Tree/Shrub Establishment and Maintenance Guidelines

This technical note provides guidance for establishing trees and shrubs as part of the following Natural Resources Conservation Service (NRCS) Field Office Technical Guide (FOTG) Conservation Practices:

Windbreak/Shelterbelt Establishment (practice code 380)
Tree/Shrub Establishment (practice code 612)
Riparian Forest Buffer (practice code 391)
Upland Wildlife Habitat Management (practice code 645)
Hedgerow Planting (practice code 422)
Alley Cropping (practice code 311)
Recreation Area Improvement (practice code 562)

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CONSERVATION TREE AND SHRUB PLANTING SUITABILITY GROUPS

Refer to the Windbreak Suitability Groups in Section II of the Field Office Technical Guide (FOTG) to determine adaptation and performance of trees and shrubs for the soils of each windbreak suitability group.

PLANT STOCK REQUIREMENTS

Planting stock must be grown from locally adapted seed or cuttings of known origin and meet height and caliper standards listed below. For species that are not native, the seedlings should be produced from seed collected from localities having climate, latitude, and altitude similar to that of Kansas or from seed sources that have been selected and tested in tree improvement programs. Planting stock from out-of-state sources must be certified disease and insect free.

Bare Root Deciduous Seedlings shall not be less than 3/16-inch caliper at 1 inch above the root collar. Bare root deciduous seedlings shall have a shoot (top growth) of at least 12 inches. Rooted planting stock must not exceed a 2:1 shoot-to-root ratio (see Figure 1)**.**

Bare Root Coniferous Stock shall have a minimum stem diameter of 5/32 inch at 1 inch above the root collar. Rooted planting stock should have a well-developed fibrous root system and should not exceed a 2:1 shoot-to-root ratio (see Figure 1).

Vegetative Deciduous Cuttings shall be no less than 1inch diameter at the base (recommend 2 to 3 inch diameter for better survival), have the apical bud and all lateral side branches removed, and produced in lengths long enough to reach a soil depth that remains saturated throughout the growing season, or the site must be irrigated.

Vegetative material should be collected while dormant. Dormancy means no bud swell, no green showing on buds, and no separation of bud scales. Actively growing materials can be used, but survival will usually be lower. Avoid cutting current years growth. The best material is 4 to 5 years old. A horizontal cut at the top and a 45-degree cut at the bottom will aid in planting. The ends of the cuttings may be treated with latex paint. Vegetative material works best if planted within 2 to 3 weeks of harvest. Material may be stored if dormant for a short period of if kept at a temperature of 34 to 38 degrees F. Do not allow stock to dry out for even short periods of time, as survival will be greatly reduced.

Container-grown Stock shall have a seedling height of at least 6 inches. Container-grown stock must be produced in containers that minimize girdling roots or J-roots.

Seeds should be collected as close to the planting site as possible, or purchased from nurseries or other sources that are known to be using locally adapted seed. Seed from walnut and oaks should be collected within a 200-mile radius of the planting site.

Not all seed is viable or sound. The percent of sound seed in a batch can be determined by simply cutting or cracking open a sample of the nuts. Viable nuts have white, sound-looking nut meat; nonviable seeds have darkened or shriveled kernels that may be watery or give off a foul or rancid odor. Floating seed has also been used to determine viability of some species; however, it is not as reliable as a cut test.

There is a large variation in seed quality between species. Some species of trees and shrubs have a high percentage of viable seeds that will easily germinate the first season after planting. Other species have seed that is very difficult to germinate. Even with proper scarification and/or stratification, some species will only show 2 to 3 percent germination 2 years after planting.

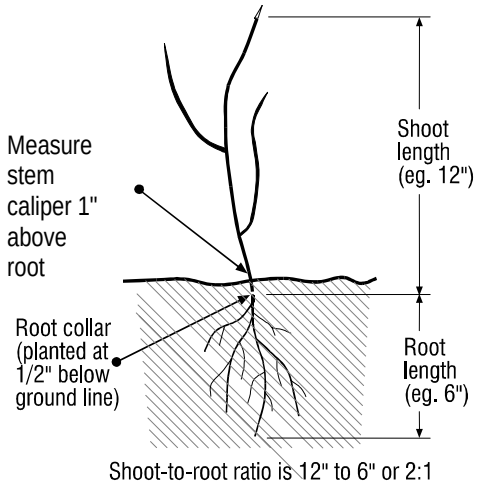

Figure 1: Shoot / Root Ratio

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Storage, Care, and Handling Requirements

Rooted planting stock and cuttings will be stored in a cool, moist environment (34 to 38°F) or heeled into the soil. During all stages of handling and storage, keep stock free of mold and roots moist and cool. Keep roots covered at all times. Live cuttings that are not immediately planted after harvest shall be promptly placed in controlled storage conditions (34 to 38°F) and protected until planting time.

