Ornamental Crabapple Society
Bulletin

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Letters to the Editor

Dear Tom:

Among other things, this is a long overdue congratulations to you for the splendid job you're doing in handling MALUS. Fall 1988 Volume 3 Number 2 just arrived. The color prints are excellent, layout good.

The comment, inside front cover under acknowledgments, is inaccurate, i.e. "Malus Sargentii: Nearly indistinguishable from M. zumi calocarpa, Lester P. Nichols". That I cannot swallow. If the remark were confined to size and shape of leaves, a partial "O. K.", but certainly not flowers, shape or form, and even "iffy" for fruit.

I presume the Morton Arboretum has a copy of Den Boer's book. In case not, here are 3 pages of "copy". Those who knew him and worked with him considered Arie the flowering Crabapple expert of his time, and, I'll add, still is. I've also worked with Les Nichols for 10 years or so. His contributions are on a par, too, but in another area, as you know so well. Please give my regards to George Ware.

Sincerely,

Bill Collins

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Dear Dr. Green:

Thank you very much for sending the Winter 1988 issue of MALUS. I was delighted to see that you had published my article about the Allegheny Crabapple. I was then immediately chagrined to see that it was listed as ANONYMOUS!

I would appreciate a note of correction in an upcoming issue and perhaps a note as to what kinds of articles you might like to have in the future.

Yours very truly,

Bill Paxton
Host of "Diggn' In" Gardening talk show WIXZ AM radio in East McKeesport, PA

I wish to offer an apology to Mr. Bill Paxton, host of "Diggn' In" gardening talk show WIXZ, AM radio in East McKeesport, PA for his article "The Allegheny Crabapple" in MALUS Volume 3, Number 1. The cover letter was separated from the article. When the article was typed by the publisher (Tom Green), he was unable to identify the author. We want to thank Mr. Paxton for his article.

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Dear Tom:

With a great deal of interest, I read your article in the last MALUS on Malus x zumi vs. M. z. var. calocarpa. I too have observed much variation, especially among zumi seedlings, some with yellow fruit, etc., even to the point of keeping various seedlings, including a double white for potential propagation.

My purpose in writing is really to obtain, if possible, some authentic M. z. calocarpa scion-wood for bench grafting. I do not have a true example of calocarpa in my entire collection. Nurserymen I have talked to mention variation among various supposedly true M. zumi calocarpa so I would like to get something from the original Arnold Arboretum accession you mentioned in the article (or seedlings such as #966, 967 or 968-40).

I would also take some of the 'Morning Sun' selection if available.

Send to me at the Wichita address. Thanks.

By the way, do you know when the first edition of John Sabuco's Plantsman's Journal is due out?

Sincerely,

John C. Pair
Research Horticulturist
Horticulture Research Center
1901 E. 95th Street South
Wichita, KS 67233

The entire first issue of "The Plantsman's Journal" was lost, requiring complete replacement of pictures, ads, separations and refinancing of the above. While it seems a black cloud hangs over "The Plantsman's Journal: it should be out quite soon... I never give up! Further, those who have sent in their subscription money will receive three free issues!

John Sabuco

Perhaps the epitome of perfect landscape usage for 'Indian Magic' is to be seen at Boerner Botanic Garden in Hales Corners, Wisconsin, just outside Milwaukee. Here it is used to anchor a country stone bridge that perfectly foils both flower and fruit. 'Indian Magic' has withstood -38° that I know of, but for now, I recommend use no further North than Zone 4, until fully tested in colder climates. Bob Simpson, of Simpson Nursery and Orchard Company in Vincennes, Indiana, introduced 'Indian Magic' which he named after a favorite horse! (And here I thought the name was chosen specifically for this tree as in an Indian Summer theme.) For all our rural readership; rest assured this is no horse apple!

PERFECTING THE CRAB

A researcher tries to eliminate sucker growth on crabapples by varying rootstocks

By Keith Warren

Crabapples are nearing perfection. Advances in breeding and selection, coupled with careful research of disease resistance, have made these ornamentals more beautiful and problem-free than ever. The best cultivars now approach the theoretical "perfect" landscape tree - with one exception.....suckers.

With crabapples, the roots close to the soil surface tend to produce heavy sucker growth. And the more you cut them back, the more they seem to multiply. Suckers are not unsightly, but they limit the tree's use in landscapes where low maintenance is a prime criterion.

Eliminating suckers may be the last frontier to conquer in perfecting the Crabapple. To accomplish this, the industry needs to examine our current propagation techniques.

Traditionally, growers propagate crabapples by budding or grafting them onto seedling rootstocks. Most often, they use Malus domestica. But they occasionally use other Malus species and some Crabapple cultivars, such as 'Dolgo' and 'Red Splendor'. However, advances in cutting and tissue culture propagation may change this traditional approach.

For example, growers recently solved a major problem they encountered among popular Acer rubrum cultivars. They found that by propagating these trees on their own roots, through softwood cuttings, propagators could eliminate bud union incompatibility. Many growers are now eager to try these techniques on other trees. Some are hoping "own-rooted" propagation will solve the crabapple's suckering problem.

