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Title: Starting the Dialog on Tree Quality in Pennsylvania

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Abstract:

Lack of available quality trees for purchase has been a major obstacle in the Tree Vitalize Program's goal of planting 8,000 neighborhood trees. This paper will discuss the problems associated with the available nursery stock and the reasons why current production methods produce poor quality trees. Problems associated with poorly pruned trees regularly encountered in the field include co-dominated stems and multiple leaders, included bark, topping, flush cuts, stubs and trunk wounds. Additional problems, not pruning related but associated with installation and field management, are J roots, stock planted too deep, and over staking. Better quality trees start in the formative years of production at the nursery. Young trees with a strong central leader should be the goal of street tree production. A number of states have addressed the topic of tree quality standards within their borders. This paper will discuss three examples of possible remedies and their potential applicability in Pennsylvania. In the wake of global warming, society is becoming more aware of the benefits associated with trees. Their cooling effects on the environment, ameliorating carbon emissions and cleaning the air are all extremely important. However, trees need to live long enough to reach that potential. Currently, the poor quality of available trees create hazards for society and shortens their life expectancy.

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INTRODUCTION

The involvement of Morris Arboretum in the Tree Vitalize Program has allowed me the opportunity to see the difficulty of purchasing quality nursery stock in the Philadelphia region. This paper will discuss the issues associated with the physical structural problems of trees and the possible remedies. Currently, the Pennsylvania Landscape and Nurseryman's Association (PLNA) sets standards for the nursery industry. Its governing body of principles is the American Standard for Nursery Stock, ANSI Z60.1-2004.

The ANSI standard used by the PLNA inadequately protects the public. The ANSI Z60.1-2004 warns on page one of its introduction,

“... this book is a communication tool, and does not provide buyers with any assurance of the health or quality of the nursery stock being specified or sold.”ⁱ

The ANSI Z60.1 nursery stock standard is not meant to be a measurement of plant quality. It provides buyers and sellers with a common terminology in order to facilitate transactions involving nursery stock. The standard defines terms and numerical relationships among tree parts without specifying what makes a tree a quality tree. Pennsylvania nurseries have yet to develop specifications to ensure quality trees get planted and purchased.

The understanding that the ANSI Z60.1 is calling itself a tool to “start” communication about quality, without requiring quality production, leads to thoughts by Alex Shigo, the father of modern arboriculture. Shigo commented that

“Tree care practices that were developed centuries ago have changed little over the years. Practices are deep-rooted in attitudes and grow as survival factors. Attitudes are closely attached to rationalization. When it's wrong it is rationalized as, it's always been done this way. After centuries of mistreatment it is time to stand up and aim for something better. Old arboriculture is tree care based on old recipes and myths; plant deep, cut flush, paint wounds, dig into cavities, over prune, over water, over fertilize, inject anything that stands still, top trees, add lots of fresh chips as mulch, plant the wrong tree in the wrong place and most important, don't read or learn anything new!”ⁱⁱ

PROJECT GOALS AND OBJECTIVES

Understanding that the reference material the PLNA is using to guide the nursery industry disclaims its ability to produce a quality and healthy product, the question I propose is, “who protects the consumer?” How does the individual homeowner know that the plants she purchases may not be the quality she expects and can require corrective pruning to create a viable and structurally sound tree? How does the purchaser know that poor quality trees are typical in the marketplace?

The closest reference to a quality tree in the ANSI Z60.1-2004 is a short paragraph related to specimens. It states...