Seeds shall be stored in a cool (35 to 40°F), dark area. Depending upon the species, seed storage may require moist or dry conditions. Become knowledgeable of the duration of seed viability. Some species of seeds lose viability within months after maturity. Others, with proper storage, remain viable for years.

Acorns should be collected in breathable sacks as soon as seed falls (late August-November) and soaked in water (running water is best) for 12 to 24 hours, drained for 30 minutes, and stored in a cool dark area. When collecting black walnut, leave husks on for fall planting and store in piles less than 10 inches deep to avoid heat buildup. Removing husks is unnecessary work that can cause seeds to dry out.

Landowners may keep stock for up to one week before planting by storing it in a shaded, cool, moist place. An unheated basement or fruit cellar works very well. Plant bundles should be turned every day when temporarily stored to avoid mold and/or drying problems within the bundle. Ensure roots are moist and not exposed to the air. Do not store in a bucket of water. Trees will commonly break dormancy (begin to leaf out) with this type of storage, resulting in poorer survival.

For longer storage periods, stock may be heeled in. This can be described as high-density planting in a furrow. Locate the heel-in bed in good soil in a protected location. See Figure 2 for details.

Thoroughly soak the trench with water after planting to remove air spaces and improve root/soil contact.

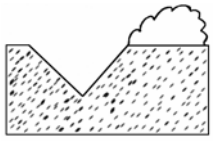


Figure 2A: Dig a trench deep enough for proper root placement.

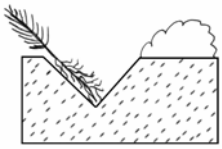


Figure 2B: Break bundles and spread along the trench wall with 2 to 3 inches between each plant.

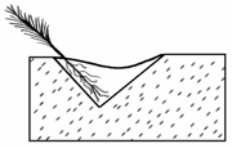


Figure 2C: Immediately cover roots with soil and lightly pack.

Cover roots quickly to minimize exposure to sun and air. Short periods of exposure can greatly reduce survival and establishment. Leaving plants in a heel-in bed for longer than one season increases the difficulty of transplanting and decreases survivability. Moving the transplants to their permanent location should be performed while the material is still dormant.

Roots of bare root stock shall be kept moist at <u>all times</u> during planting operations by placing in a water-soil (mud) slurry, super-absorbent (e.g., polyacrylamide) slurry, or covering with wet peat moss, wet shingletow, or other equivalent material. Do not cover with dry shingle tow, peat moss, etc. and expect to thoroughly wet it afterwards. No matter the amount of water applied, some roots will remain dry.

The rooting medium of container or potted stock shall be kept moist at all times by periodic watering.

Pre-treat stored unrooted cuttings prior to planting by soaking in water for 24-48 hours. Note: There is some debate as to the effectiveness of soaking stored, unrooted cuttings prior to planting. However, soaking will not harm cuttings and <u>may</u> increase survivability.

Keep roots moist and covered throughout the entire planting operation. To further reduce planting shock, stock could be carried during the planting process in buckets of water or slurry. Do not allow rooted conifer stock to be immersed for longer than one hour.

Stock shall not be planted when soil is frozen or dry. Do not handle trees or shrubs when temperatures are freezing or below.

Reduce exposure of bare root seedlings to air and sunshine while loading the planter and during the planting operation. Do not plant on hot, dry, windy days.

PLANTING SITE PREPARATION

Planting sites shall be properly prepared based on soil and vegetative conditions listed below. Avoid sites that have had recent application of pesticides that may be harmful to woody species.

Prior to initiating tree planting, check waiting period restrictions and carryover characteristics of pesticides applied to the planting site in the previous one to two years.

If pesticides are used, apply only as needed within federal, state, and local regulations. Follow label directions and heed all precautions listed on the container.

On sites treated with pesticides, especially tilled sites, be alert to health risks that may result from handling the chemically treated soil or breathing the chemically impregnated dust.

Site preparation may include the whole field, strips, or patches. Individual site preparation for each tree/shrub should provide a minimum 4-foot diameter circle, or a minimum 4-foot x 4-foot square, or a 4-foot-wide strip at each planting spot (2 feet on each side of the planted stock).

The planting area must be free of living sod and perennial weeds before planting.

Tillage Site Preparation

Tillage Site Preparation on Sod-covered Sites (or Sites With Perennial Herbaceous Cover)

Perform sufficient tillage to kill the sod and maintain the entire site in a reasonably weed free condition prior to tree and shrub planting.