Fueling this interest is the fact that several crab cultivars are now being propagated by tissue culture, which makes available large quantities of own-root plants. However, what works well for one plant may not be at all appropriate for another. I have observed that many own-rooted crabapples do, in fact, produce quite a few suckers. A small research project at Kansas State University bears this fact out. Researchers studied 'Radiant' and 'Snowdrift', comparing own-rooted plants with those budded on other seedling rootstocks. Own-rooted production seemed to control suckering in 'Radiant', while cut own-rooted 'Snowdrift' suckered heavily.

These researchers concluded that planting the trees four inches deeper than they were planted at the nursery provides the best suckering control. However, they noted that deep planting is not normally a good horticultural practice. I agree. Besides, the roots of deep-planted trees eventually grow closer to the soil surface. Thus, in later years, they could produce suckers.

For all these reasons, the nursery industry should take a critical look at own-rooted crabapples and evaluate them carefully before putting them into full-scale production and planting them in landscapes.

Beyond the practical considerations, I am also disturbed by one implication of own-rooted Crabapple propagation. If the industry does not experiment with different rootstocks, we will fail to take advantage of this plant group's great variability.

Most modern crabapples are complex hybrids of several parents. Thus, there is perhaps more above-ground diversity among the existing 700 or 800 named Crabapple cultivars than within any other group of trees. And the same is probably true below ground.

Unfortunately, roots are hidden below ground, and what is out of sight is often out of mind. We know about flower and leaf color, size and shape, fruit qualities, disease resistance, and many other above-ground features of leading Crabapple cultivars. But what do we know about their root attributes? Anchorage; tolerance to wet soil, salts and drought; and resistance to soil-borne pathogens - all are totally unknown. Yet, if we understand the differences that exist, we can manipulate them to our advantage - to create a better, more perfect tree.

The variability in morphology and quality among the various Crabapple cultivars' root systems can be traced to two factors: growing conditions and genetics. To improve a cultivar's root system, we can change the conditions. Media, transplanting practices, and pot size and shape can all be modified to improve root structure.

But the impact of the changes we can make in this way is limited. For example, roots of young tissue-cultured trees are extremely fine; these plants must be carefully handled in the greenhouse in small pots. While progress is being made, it is difficult to eliminate circling roots in tissue-cultured trees completely.

This leaves genetics. But, by definition, we cannot alter a cultivar's genetics without creating a new cultivar. If the genes of a cultivar happen to specify beautiful flowers, bright fruit, and disease-resistant foliage, combined with a weak and disease-susceptible root system, then those will be the characteristics of every one of these plants propagated on its own roots.

So, if we are limited in the changes we can make by altering the growing conditions and we cannot alter a cultivar's genetics, how can we create a better rather than a new tree? Why not take advantage of all this diversity and actually build a better tree? Why not take the best disease-resistance cultivars and bud them onto the finest proven clonal rootstocks?

Ten years ago, I began working on alternative root systems for crabapples, experimenting with cutting propagation as well as investigating clonal rootstocks used in fruit tree production. I soon found that a number of Crabapple cultivars were easy to root, some were moderately difficult, and a few were nearly impossible.

I also found that most of the Malling series rootstocks, developed for the apple industry, are compatible with crabapples and produce good scion growth. These rootstocks have been in existence for years and have been used worldwide in all types of soils. Research dollars commensurate with the economic importance of the orchard industry have been spent on testing and evaluating these root systems. Thus, unlike Crabapple rootstocks, the features of the Malling rootstocks are very well known.

I began carefully testing various rootstocks. I looked at a number of seedling, as well as clonal rootstocks:

. EMLA from England.
. The Polish series from Poland.
. The Budagovski series from the U.S.S.R.
. Alnarp 2 from Sweden.
. Antonovka clones from Washington.
. Mark from Michigan.

I also tested new rootstock introductions as they became available.

I conducted tests in three separate planting years. After budding a number of crabapples on each rootstock, I evaluated bud take, compatibility, scion growth rate, root morphology and, most importantly, sucker growth.

In general, clonal rootstocks performed well and greatly reduced sucker production. Most seedling rootstocks grew well and produced good scion growth. But seedling rootstocks tended to produce heavy suckering.

I also found that scions influence the rootstocks' sucker production. For example, scions of 'Royalty' and 'Sargent' caused greater than average sucker production, while scions of M. floribunda and 'Snowdrift' caused less than average suckering. This was interesting, but it does not represent a solution. All budding cultivars produced too many suckers when M. domestica or other Malus seedlings were the rootstocks.

In the first of the three trials, I used 100 plants for each of 10 rootstocks. Five were EMLA clones. The other five were various Malus species. I used M. domestica as the control.

I budded 14 cultivars onto each set of rootstocks. The differences I noted in sucker production were tremendous, varying 47-fold from the best rootstock to the worst. M. baccata was the worst, producing an average of 6.6 suckers per tree. EMLA 111 was the best, producing 0.14 suckers per tree. The control produced four suckers per tree.

Additionally the test showed that EMLA 106, Alnarp 2, Budagovski 490, Budagovski 118, and Polish 18 produced trees that were nearly sucker-free. Of these, EMLA 106 is a proven rootstock, having been used for many years in the US.

