Agri Articles
(e-Magazine for Agricultural Articles)
Volume: 03, Issue: 04 (JULY-AUGUST, 2023)
Available online at http://www.agriarticles.com
©Agri Articles, ISSN: 2582-9882

Precision Planting Techniques for Urban Trees

(*Navaneetha Krishnan S[1], Balasubramanian A[2], Vasanth V[3], Arasakumar E[3], Nilav Ranjan Bora[3] and Ashwin Niranjan M[3])
[1]Department of Silviculture and NRM, Forest College and Research Institute, Tamil Nadu Agricultural University, Mettupalayam - 641301, Tamil Nadu, India
[2]Dean Forestry, Forest College and Research Institute, Tamil Nadu Agricultural University, Mettupalayam - 641301, Tamil Nadu, India
[3] Department of Sericulture, Forest College and Research Institute, Tamil Nadu Agricultural University, Mettupalayam - 641301, Tamil Nadu, India
*Corresponding Author's email: nivasforestry@gmail.com

Urban forestry is a multidisciplinary field that focuses on the management, conservation, and enhancement of trees, forests, and green spaces within urban environments. It combines principles from forestry, ecology, urban planning, and community development to create and maintain healthy and sustainable urban ecosystems.

The primary goal of urban forestry is to recognize the vital role that trees and green spaces play in urban areas. These benefits include improving air quality, mitigating the urban heat island effect, providing habitat for wildlife, reducing noise pollution, enhancing aesthetics, and promoting overall human well-being. Urban forestry also contributes to climate resilience by absorbing carbon dioxide and reducing storm water runoff.

Urban Planting Techniques

Selection of site: Site selection is the first, important step to make when planting trees in an urban environment. Quality sites have a higher probability of supporting long-lived and healthy trees, whereas poorly chosen sites produce poorer-quality trees. Urban environments are challenging for tree survival. They often contain soil contaminants, air pollution, high velocity wind, compacted and poorly aerated soil, higher temperatures, altered soil drainage, and small planting areas. Considering these challenges, choosing the best site for planting is critical for optimal growth and survival, followed by careful preparation of the site, tree selection, and planting.

Site Characteristics: Knowing the characteristics of a planting site will help you determine whether the site will support healthy tree growth and development. The Site Factors Checklist below may be useful when evaluating site conditions. Some of the important site conditions to consider include soil characteristics, environmental conditions, site location, soil volume and social influences.

Site Location: The site location offers clues on potential stresses that may impact tree health and maintenance. For example, a tree located within a downtown sidewalk will probably require more maintenance than one located in a park. Sites with pedestrian and vehicular traffic require special attention. Streets, Sidewalks, and Other Paved Areas- If the site is located near a street, sidewalk, bike path, or other paved area, several site factors must be considered.

- ***Pedestrian and vehicular areas*** — For any site near where pedestrians or vehicles travel, tree species selection is critical. Species with thorns or prickly foliage or soft, messy fruit

should be avoided. Trees with drooping branches will require frequent pruning. For public safety, it is always important that traffic lights, signs, and intersections not be obstructed by trees. Select a species tolerant to high salt levels in the soil if the site is located near a road where de-icing salts are used.

- ***Conflicts with roots and pavement*** — Tree roots may grow under asphalt or cement pavement, which can cause the pavement to crack and buckle. Some communities have tried using root barriers and root training to avoid root-pavement conflict. There are different types of root barriers, from cylinders to herbicide strips, that are placed in the planting site. They are designed to physically deflect the roots away from the pavement. In some cases, they do prevent root growth near sidewalks, but they may also limit tree growth. Root training is an option that uses chemical and physical barriers, deep fertilization, and irrigation or aeration structures to improve the soil conditions in the deeper soil horizons. If the barriers are successful, the roots will grow deeper, avoiding surface problems such as cracked sidewalks.

Structures Trees need to be far enough away from buildings to allow for proper crown and root development (Gilman 1997). Trees that grow large, such as oaks, should be planted at least 15 feet from a building. Small and medium-sized trees may be planted closer to the building, but regular pruning may be required.

Utility Lines Utility lines for water, sewer, phone, electric, or cable may cause problems for trees. When selecting a site, check for underground or aboveground lines that might interfere with the future growth of the tree.