Plow or chisel the sod to a minimum 12-inch depth at least one year prior to spring planting. Disc the site through the preplant growing season and immediately before planting to control any species that have resprouted.

Nonselective herbicides may be used to kill sod grasses and other herbaceous species prior to tillage. Follow guidelines under Chemical Site Preparation and instructions found on the herbicide label.

Avoid tilling soils that are wet, to minimize compaction.

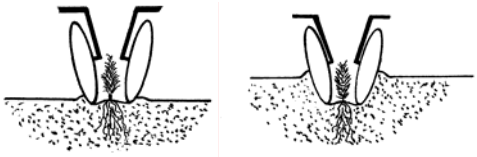
Be alert to potential wind and water erosion risks during the fallow period. Seed an annual cover crop of oats or spring grains to control erosion while minimizing water usage. Oats and spring grains will die over winter, but must be seeded early enough to attain 4- to 6-inch height prior to freeze-up to provide soil protection.

For very erosive sites and no plans for cover crops, till only 5- to 8-foot-wide strips (10 foot strips, if weed control fabric is to be installed after planting) where the trees/shrubs will be planted while leaving and maintaining the existing vegetation between the rows. This will reduce wind and water erosion, sandblasting, provide easier site access, and provide wildlife benefits. If the existing vegetation is fescue or smooth brome, tilled strips are not an option. The entire planting area will be tilled. If the site is very erosive, a cover crop will be established.

Orient tree and shrub plantings on the contour, when possible, to minimize water erosion risks during the fallow period and subsequent planting and maintenance operations.

Avoid deep tillage (greater than 2 inches deep) immediately prior to planting to prevent drying the seedbed.

Firm the seedbed prior to planting by cultipacking, if needed, to reduce soil moisture loss and aid in proper plant placement. A firm seedbed for tree planting should be similar to a firm seedbed for grass seeding where adult human footprints are barely visible and planting equipment leaves a minimal trench. See Figure 3.



This
Firm soil, plants at proper depth.

Not This
Soil too loose, plants pressed too deep.

Figure 3: Effects of Seedbed Firmness

Tillage Site Preparation on Cropland Sites

Shallow tillage immediately prior to planting to remove sprouted annual weeds and grasses is appropriate. Shallow tillage between harvest and freeze-up the year before planting is permitted, if needed. If a compacted plow layer exists, chisel or plow to break up the restrictive layer prior to planting. Be alert to potential wind and water erosion risks during the fallow period. If needed, seed an annual cover crop of oats or small grains to control erosion while minimizing water usage. Oats or small grains will die over winter but must be seeded early enough to attain a 4- to 6-inch height prior to freeze-up to provide soil protection.

Avoid excessive tillage prior to planting. Tillage is not needed or effective if there are no weeds present and may deplete soil moisture as well as to bring up a fresh supply of weed seed to the surface.

Prior to planting, firm the seedbed, if needed, to reduce drying and to aid in proper depth placement of the plant and natural moisture movement within the soil. A firm seedbed for tree planting should be similar to a firm seedbed for grass seeding where adult human footprints are barely visible and planting equipment leaves a minimal trench (see Figure 3).

All precautions concerning erosion and sand blasting on sod-covered sites apply on cropland sites.

Consider tilling only 4- to 5-foot strips where the tree/shrubs will be planted (10 foot strips, if weed control fabric is to be installed after planting), thereby allowing the standing stubble between the rows to act as temporary wind protection for new seedlings.

Scalp Planting Site Preparation

Scalp planting is a method that places plant material in an area cleared of competing vegetation. The area cleared is usually a foot or more wide on each side of the planted row. This operation is usually performed by attachments to the planting machine. It can also be done by other machines in a separate operation, or by hand immediately prior to planting.

Scalp planting into aggressive sods such as smooth brome or fescue is not recommended.

Scalping tends to encourage a rapid flush of annual weeds on the freshly exposed soil that will require a post-plant weed control effort.

When scalping on native range sites, orient plantings in locations that are most conducive to tree/shrub growth. Best tree growing sites are often found in toeslope positions, north facing slopes, or in swales and draws.

When possible, orient rows on a true contour to harvest runoff moisture and reduce erosion.

Chemical Site Preparation

Chemical Site Preparation on Sod-covered Sites (or Sites With Perennial Herbaceous Cover)

Site preparation by herbicides on sod sites should be initiated the growing season before planting.

Follow label instructions so that application technique and timing of herbicide application will lead to a complete control of the vegetation. Repeated applications throughout the fallow year may be necessary.

For sites with rhizomatous and or other competitive grasses such as smooth brome or fescue, completely spray the entire area where the trees/shrubs will be planted, including a 10-foot-wide band around the outside of the planting area.