“When ‘specimen’ or ‘quality grade’ trees are called for in the landscaped specifications, the desired characteristics shall be stated. Specifications should include deviations from standard

minimum for caliber, height, root ball diameter, and container or box size. As well as other factors such as symmetry, crown width, fullness of branching, single or single dominant leader, age, specialized pruning techniques, or uniqueness of the plant. The determination of compliance with the term ‘specimen’ shall be determined with reference to the descriptive characteristic provided in the specifier’s or buyer’s specifications”ⁱⁱⁱ

How would a consumer know she wants a “specimen” tree? If she knew a “specimen” tree was the most long-lived, how could she obtain such a “specimen” tree? More important, who changes the consumer’s purchasing habits and helps her realize that the specimen tree is a higher quality, longer-lived tree? It is nearly impossible to purchase such a structurally sound tree. The consumer accepts the structurally unsound tree that is readily available on the market. Planting this type of tree is not in her long-term interest. The first few years are the formative years in a tree’s life. The primary objectives in training young trees are to develop strong branch unions, to eliminate structurally weak branch unions, and to develop a strong central leader.^{iv} Proper pruning early in the life of a tree is essential for a long, healthy life.^v Pruning trees, particularly when younger, helps promote healthy trees with good branch architecture. Training trees for structural integrity requires attention to development of strong branch unions with branch collars, branch spacing and proper branch union (crotch) angles.^{vi}

Comparing the pruning techniques recommended by the International Society of Arboriculture (ISA) to the ANSI A300 Part 1 standard^{vii} used in the the Pennsylvania nursery trade, the Pennsylvania trees receive severely substandard pruning.^{viii} Pruning can either help or hurt trees. When appropriate practices are used, pruning can provide significant benefits. When inappropriate pruning practices are used, significant harm follows. For the long-term health and structural stability of trees, it is critical that early pruning practices conform to optimal professional standards, *e.g.* the ISA standards.

PROBLEMS WITH CURRENT PRODUCTION METHODS

Problems associated with poorly pruned trees regularly encountered in the field include co-dominant stems and multiple leaders, included bark, topping, flush cuts, stubs and trunk wounds. Additional problems, not pruning related but associated with installation and field management, are J roots, stock planted too deeply, and over staking on young trees. If trees were pruned more carefully in nurseries, many of the problems could be avoided or eliminated. Better training of field hands will promote the understanding that each tree is a unique individual with a specific form that requires a well-thought-out pruning regime.

Heading is “cutting a currently growing or one-year-old shoot back to a bud, or cutting an older branch back to a stub or lateral branch not sufficiently large to assume the terminal role.”^{ix} It is also referred to as “topping” or “lopping”. Removing the terminal bud of a 1 year–old seedling whip (single stem) that is just beginning to grow delays the initiation of root growth until another bud begins to grow.^x Many trees are topped in the nursery when they become 4 to 5 feet tall. This forces laterals below the cut. These branches form a compact head giving the tree good proportions when small but leaves the tree with no leader. In many cases, these branches are too low and too close together.

Many nursery operators trim trees like hedges to form dense canopies. This makes the trees look better temporarily, keeping them from growing into each other, and makes them easier

to harvest, ship and handle. However it often leads to the development of many crossing and parallel branches.^{xi} Wounds made by topping cuts weaken tissues from the trunk to the roots. Pathogens causing rot and root diseases infect the weakened wood. When treetops are removed, roots begin to starve; many opportunistic pathogens will infect starving roots. Shigo calls a tree's primary pathogen "the person who removes the treetop."^{xii} Topping stimulates excessive sprouting. Excessive sprouting is a sign of low energy reserves. Topping and flush cuts are a major cause of death in trees.^{xiii}

Co-dominant stems (multi-leader) stems are two stems or trunks of equal size developing from two apical buds at the tip of the same stem. Each co-dominant stem is a direct extension of the stem below its origin.^{xiv} There are no branch collars at the bases of co-dominant stems. Pathogens are able to spread downward in a co-dominant stem because they lack the built-in protection zone formed by the branch collar. Removal of one of the stems will correct this when the tree is young, *i.e.* when the co-dominant stem is less than two-thirds the dominant main stem. For co-dominant stems greater than about 4 inches in diameter, pruning out one stem can cause more problems than it solves.^{xv} In the natural forest, co-dominant stems do not accrue until the tree has developed its mature crown.^{xvi} Observations of Pennsylvania nursery stock have shown consistent heading of trees, evident in my visits to nine nurseries this past year. The practice of heading and shearing causes trees to fork early and form co-dominant stems. Heading makes mechanical harvesting and shipping easier. It also ensures a visually uniform product, highly desirable to the consumer. The problems associated with co-dominant trees has made it difficult for Morris staff to purchase sufficient numbers of quality trees for Tree Vitalize. Morris staff frequently walks acres and acres of nursery fields, only to find row upon row of poor quality trees--trees below the standard we aim to include in Tree Vitalize.