- ***Aboveground utility lines*** — If the site has aboveground utility lines, select a small-growing species that will top out at least 5 feet below the wire, or select a species with a narrow crown and place it so it will not grow into the utility line.
- ***Belowground utility lines*** — The planting site should be located at least 12 feet from a major underground utility line for large trees. A common misconception about tree roots is that they actively grow into sewer and water lines. Roots will follow a path of least resistance and only grow into sewer and water lines that are broken.

Site Activities The type of activities — past, current, and future — on the site can help in evaluating the planting site. Has construction occurred on the site that may have changed soil conditions? How many people or vehicles use the area around the site? Are there safety concerns, such as personal welfare or property damage? Will the trees need to be protected from compaction, vandalism, or potential injuries? This type of information can usually be determined by visiting the site and talking with people who are familiar with it. The property owner or local planning departments are good resources for finding out about future plans for the site.

Urban Planting Sites: Several types of planting sites are unique to urban areas, including street lawn, tree pit, roadway, planter, and cluster planting. These sites may require special considerations when selecting a species and choosing a proper planting technique.

Street lawn The street lawn, also known as the tree lawn, is the space between the curb and the sidewalk. Depending upon on the mature size of the planted tree, the street lawn should be at least 3 feet wide. If there is a choice, a street lawn is preferred to a tree pit because the street lawn has a continuous strip of soil. Do some checking before planting in a street lawn because of the potential conflicts with pavement, utilities, and local highway department guidelines.

Basal Amendments

Preplant Application: Preplant incorporation of phosphorous and potassium into soils should be based on soil test results. It is advisable to incorporate these nutrients so that they will be in the root zone when woody ornamentals are planted. This is especially important for those mineral elements that are not very mobile in soils. Phosphorus, for example, moves

very slowly, as little as one inch per year from the site of application. Superphosphate (0-20-0), triple superphosphate (0-40-0), ammonium, and potassium phosphates are commonly used forms of phosphorus fertilizer. Rock phosphate is a natural source of phosphorus, but rates of application should be adjusted to accommodate the very slow rate of release of the nutrient. Particular attention must be paid to phosphorus levels in soils planted to needled evergreens since their growth response to nitrogen is greatest when phosphorus levels are high.

Preplant incorporation of potassium can provide sufficient reserves to support plant growth for five years in soils that are high in organic matter or clay content. When dissolved in soil water, potassium is a positively charged chemical (cation) and binds to particles of clay and organic matter. With high levels of clay and organic matter, potassium can be added in a single application. More frequent applications of this nutrient are necessary in sandy soils because they have less ability to bind potassium. Common fertilizer forms of potassium include potassium chloride (muriate of potash), potassium sulfate, potassium nitrate, and natural materials such as kelp meal, greensand and alfalfa meal.

Rates of application of phosphorus, potassium, and nutrients other than nitrogen should always be based upon soil test results. Any nitrogen applied as a preplant nutrient should be in a slow-release form or natural organic form.

Postplant Application: Rates of fertilizer application are typically based upon the amount of nitrogen in the fertilizer since nitrogen is the mineral element most responsible for vegetative growth. For annual maintenance, it is recommended that a tree receive 1 to 3 pounds of actual N per 1000 sq. ft. of surface area. The actual amount of a fertilizer to apply for maintenance of woody plants may be determined by the area method.

Reduce the amount of fertilizer applied at any one time to trees on shallow, sandy, or poor sites, so as not to burn the plant's roots. Using fertilizers with slow-release forms of nitrogen will also help reduce the possibilities of root injury in such situations. Rates of nitrogen application should be adjusted on sites where there is a high potential for ground water contamination from nitrate leaching. On such sites, nitrogen application rates of 1 lb N/1000 sq. ft. or less would be advisable. Several applications at these reduced rates may be made during the growing season if needed for improving plant health. Again, use of slow-release forms of nitrogen can reduce the potential for leaching.

Rates of nitrogen application should also be adjusted according to levels of soil organic matter. Applying high rates of nitrogen to soils low in organic matter will accelerate depletion of the organic matter and in the long run reduce the fertility and structural integrity of the soil. Analysis of organic matter levels may be requested when submitting soil samples for testing. Soil organic matter levels of 4% or greater are desirable. In coastal areas where organic matter content of sandy soils is often in the range of 1-2%, use fertilizers with at least 50% of the nitrogen in water-insoluble (WIN) or slow-release form. In general, at a pH between 6 and 7, it can be assumed that 1/4-1/2 pound of nitrogen per 1000 square feet is being made available per year for each one percent of organic matter in the soil. Therefore, a soil with 4% organic matter can contribute from 1-2 pounds of nitrogen per 1000 square feet per year. That is typically enough nitrogen to support healthy growth of woody plants.