The others are relatively new to this country and need further testing before I can make any recommendations. However, these newer rootstocks do offer some size control. Budagovski 490 is slightly more dwarfing that is EMLA 106. And Alnarp 2 is similar to or slightly more vigorous than EMLA 111. Among the fully dwarfing rootstocks, both Mark and EMLA 26 appear to have potential. Again, additional testing is needed before these stocks are used in full-scale production.

After compiling my results, I divided the rootstocks into five groups based on suckering. The rootstocks in Group I should eliminate the suckering problem for crabapples. Group II rootstocks are probably acceptable for sucker control, but they need further evaluation before widespread production begins. Groups III, IV, and V produce too many suckers to be recommended.

Rootstocks in groups I and II vary from extremely dwarfing to full size. Several should not be used because of poor anchorage. EMLA 9 and EMLA 27, for example, have reputations for poor anchorage. Trees budded on these rootstocks must be supported with stakes.

At this point, I recommend EMLA 106 and EMLA 111 for general use. English growers have used both in Crabapple propagation for a number of years, and they have performed well. In the US, fruit-tree growers also widely use both rootstocks.

Although some people have reported EMLA 106 to be susceptible to collar rot, I have used this rootstock in wet soils without problems. EMLA 111, on the other hand, has proven adaptability to soils ranging from dry and sandy to heavy and wet. It provides excellent anchorage and has better cold hardiness than does M. domestica.

EMLA 106 produces a semi-dwarf tree, about 60 to 70 percent of full size. EMLA 111 produces a tree of nearly full size. Both produce trees that grow vigorously in the nursery, then slow down as they mature in the landscape.

EMLA 111 should be planted with the bud point touching the soil level, as burr knots (lumps on the stem formed by root initials) will produce additional roots. If left above ground, these burr knots inhibit nutrient movement through the trunk.

EMLA 106 should be planted with the bud point 1 or 2 inches above the soil so that scion rooting does not occur, as this would counteract the rootstock's dwarfing effect.

Crabapples have come to be the most widely planted small flowering trees in the country. However, the heavy production of unsightly and annoying suckers remains a major landscape problem. Own-rooted material may help eliminate this problem, but the root characteristics of each cultivar are variable and much unknown. Only long-term evaluations of own-rooted cultivars will tell which will perform well on their own roots and which will fail. This requires time.

In the meantime, clonal rootstocks provide a proven, successful alternative. They can eliminate the problem of suckering, and they can also control size and add a known degree of insect and disease resistance. Thus, propagating crabapples on the other roots seems to be the direction to take on the road to perfecting the Crabapple.

Keith Warren is the Horticulturist at J. Frank Schmidt & Son Co., Boring, OR.

TREE PLANTING RECOMMENDATIONS

Thomas L. Green, PhD
Gary Watson, PhD
Kris R. Bachtell
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Diagrams that show how to plant a tree can be readily found in various horticultural publications. It is interesting to note that the diagrams vary considerably. If a tree can be successfully planted by using any method, then the recommended diagram would be the one that is the most economical to construct.

Unfortunately, there has been little research showing how a tree may respond (i.e., root growth, root location, survival rates) when planted, following the different planting methods. It would seem to be reasonable to assume that they all cannot be correct. In fact, it is known that some of the planting diagrams can lead to problems that may show up much later. For example, many planting diagrams show to dig the hole deeper than the ball. They also show that backfill, placed below the ball, must be tamped or compacted to prevent settling. When settling occurs and the root flare is six inches or more below grade, stress and disease problems may occur causing poor establishment or death. If the backfill is to be compacted to prevent settling, then soil does not need to be removed deeper than the ball in the first place.

Many planting diagrams show hole width beyond the ball at one foot or less. Yet, tree roots will grow 18 inches or more per year under optimum conditions. Also, tree roots regenerate from their cut surfaces, at the outer part of the planting ball. The undersized planting hole (diameter), therefore, leaves a barrier to inhibit optimum root growth.

The research literature provides ample evidence that shows, in most soils, established trees do not have taproots; and most root systems are arranged horizontally close to the soil surface. The undersized planting hold (diameter) does not allow for natural horizontal root development.

Technology is supposed to make work easier. Yet, new strong synthetic twine and "burlap" used for B + B may cause plant failure. If the twine around a tree base is not cut, it may girdle the plant. Fine roots can penetrate the small openings in the fabric weave, but they cannot expand or develop into larger woody roots because they are girdled by the fabric. This root girdling has been observed with untreated hemp burlap. This is why it is recommended to cut all ropes and remove all fabric, synthetic or not, before backfill is added. Likewise, wire from wire baskets does not corrode and "melt away". Intact oxidized wire has been found seven years after planting. Wire baskets with small diameter holes have been observed girdling roots. It is not difficult to remove the wire on the upper portion of the root ball before backfilling.

Forestry and horticulture literature provide ample evidence for keeping the turf or lawn away from the trees. Yet, the installation of lawn or sod around trees planted in urban areas is considered to be a standard practice. This frequently causes lawn mower and weed whip injury, which is considered to be one of the most serious problems for newly planted trees. The grass plant also creates a very hostile and antagonistic environment for the horizontally spreading tree roots. The lawn competition can contribute to enough tree stress that it becomes prone to attack by insects and diseases. Organic mulch is recommended to conserve moisture, ameliorate temperature extremes, provide natural nutrients, and create favorable edaphic conditions for root growth. However, it must be used correctly, or it too, can inhibit root growth.