Included bark between co-dominant stems develops a very weak branch union. The cambium of the trunk and branch turn inward within the branch collar, adding to the development of included bark. Branches growing close together when young will grow into each other with age, not being able to develop their full structural potential and strength.^{xvii} Trees should have well spaced-structural branches, oriented uniformly around the trunk. One of the most common locations for the above-ground portion of a tree to fail is at the junction of two or more co-dominant stems.^{xviii} The nursery practice of shearing allows the opportunity for narrow crotches on such trees. These trees often develop included bark, leading to stem failure. If the stem fails and a large branch of a street tree falls, the tree becomes a public hazard. Tree Vitalize's goal of planting street trees in urban and suburban areas requires that trees have strong branch attachment.

Flush cuts (removal of the branch collar) and stubs are evidence of poor pruning practice. ANSI notes, "The flush cut is the beginning of many problems for trees."^{xix} Proper pruning cuts are made at nodes, never internodally as this produces stubs.^{xx} Stubs can lead to decay and cavities over time. Flush cuts on young trees can weaken the trunk wood and predispose the trunk to cold and heat injury. Flush cuts remove the collars at the base of the branch injuring the trunk both above and below the cut by removing the protection zone.^{xxi} Purchasing trees with flush cuts passes on the inferior and damaging work of poor pruning in the nurseries to the ultimate consumer. Better training of nursery staff in plant biology (branch collar location) could lead to fewer flush cuts and a better quality tree.

Stem girdling roots (SGR), also called kinked roots or J-roots, are another problem encountered in the nursery industry. SGR is a primary root(s) that is sharply bent, causing a restriction to water, nutrient, and photosynthate movement. Kinked roots may compromise the

structural stability of root systems.^{xxii} SGRs form at the time of planting; prevention begins with proper planting. Time spent inspecting for and correcting developing SGR problems at planting is time well invested. This is considerably less costly than the time required for a root collar examination after the tree has been in the landscape for several years. For bare-rooted nursery stock (whips), close examination of the root system allows removal of encircling roots and 'J' roots that could eventually compress stem tissues. If the root collar flare is buried more than 1 to 2 inches, the excess growing medium should be removed to expose the flare areas prior to planting. If the root collar flare and stem are above the soil surface, developing SGRs will be easily detectable and treatable long before they cause physiological stress to the tree. Therefore, prevention of SGRs must include planting trees so that the root collar flare is at or only slightly below the soil or mulch surface.^{xxiii} Better attention at planting whips, focusing on the roots' position and collar depth, would prevent many future SGR problems.

Over staking of young nursery stock is another common nursery practice that harms tree quality. A tree whip will have lost up to four fifths of its root system at transplant. What remains is insufficient to anchor the tree securely once it is replanted. Only a short stake is needed to provide temporary anchorage, holding the tree upright, until new roots develop into the surrounding soil. Stakes should reach no more than one third of the height of the trunk. Many trees encountered in Pennsylvania have stakes taller than the trees and are tightly secured. Currently, many nurseries place a bamboo stake physically against the trunk of a young tree. Often this stake is tied tightly, creating the opportunity to develop an open wound from abrasions.