Methods of Application

There are several methods of applying fertilizers to trees and shrubs. The method selected depends upon soil characteristics, site factors, cost, and type of nutrients to be applied.

- *Liquid soil injection*: This is the method most often used by professional arborists because it is quick, easy, and also leads to rapid uptake of nutrients. It utilizes high pressure injection of liquid fertilizer into the soil. Injection points should be 2-3 feet apart depending upon pressure and about 8-12 inches deep. Slow-release forms of liquid injection fertilizers are also available.

- *Drill hole*: This technique requires drilling holes into the soil and distributing granular fertilizer evenly among the holes. Holes are drilled to depths of 8-12 inches and are spaced 2-3 feet apart in concentric circles around the tree, beginning at a point about 1/3 the distance from the trunk to the drip line and extending 1-3 feet beyond the drip line. While rarely used today on a commercial scale, this method is effective in opening heavy compacted soils, allowing fertilizer, water and air to reach the root zone. The holes may be left open or filled with compost, peat or other organic material. The drill hole method should be used where high fertilizer rates or fertilizers with a high salt index create a potential for injury to fine turf.
- *Surface application*: Granular forms of fertilizer may be spread by hand or mechanical spreader over the surface of soil around trees and shrubs. This method is quick, easy and inexpensive, and recent studies have shown this method to be as effective in supplying nutrients to plant roots as other techniques. It is particularly appropriate for applying fertilizers to mulched areas and shrub borders. A tree growing in a lawn area will utilize nutrients from surface applications of fertilizer made to the lawn and may not need additional fertilizer.
- *Fertilizer spikes/stakes*: With this method, solid rods of a pre-measured amount of fertilizer are placed in holes in the soil around woody plants. Wide spacing of holes and slow lateral distribution of nutrients limit the effectiveness of this technique. It is not recommended.
- *Foliar fertilization*: This technique entails spraying liquid fertilizers onto the foliage of plants. It is used primarily as a "quick fix" for minor nutrient element deficiencies. Foliar feeding is not effective in supplying essential nutrients in quantities necessary for satisfactory growth. The most effective time to spray foliage with micronutrient solutions is just before or during the growth period.
- *Tree trunk injections*: Injections of nutrients directly into a tree is used almost exclusively to correct minor element deficiencies, e.g. iron, manganese and zinc. This technique may also be used in urban settings where root or surface applications of fertilizers are not practical.

Frequency of application: Frequency of application depends on the general vigor and growth of the plant, with the exception of newly planted trees and shrubs. Woody plants growing in rich soils with continual replenishment of nutrients from decomposition of organic matter may not need regular fertilizing. However, plants that are in a nursery production cycle, as well as landscape plants that show either abnormal leaf size or color, little or no annual growth, or significant amounts of dead wood within the plant, should be fertilized annually.

Time of application: Fertilizers are best applied in late August through September. Root absorption of nutrients is very efficient in late summer and remains so until soil temperatures approach freezing. Nitrogen that is absorbed in fall will be stored and converted to forms used to support the spring flush of growth. The next best time to fertilize woody plants is early spring prior to initiation of new growth.

Trees and shrubs should not be fertilized during times of drought stress or when they are showing signs of water stress unless irrigation is available. Plants do not absorb nutrients without adequate water. Some fertilizers may also damage roots if water is lacking.

Pitting and Planting Techniques

Tree or planting pit Tree or planting pits are small areas of soil within a sidewalk, parking lot, or other paved area. They are common in urban areas because often this is the only space available for planting trees. They also offer the advantage of softening the hardscape in urban areas. Trees planted in tree pits usually require special attention because of the unique growing conditions at the site.

Roadway Tree plantings in the median and on the sides of the roads provide many benefits, such as intercepting dust and particulate matter; reducing glare, noise, wind, and erosion; visually separating opposite lanes of traffic; and reducing mowing costs. However, trees near roadways can be damaged by vehicles, lawnmowers, string trimmers, herbicides, and de-icing salts. Drainage problems are common, because the sites usually have disturbed soil that has been placed on top of compacted soil. It is also common to find construction rubble from road projects in the soil. Each state's department of transportation usually has specific guidelines for plantings near roadways, such as species selection, planting distance from pavement, and distance between trees. It is important to work with them, especially during the planning phase.