The key to successful tree establishment after planting is providing a favorable environment for root growth at planting time and a good follow-up maintenance program. The purpose of this document is to provide recommendations that will help increase plant survival. Any or all of the sections can be used for developing specifications for contracting tree planting. The diagrams and recommendations for tree planting are based upon research and the experience of nurserymen and landscape contractors. It is intended to provide the minimum requirements for tree planting and keep time and labor costs to a minimum.

Figure 1

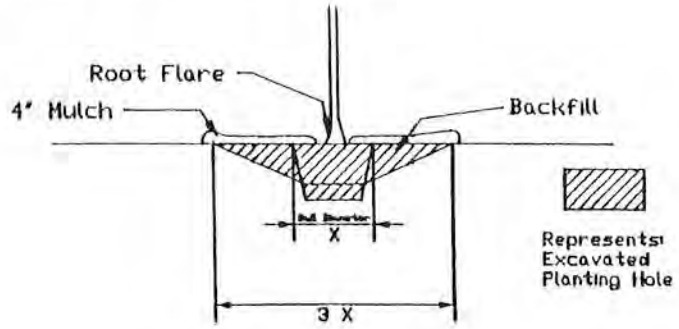


Figure 2

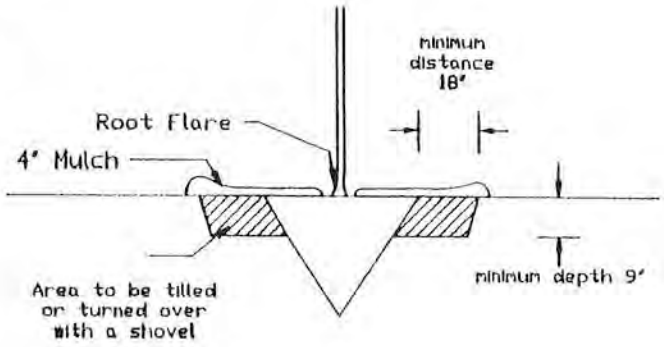
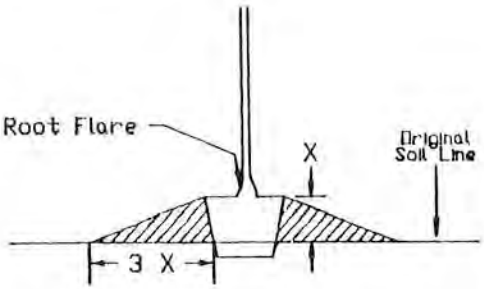


Figure 3



X = 3/4 of the height of the root ball

CRABS YOU SHOULD KNOW: MALUS 'INDIAN MAGIC'

By:

Dr. John Sabuco

I expected that trying to sell a Crabapple that is practically certain to contract scab every year would be difficult. The thought of selling this tree to a client pre-programmed to hate "messy, sickly, good for only one week" crabapples was a bit (a lot) unnerving. Charging a few hundred dollars for the plant seemed impossible. I found that my expert over-novice approach, "Trust me!" did not work.

I found that the self-torture promise did a much better job of selling scab tolerant crabs. It works like this: "I promise that if you don't like this tree, I'll not only replace it free, I'll drink a 16 oz. puree of raw eggs and anchovies!" They usually buy after that line.

I have never had to replace a Malus 'Indian Magic' specimen, nor drink the egg and anchovy cocktail. Scab tolerant crabs are perhaps the right path to take for new crab recommendations. The problem with scab resistant cultivars is that this is a temporal condition for two reasons:

This page: M. 'Indian Magic' in bloom at Boerner Botanic Garden (John Sabuco).
Opposite Page top: M. 'Indian Magic' in fruit (Les Nichols).
Bottom: M. 'Indian Magic' fruit detail (Les Nichols).

1. Scab is genetically unstable. Mutant generations occur with alarming regularity and, if reproducible, form new strains to which a formerly resistant cultivar may have no defense.

2. Cloning is not an exact replication of the parent material as is commonly believed. There is a condition known as cumulative replicate degeneration which means that "something" is lost after years of taking cuttings from former cuttings of cuttings. The only way to prevent this is to infuse genetic material from original or close to original parent plants. This if often impractical. The "something" that is lost can be anything and is often a plant's resistance to disease. Hybrid Tea Roses present an excellent example of this with regard to Black Spot which is genetically stable. Many plants from the 30's and 40's which did not contract Black Spot then, are buck naked by July in the 1980's. The same problem occurs with crabs.

Tolerance to scab is conceding the infection, but not the foliage. Scab tolerant crabs become infected regularly. The scab rarely affects the fruit and rarely defoliates the tree. The lesions may or may not be conspicuous, but they rarely crumple the leaf. If defoliation is early, it is usually only slightly before normal abscission. A tolerant crab will have its entire compliment of foliage, when at the same time, a non-tolerant cab, standing right next to it, will be completely defoliated. Put in a nut-shall, a tolerant crab contracts scab, but doesn't "loose its head" over it!