Proper staking allows tree movement. This movement is transmitted through a freely moving tree which stimulates diameter growth in the trunk and major roots. Holding a tree still with a stake and ties can reduce good trunk flair and reduce caliper. The nursery industry sells trees based on trunk caliper. Aggressive staking of young trees reduces the caliber, thereby extending the time in production.

STANDARDS AND OTHER STATES

A number of states have addressed the topic of tree standards within their borders. Florida has the most comprehensive standards. In 1965, the first edition was passed by the legislature, a second edition passed in 1998; it includes a 10 step grading process for trees. The Florida standard for trees is divided into 4 groups.

Florida Standard

1. Florida Fancy, determined by single trunk, with branch diameter smaller than 2/3 in relation to trunk, no flush cuts/open injuries, crown full of foliage, root ball is appropriately sized.
2. Florida #1, requires some pruning to develop good structure, has minor trunk injuries, double leader in top half of tree.
3. Florida #2, trees are misshapen or require major corrective pruning, defects may take several years to correct, double leader on bottom half of the tree.
4. Cull, defects are not correctable, lack vigor, may have poor trunk and branch structure, circling roots, open wounds, flush cuts, or a loose root ball.

The Florida Standard has a complete tree matrix inventory and scoring system for each species. To achieve a Fancy grade a tree must meet all the requirements; if it fails it is downgraded to the appropriate grade. The steps in grading are:

- Step 1- Grade trunk
- Step 2- Branch arrangement
- Step 3- Appropriate tree matrix
- Step 4- Trunk caliper
- Step 5- Crown spread
- Step 6- Structural uniformity of crown
- Step 7- Determine the lowest grade given in steps 1, 2, 5 and 6
- Step 8- Downgrading factors
- Step 9- Downgrading factors
- Step 10-Roots

Personal interviews with a number of professional nurserymen in Florida have demonstrated that after some training and modifying some production techniques they are happy with the standards and are benefitting from the increased price of their product.^{xxiv} They were initially apprehensive about being regulated and concerned about the increase in labor to train and their ability to retain quality employees. Their fears did not materialize, and they now support the standards. With this system, a nurseryman can choose the level of quality desired and sell trees to such markets. In Pennsylvania and New Jersey, Tree-Vitalize has encountered many trees that would be graded as Florida #2 or cull. This has limited the selection and the quality standards that we have aimed to achieve.

In *California, The Urban Tree Foundation* (UTF) is a 501(c)(3) non-profit organization, providing services and programs to benefit the urban forest throughout the state. It is comprised of a committee of municipal arborists, urban foresters, nurserymen, University of California Cooperative Extension horticultural advisors, landscape architects, non-profit tree groups, and horticultural consultants, who developed specifications to ensure high quality landscape trees. Their intention is to help landscape professionals develop their own comprehensive and detailed specifications, to ensure that they can obtain high quality container-grown nursery trees, and to help nursery professionals in their efforts to improve the quality of trees grown in California.^{xxv}

The UTF Guideline contains specifications for tree health and quality; species/cultivar, trees shall be healthy and vigorous, as indicated by an inspection for the following: Trees shall be relatively free of pests (insects, pathogens, nematodes or other injurious organisms). An inspection of the crown, trunk, and roots shall find the following characteristics:

- a. Crown Form:** The form or shape of the crown is typical for a young specimen of the species/cultivar. Wind, pruning practices, pests or other factors do not significantly deform the crown.
- b. Leaves:** The size, color and appearance of leaves are typical for the time of year and stage of growth of the species/cultivar. Leaves are not stunted, misshapen, tattered, discolored (chlorotic or necrotic) or otherwise atypical.

c. Branches: Shoot growth (length and diameter) throughout the crown is typical for the age/size of the species/cultivar. Trees do not have dead, diseased, broken, distorted or other serious branch injuries.

d. Trunk: The tree trunk should be fairly straight, vertical and free of wounds (except properly-made pruning cuts), sunburned areas, conks (fungal fruiting bodies), wood cracks, bleeding areas, signs of boring insects, galls, cankers/lesions and girdling ties.