Planters/ Containers Planters or containers are an option for sites where it is impossible to plant because of poor soil, lack of soil, underground utilities, or other factors. Planters can also be used for architectural design purposes. Tree planters come in various shapes and sizes and are made of plastic, wood, cement, or other composite materials. They should have thick walls, be a light color, and measure at least 18 inches deep with an adequate drainage hole.

Cluster planting Cluster plantings, clumping, open-space planting, and urban tree islands are different names for planting groups of trees in a large space. Cluster plantings provide many benefits, such as reduced maintenance costs, shelter from weather extremes, and increased life spans for the trees. However, since the trees are located close together, insects and disease can move quickly from tree to tree. Overcrowding may also become a problem. Proper species selection and spacing are critical to avoid these problems.

Urban Tree Management

Pruning Techniques

The first priorities when pruning established trees are to reduce conditions in the tree that contribute to weakness, ensure strong tree structure by guiding future growth, and create clearance. Treating defect by reducing or thinning stems that compete with the leader, large forked limbs and those with inclusions, or aggressive (fast-growing) or long branches reduces risk by slowing their growth rate or redistributing mass. *Once this structural and clearance pruning is completed*, one or more of the other pruning methods can be applied if needed to complete the job, provided the targeted pruning dose has not been exceeded.

Trees that grow to be large are more structurally sound and cost-effective to maintain when trained with a central dominant leader that extends 30 feet or more into the crown. Trees with branches smaller than half the trunk diameter, and with branches spaced along the central leader, or trunk are stronger than trees with branches clustered together. Vigorous, upright branches and stems that compete with the central leader can become weakly attached. Structural pruning in the landscape aims to develop and maintain the strong central leader structure found in the forest.

Structural pruning selectively favors a single, dominant leader by suppressing competing leaders using reduction cuts. Reduction cuts shorten stems back to lateral branches that are at least one-third the diameter of the cut stems. Structural pruning on shade trees that occurs regularly when the tree is less than about 20 inches trunk diameter establishes strong form early. It is normally performed every few years to gradually encourage more growth in the selected leader. Structural pruning performed on most tree species that become large at maturity promotes longevity, decreases future maintenance costs, and reduces conditions in the tree that could place people or property at risk. All branches and stems should be shorter than the central leader after pruning is completed.

Shortening or removing branches that are larger than half the trunk diameter at planting, and every few years, is an effective way to maintain a leader. These stems and branches are shortened by cutting back to a live lateral branch. This lateral branch should be pointed away from the trunk and it should not be growing upright. The central leader should

be more visible in the crown center after pruning. Only large-diameter branches need to be pruned because they compete with the leader and could be weakly attached. Small branches do not need pruning because they will not compete with the leader.

Crown Architecture Management

Lower branches often have to be removed to clear them from traffic, to prune them away from a building or walk, make signs visible that were installed too far off the ground, or open up a desirable view. Shortening or thinning limbs in large trees is preferred over removal because of the negative health impacts of large limb removal. Crown raising does minimal damage to a tree as long as **1)** removed limbs are not too large (preferred cut diameter is less than two to four inches), **2)** only a few branches are removed at one time, and **3)** many branches are not removed from the same spot. *The best way to accomplish this is by structurally pruning over time to keep low branches small*

Removing too many low branches shifts future growth to the top of the tree. Wind is stronger there, and with no low branches, crown movement at the top of the tree can not be counter-acted, or damped, by the removed lower branches. Too much raising also causes dysfunctional wood leading to cracks and possibly decay inside the trunk. Removing too many lower branches can result in sunburn on the lower trunk and causes sprouting on the trunk and remaining limbs.

The live crown ratio should be at least sixty percent, meaning that there should be live branches along the upper sixty percent of the trunk to distribute wind stress and develop trunk taper for stability and strength. Some major branches should be left on the lower one-half of the trunk. Similarly, half the foliage on scaffold limbs should originate from secondary branches on the lower two-thirds of these limbs where practical. Lions-tailing is not synonymous with crown raising and is considered inappropriate pruning. Removing up to about fifty percent of the foliage and associated branches from the lower crown on conifers has little impact on subsequent growth and movement in wind. In contrast, thinning the top half of the crown would have a greater effect.