'Indian Magic' is fairly small for a full-sized Crabapple. Its size range is 10-20' high and wide, but 10-12' high is perhaps the landscape design size. The head is fairly symmetrical, but somewhat irregular. (A crown which is symmetrical and very regular would be Malus 'Snowdrift'.) The flowers are dark rose colored in bud, normally opening to pink. The flower color, however, is quite variable, and dependent upon the weather. From year to year I have seen the flower as an old rose color on the dark end of the spectrum, to white blushed with pink at the other end. The same condition occurs with Malus 'Adams' and it is not only charming, but these two trees combined in a landscape can lead to very beautiful changing pastoral "murals" in successive years.

The fruit display is something to behold. It is profuse and annual. The fruit is longitudinally elliptical and lacquered scarlet-red. It is 1/2" long and 3/8" wide with a conspicuous small, whitish, calyx scar halo. The fruit colors just before peak fall foliage display.

Fall color is very fine for a crab being orange to orangey-gold and yellow and quite bright. If scab defoliates 'Indian Magic' it is usually just as the fruit colors (or about one week earlier than usual) giving a bit longer fruit display. The combination of fall color and fruit is quite spectacular. (See cover photograph.)

TREE PLANTING RECOMMENDATIONS (an outline)

Thomas L. Green, PhD
Gary Watson, PhD
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1.0 TREE SELECTION

1.1 Source
Trees best suited for your soil and climate should be available from reliable local nurseries. Inquire about the species and origin of the rootstock for grafted trees. Trees that are ordered must comply with the provisions set forth by the American Standard For Nursery Stock, ANSI Z60.1 - (most recent edition). Any plant not meeting these Nursery Standards may be rejected.

1.2 On Site Selection
The best quality trees can usually be obtained by on-site inspection and selection. Selected trees should be marked with (numbered) plastic locking tags. Record the tag number, species, and cultivar for each tree. Inventory the plants upon receipt and before acceptance.

2.0 PLANTING HOLE PREPARATION [for all trees except planted by tree spade] Figure 1.

2.1 Hole Configuration/Shape
Dig a shallow saucer that has a diameter of to 3 times the diameter of the root ball and 2/3 the depth of the root ball at the center. In the center of the saucer dig a hole the same width as the bottom of the root ball and 1/3 the depth of the root ball. This will allow the bottom 1/3 of the root ball to fit snugly into the hole, helping reduce the need to stake.

2.2 Hole Depth
The hole should not be deeper than the depth of the root ball so that the ball can be placed on firm, undisturbed soil. After settling, the root flare should not be more than 2" above or below the original soil level.

3.0 PLANTING METHOD

3.1 Bare Root

3.1.1 Bare root trees must comply with Nursery Standards Specifications.

3.1.2 Roots must be kept moist from the time of digging until the time of planting.

3.1.3 All bare root trees should be inspected before planting. Any trees with poorly formed root systems, spiraling root systems, dead roots, or broken and damaged roots should be rejected.

3.1.4 Bare root trees should have the same guarantee as trees planted by other methods.

3.1.5 Staking is recommended for bare root planted trees (see 7.0, Staking Recommendations).

3.1.6 The root flare must be within 2" of the original soil surface. For grafted trees, the graft junction will be above ground level.

3.2 Ball and burlap

3.2.1 Ball and burlap trees must comply with Nursery Standards Specifications.

3.2.2 The root flare must be within 2" of the top of the ball; if not, reject the tree.

3.2.3 After setting the tree in the hole and before backfilling, all twine and/or binding rope must be cut. The burlap on the upper 1/2 must be removed* or dropped to the bottom of the hole. *Any non-degradeable material (e.g., nylon) must be removed from the hole.

3.3 Wire Basket

3.3.1 Tree ball sizes contained by wire baskets must comply with Nursery Standards Specifications set forth for ball and burlap trees and shall hold the ball in a firm, rigid condition.

3.3.2 The root flare must be within 2" of the top of the ball; if not, reject the tree.

3.3.3 After setting the tree in the hole and before backfilling, the wire on the upper 1/2 of the ball must be removed.

3.4 Fabric Bag (in ground) Containers

3.4.1 Nursery Standards Specifications have not yet been developed for Fabric Bag Containers. Buyers of trees in Fabric Bag Containers will have to judge for themselves whether the ball size and integrity is adequate for the size of the top.

3.4.2 The root flare must be within 2" of the top to the ball; if not, reject the tree.

3.4.3 Before backfilling the hole, the fabric bag must be removed, including below the ball, if possible. Since the fabric does not degrade, it should be removed from the planting hole.

3.5 Container (above ground) Grown Plants.

3.5.1 Container (above ground) Grown Plants must comply with Nursery Standards Specifications.

3.5.2 The root flare must be within 2" of the top of the ball; if not, reject the tree.

3.5.3 After setting the tree in the hole and before backfilling, all non-degradeable container material (e.g., metal can) must be removed. If the container material is degradeable (e.g., peat pot), then the top 1/2 of the container must be removed.