e. Tree height and trunk diameter are typical for the age, species/cultivar and container size.

f. Roots: The root system is free of injury from biotic (insects, pathogens, etc.) and abiotic agents (herbicide toxicity, salt injury, excess irrigation). Root distribution is uniform throughout the soil mix or growth media and root growth is typical for the species/cultivar.^{xxvi}

The *Suburban Tree Consortium* was created in 1985 by a group of municipalities interested in improving the quality and selection of parkway trees in the Chicago area. The goal of the Consortium is for a group of municipalities to enter into a contract growing arrangement whereby nurseries grow trees according to predetermined specifications. The communities lobbied, with the help of the West Central Municipal Conference, to change the state statute to extend the length of time municipalities could enter into contractual relationships with area nurseries. Today, Illinois State Law allows municipalities to enter into long-term contractual relationships for the purpose of procuring parkway trees. The benefit of municipalities working together is two-fold. First, buying power and economies of scale are increased by merging orders, and mortalities are decreased because there are more stringent specifications and better relationships with area nurseries. Second, municipalities communicate more, increasing the awareness and promoting the concepts of urban forestry in general.^{xxvii}

Consortium growers stated in telephone interviews that they have greatly benefited from the long-term contacts with municipalities.¹ The assurance that a crop is pre-sold at the time of planting is not only comforting to nurseries, but nurseries have been able to use this assurance to obtain a bank line of credit. Both the grower and the municipalities have benefited from this arrangement.

IMPLEMENTING CHANGE

The three examples of how other states and groups are dealing with the problem of tree quality demonstrate that the problem is recognized and can be corrected. In Florida it took the perseverance of Dr. Edward Gilman of the University of Florida, an outspoken individual with a wealth of scientific knowledge and political will power, to follow this issue for close to nine years to implement the revised Florida Standards. This is the high standard Pennsylvania should aspire to, but it would be a long and arduous route to pass such legislation. It would then take years before quality trees could be brought to market and purchased by the public or Tree-Vitalize.

¹ Mr Russel Skinner, interviewed by author, written notes, Jacksonville FL., 11 December 2006.

Creating a 501(c)(3) non-profit organization similar to The Urban Tree Foundation is an option in Pennsylvania. The PLNA, if interested, could help with outreach to nurseries and include structural pruning techniques in their educational programming. By reaching out to buyers and growers through education, better quality trees could make it to the market.

The third option, the power of group purchase, is achievable locally by pooling together like-minded groups. The Philadelphia region has a plethora of institutions to form a collective buying group. Groups such as the Pennsylvania Horticultural Society, Tree Tenders, arboretums, (with Morris in the lead as the official arboretum of the Commonwealth of Pennsylvania), colleges and universities, Fairmount Park, local municipalities and arborists could be foundation members. By contract growing trees to specific specifications, such a group could be planting high quality, longer living trees within five years. This could be a much faster result than involving state legislation or the PLNA.

CONCLUSION

Society is becoming more aware of the benefits associated with trees in the wake of global warming. Trees' cooling effects on the environment, their ability to ameliorate carbon emissions, and clean the air are all very important roles. However, trees need to live long enough to reach that potential. Currently the poor quality of available trees shortens their life expectancy. By changing the way trees are managed in their first five years, the longevity for those trees will increase dramatically. The urban environment is a harsh place for a tree. Trees have many obstacles to overcome from drought, soil compaction and air pollution, to name just a few stress factors. Giving them the best start in life is the least we can do for a living being that potentially can outlive us all. Contract growing trees in southeast Pennsylvania to specifications, determined by a unified tree growing consortium, would ensure production of structurally correct trees. Trees without multiple leaders, included bark, flush cuts, and co-dominant stems will reduce future costs to municipalities for street tree maintenance. Planting structurally sound trees will increase longevity, reduce safety hazards and allow trees the opportunity to reach their full potential.

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