3.6 Tree Spade

3.6.1 Selection of tree spade size will depend upon the size of the tree. Root ball diameter should be 10-12" for every inch of stem diameter measured 12" above the ground.

3.6.2 The root flare must be within 2" of the top of the ball; if not, reject the tree.

3.6.3 After planting, the soil immediately adjacent to the soil moved with the spade should be turned over to a depth of 12" or shovel depth for a minimum distance of 18" (see Figure 2). This will fill gaps, eliminate glazing, and provide loose soil for root regeneration.

3.6.4 After a two-week minimum settling period, the spade soil surface must be within 2" (above or below) of the surrounding soil surface.

4.0 BACKFILL

4.1 Original soil should be used as the backfill, unless considered unsuitable for tree root growth.

4.2 Amendments

4.2.1 When the original soil is not considered usable, good pesticide-free agricultural topsoil should be used.

4.2.2 Organic matter (e.g. peat moss) is not recommended for use as backfill material. If the only available backfill lacks soil structure, organic matter can be incorporated at a volume not to exceed 5%. Before use, all organic matter should be fully composted when incorporated.

5.0 MULCH

5.1 Two inches of composted organic matter (e.g. composted leaves or wood chips, mushroom compost, composted cow manure, Milorganite, etc.) should be applied as the basal mulch layer.

5.2 Two inches of coarser* organic material (e.g. wood chips, pine bark, shredded bark, etc. should be applied over the composted mulch. * Finer material may be desired where reel lawn mowers are used.

5.3 Mulch depth should not exceed 4", and there should be a 4" minimum mulch-free area around the tree trunk.

5.4 Mulch diameter should extend at least to the edge of the excavated hole.

5.5 Mulch duration
Trees should remain mulched until they become established (4-6 years). Mulch may need to be replenished after 2-3 years or as needed. Mulched areas may be seeded, not sodded, after the tree has become established.

5.6 Weed control
Maintain a weed- and turf-free mulched area through careful mechanical cultivation or through the judicious use of post- and/or pre-emergence herbicides. Consult with local extension publications for recommended chemical applications.

6.0 TREE - SOIL COLLAR (unmulched trees)
After trees have become established and mulch is replaced with lawn, it is important to maintain a turf-free area around the base of each tree to prevent lawn mower injury. Lawn mower damage causes very serious injury to young trees. However, it is 100% preventable.

6.1 A weed- and turf-free area should extend a minimum of 4" around the trunk of each tree.

6.2 Control weeds and turf with careful mechanical cultivation and/or through the judicious use of post- and pre-emergence herbicides. Consult with local extension publications for recommended chemical applications. The use of gas or electric powered weed whips can be damaging to the trunk of young trees and must be used with the utmost of care.

7.0 STAKING
B & B and Tree Spade trees usually do not require staking. If trees lean after planting, staking may be necessary.

7.1 Stake Material
Treated wood or metal stakes of sufficient length to extend below the frost line are recommended.

7.2 The material that holds the tree to the stake must allow for some stem movement and must not damage the bark. The tree should not be held rigid.

7.3 The point of attachment to the tree should not exceed 2/3 of the height of the tree.

7.4 Two stakes within the mulch but outside of the root ball are recommended. The stakes should not interfere with normal mowing around the tree. Large diameter trees may require 3 stakes or anchors placed outside the backfill and mulch area.

8.0 TRUNK WRAPPING
Wrapping will help prevent sun-scald and deer injury.

8.1 Length of time
The trunks of newly planted trees should be wrapped for a minimum period of 3 years. Apply wrap in mid-November and remove in late April.

8.2 Material
The wrap materials must shade the bark and help reduce temperature fluctuations on the side of the trunk exposed to the sun. Burlap, Microfoam, heavy-duty aluminum foil, and plastic rodent resistant spiral wraps have proven to be acceptable materials.

9.0 GUARANTEE

9.1 Nursery Planted according to Specifications:
Trees are guaranteed for a minimum of 12 months from the date of planting. The guarantee includes the cost of replacement tree and the cost of labor for removal of the dead tree and cost of labor to install the replacement tree.

9.2 Self Planted According to Specifications:
Some guarantee is often provided from some retail nurseries. Wholesale nurseries rarely guarantee trees they do not plant.

10.0 WATERING
Trees should be watered after planting and installation of mulch. Excess moisture adversely affects newly planted trees more than lack of moisture. However, the root ball may dry out within days, even if the backfill soil is moist. This is especially true with the larger plants during hot weather. Mulch will help to conserve moisture. Water once every 1-3 weeks during dry periods or as soil and climatic conditions dictate.

11.0 PLANTING IN POORLY DRAINED SOIL
Very few species grow in saturated soils.

11.1 Installation of tile drainage
Drain tile may be installed to improve drainage. The drain tile should connect to a storm sewer or flow to a lower level. It should be 4" minimum diameter. Closed systems (e.g. gravel filled pits) are not recommended.

11.2 Mini-berm (see Figure 3)
Excavate a hole 1/4 the depth of the root ball and the width of the root ball base. Set the ball in the hole. The distance from the soil level to the top of the ball is X. Extend the berm base 3 times the X distance from the root ball. Construct the mini-berm with good black topsoil (see 4.2.1) from the berm base to the top of the root ball (3:1 slope). Mulch soil surface (see 5.0).

12.0 PRUNING

12.1 Remove all limbs broken during digging, transporting, or transplanting operations. Also remove crossing branches, rubbing branches, and "V" crotches. For more complete information on pruning see Arboriculture, by R. W. Harris.

12.2 Do not leave stubs. Cuts should be made at the branch collar.

12.3 Do not apply a protective pruning paint to cut surface*.
* The exception to this is when oaks or elms are pruned any time between 1 April and 30 November. Painting the wound with orange shellac is recommended.

13.0 FOLLOW-UP MAINTENANCE

13.1 Early April
Remove tree wrap and inspect materials attaching trees to any stakes. Check for settling, need to stake or add mulch, and look for girdling roots.

13.2 Mid-November
Install tree wrap and inspect materials attaching trees to any stakes. Check for settling, need to stake or add mulch, and look for girdling roots.

13.3 Early April through Mid-November
Weekly check each tree for need to water and/or control weeds.

MALUS OBSCURUS

by Ann E. Holtz

Malus angustifolia, the Southern, Narrow-leaf, or Evergreen Crab has the southernmost range of the native American Crabapple trees. It ranges in the wild from northern Florida, west to the Mississippi River Valley, north to southern Illinois, and east to Maryland along the southern curve of the Appalachian Mountains. (Its unusual range makes it obscure to us "Yankees"; young trees were only introduced here at the Morton Arboretum last fall.) Its unusual range also makes it suitable to be used as a parent plant in breeding ornamental crabs for the south.

It is a small tree, growing up to 30 feet, and is noted for its fragrant flowers (1). Peattie (7) writes:

> "These are the little Crab trees that George Washington planted in the shrubberies of 'Mount Vernon,' and in his diary he speaks of their fragrance. It is that perfume that, in April when the deep pink buds opening to paler bloom, may be perceived from farther than the tree itself can be seen, shining with feminine grace through the woods. In the South, it is semi-evergreen and forms thickets."

M. ioensis differs from M. coronaria and M. angustifolia in having and retaining pubescence on the lower surface of mature leaves and pubescent sepals (3). M. coronaria and M. angustifolia leaves lose their pubescence by maturity and have glabrous sepals (3). They can be differentiated by M. coronaria's light green color on the lower surfaces of the leaves (11) and by the leaf shapes (3). M. angustifolia is described as, "Leaves of fertile twigs, and usually the others, mostly crenate-serrate, rounded to obtuse to barely acute" (3), and Elias (4) adds that the leaf is "Two and one half to three times as long as broad." In contrast, M. coronaria is described as, "leaves of fertile twigs, and usually the others, all serrate to doubly serrate, often some with triangular lobes at widest part, mostly acute to acuminate" (3), and Elias (4) adds that the leaf is 'up to 2 times as long as broad."

The cultivar 'Prince Georges,' which is probably a M. ioensis 'Plena' x M. angustifolia hybrid (12), has double (approximately 53-61 petals, diameter 5 cm.), light rose-pink flowers and does not produce fruit (6). Both M. angustifolia and the cultivar flower very late in the season (12). Synonyms for the 'Prince Georges' crab included M. angustifolia cv. 'Plena,' M. cv. 'Prince George,' and M. cv. Prince Georges (6). Den Boer (2) disputed the original name, M. angustifolia 'Plena,' because,

> "There is little resemblance between the Southern and the 'Prince Georges' crab except in some of the leaves. The plant itself looks much like the Bechtel Crab [M. ioensis 'Plena'] but is more dense."

The similarity of the leaves, and the plant's sterility, seem to have led to the conclusion that the 'Prince Georges' crab is a hybrid between M. ioensis 'Plena' and M. angustifolia. According to Huckins' key (5), the flowers of the 'Prince Georges' and the Bechtel Crab differ in the number of petals, and the styles of the Bechtel Crab are as long as the stamens at anthesis, while the styles of the 'Prince Georges' crab are shorter that the stamens at anthesis. There is also a weeping form, M. angustifolia f. pendula (8).

The species has some very useful qualities. According to Britton (1), the hard wood can be used for levers and tool handles, and the fruit can be used for jellies and cider. Peattie (7) adds, "...with plenty of sugar," because the fruit is so sour.

Both the species and cultivar can be located in Andersen Horticultural Library's source List of Plants and Seeds (University of Minnesota Landscape Arboretum, Chanhassen, MN).

(1) Britton, N. L. 1908. North American Trees. pp. 430-432.

(2) Den Boer, A.F. 1959. Ornamental Crabapples. pp. 146-147.

(3) Duncan, W.H. and Duncan, M.B. 1988. Trees of the Southeastern United States. pp. 288-291.

(4) Elias, T.S. 1980. The Complete Trees of North America. pp. 598-605.

(5) Huckins, C.A. 1967. Flower and fruit keys to the ornamental crabapples cultivated in the United States (Malus-Rosaceae). Baileya 15: 129-164.

(6) Jefferson, R.M. 1970. History, Progeny, and Locations of Crabapples of Documented Authentic Origin. National Arboretum Contribution No. 2. 52 p.

(7) Peattie, D.C. 1950. A Natural History of Trees. 327 p.

(8) Rehder, A. 1920. New species, varieties, and combinations. J. Arnold Arboretum. 2:53.

(9) -----. 1940. Manual of Cultivated Trees and Shrubs. 398 p.

(10 -----. 1949. Bibliography of Cultivated Trees and Shrubs. 275 p.

(11)Sargent, C.S. 1926. Manual of the Trees of North America. pp. 385-386.

(12)Wyman, D. 1955. Crabapples for America. 2nd ed. 45 p.

EDITORIAL NOTES ON THE SOUTHERN CRABAPPLES:
THOMAS L. GREEN

Trees, Shrubs, and Woody Vines of the Southwest by Robert Vines (1960) is the only reference I could find that mentions a double flowering M. angustifolia, forma rosea-plena. I would really like to know if a Double Flowering Southern Crab is being grown in cultivation anywhere or if anyone knows of any herbarium specimens. I would likewise like to learn the whereabouts of the Drooping Southern Crab, M. angustifolia f. pendula, (dead or alive).

The debate as to whether 'Prince Georges' is a double flowering M. angustifolia or a hybrid with a double flowering M. ioensis needs to be further studied. We know that 'Prince Georges' is sterile, which is often the case with hybrids. On the other hand, double flowering crabs tend to bear less fruit, and some are sterile. The seed source for 'Prince Georges' was from open-pollinated trees at the Arnold Arboretum. Knowing the promiscuous nature of crabapples, I would opt for hybridization. It appears the M. angustifolia doubles are rare in nature, if they exist at all. Also, the range of 'Prince Georges' extends well north of the range of M. angustifolia. Therefore, I would conclude that it is highly likely that 'Prince Georges' is of hybrid origin rather than a Double Southern Crab.

Malus angustifolia (Ait.) Michaux, Fl. Bor.-Am. 1: 292 (1803).
Pyrus coronaria Linnaeus, Sp. Pl. 480 (1753), (1)
Pyrus-Malus sempervirens Weston, Bot. Univ. 1: 230 (1770), nom.
Pyrus angustifolia Aiton, Hort. Kew. 2: 176 (1789) - Sargent, Silva N. Am. 4: 75, t. 169 (1892).
Malus sempervirens Desfontaines, Hist. Arb. Arbuss. 2: 141 (1809).
Pyrus sempervirens Willdenow, Enum. Hort. Berol. Suppl. 35 (1813).
Pyrus coronaria var. angustifolia Wenzig in Linnaea 38: 41 (1874).

Malus microcarpa sempervirens Carriere, Et. Pomm. Microcarp. 136, fig. 18 (1883).
Malus coronaria sensu Rehder in Sargent, Trees & Shrubs, 2: 229 (1913), non (L.) Miller (1769).
Malus angustifolia f. pendula Rehder in Jour. Arnold Arb. 2: 53 (1920).

Malus angustifolia Michx. Southern Crabapple

Leaves elliptic to oblong-obovate, rounded or acute and apiculate at apex, gradually narrowed and cuneate at base, and crenately serrate, hoary-tomentose below and sparingly villous above when they unfold, soon glabrous, or occasionally pubescent on the midrib below, and at maturity subcoriaceous, dull green on the upper and light green on the lower surface, 1"-2" long, 1/2"-3/4" wide; turning brown in drying; petioles slender, at first villous, soon glabrous, 1/2"-3/4" in length; stipules linear, rose-colored, 1/3" long; leaves at the ends of vigorous shoots ovate, oblong-ovate or elliptic, usually lobed with numerous short acute lobes, or coarsely serrate, usually rounded at apex, broad-cuneate at base, at maturity glabrous, or slightly floccose-pubescent below, especially on the midrib and veins, 2"-3" long, 1 1/2"-2" wide, with stout often rose-colored glabrous or pubescent petioles. Flowers about 1" in diameter, very fragrant, on slender glabrous or rarely puberulous pedicels, 3/4"-1" long, in mostly 3-5-flowered clusters; calyx-tube short and broad, glabrous, the lobes about as long as the tube. Glabrous on the outer surface, thickly covered with hoary tomentum on the inner surface; petals oblong-obovate, gradually narrowed below into a long claw, rose-colored about 1/4" wide; stamens shorter than the petals, styles 5 united at base, villous below the middle. Fruit depressed-globose; pale yellow-green, 3/4"-1" in diameter.

A tree, rarely 30' high, with a short trunk 8"-10" in diameter, rigid, spreading or rarely slender and pendulous (f. pendula Rehd.) branches forming a broad open hand, and young branchlets clothed at first with pale caducous pubescence, soon glabrous, in their first winter brown slightly tinged with red, and in their second year light brown and marked by occasional orange-colored lenticels. Winter-buds 1/16" long, chestnut-brown, slightly pubescent. Bark 3/8"-1/4" thick, dark reddish-brown, and divided by deep longitudinal fissures into narrow ridges broken on the surface into small persistent plate-like scales. Wood heavy, hard, close-grained, light brown tinged with red, with thick yellow sapwood; occasionally employed for levers, the handles of tools, and other small objects. The fruit is used for preserves.

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