Spraying of 5- to 8-foot-wide strips where the trees/shrubs will be planted while leaving existing vegetation between rows untreated is an option. This will reduce potential erosion, sandblasting, provide easier access, and provide wildlife benefits. If the existing vegetation is fescue or smooth brome, strip spraying is not an option. The entire planting area will be treated.

Undisturbed dead sod will often provide a season's weed control or suppression after the trees or shrubs have been planted.

Herbicides vary as to their risk of leaching or runoff. Avoid using herbicides with high leach or runoff potential on sites where there is increased risk of polluting surface or ground water sources.

Chemical Site Preparation on Cropland Sites

Apply appropriate burndown chemicals according to label directions prior to planting trees and shrubs, if needed.

Native Grass Cover

Warm season native grass species of blue grama, buffalograss, little bluestem and/or sideoats grama may be seeded between tree/shrub rows to reduce erosion and runoff, prevent sandblasting, and improve wildlife cover.

When using native grasses between rows, it is essential a weed-free zone of at least 4 feet be maintained around each tree or shrub for the first 3 years after planting.

Warm season native grass species initiate growth after trees and shrubs have leafed out, reducing early season competition for water. These warm season grass species are shade intolerant and will be suppressed as growing tree and shrub canopies shade the ground. In no case should a sod-forming and/or an aggressive cool season grass such as smooth brome or fescue be substituted for these species.

Short, warm season grasses are particularly effective between fabric strips. Without tillage between fabric strips, there is no risk of the fabric being hooked by a tillage implement and torn out.

The following pure stand seeding rates are to be used for designing the between-row grass seedings. Reduce rates by the appropriate percentage when using a mix of these grasses.

Blue grama 2# PLS (Pure Live Seed) per acre

Buffalograss 5# PLS per acre

Sideoats grama 6# PLS per acre

Little bluestem 4# PLS per acre

ESTABLISHMENT METHODS

Plant only in the spring of the year after frost is out of the ground. Plant bareroot stock and containerized no later than May 1.

Containerized stock may be planted in the fall (September 15-Octtober 30) if soil moisture is sufficient. Extensions of these planting dates by 10 days may be made by the district conservationist, if local soil moisture and temperature conditions justify it and are documented. Before granting an extension, consider the cooperator's ability and willingness to address the greater need for supplemental watering, wind protection, and/or shade that may be necessary in the weeks immediately following a later planting.

Immediately after, or during planting of all stock, whether by hand or machine, pack soil firmly around each plant to eliminate air pockets. Proper adjustment and operation of the tree-planting machine will eliminate the need to pack the edges of tree rows with tractor tires or feet.

Planting - Bare Root Stock (Seedlings, Transplants, Rooted Cuttings)

Before planting, examine seedlings and discard any with poorly developed root systems and those that do not meet planting stock requirements. Rooted stock will be planted in a vertical position with the root collars approximately ½-inch below the soil surface. (See Figure 4.) The planting trench or hole must be deep and wide enough to permit roots to spread out and down without J-rooting or L-rooting. Trim straggly roots of bare-root stock as needed to prevent J-roots, L-roots, broken roots, or wadded roots that may result from "stuffing" too many roots into the planting shoe. Do not over-trim roots.

Planting – Unrooted Cuttings (Willow, Cottonwood)

Base ends of longer cuttings, or the entire cutting if smaller, should be soaked for 10 to 24 hours before planting.

If cuttings have been stored for more than one week, re-cut the base end at a 45-degree angle to maximize water uptake. Cut dead wood back without damaging the green tissue.

Insert cuttings to the depth required to reach adequate soil moisture with at least one to two buds sticking above the soil surface. Longer cuttings may be planted so that 2 to 3 inches of stem are aboveground to allow for more branching.

Depth to growing season water table must be determined before obtaining cuttings to ensure cuttings are sufficiently long enough to reach the water table.

Planting – Container-grown Stock

Container-grown stock should be planted so the top of the root crown is covered with ½ to 1 inch of soil.

Planting – Direct Seeding

Understand the requirements of each species to know the best time to seed. Most species, however, used for direct seeding should be planted in the fall. Some species need a warm-cold-warm stratification period while others need a cold-warm stratification period. Some species such as bur or chinquapin oak begin sprouting within days after falling from the tree. In other words, some species germinate in the fall and some, like silver maple, germinate in the spring.

For this reason, white oaks (white, bur, swamp white, chinquapin, and post oak) must be planted in the fall because that is when they germinate. White oaks do not require stratification; their acorns germinate soon after they fall to the ground.

Walnut, the red oaks (red, black, pin, and shingle oaks), and most other tree species produce dormant seed that will not germinate unless exposed to a period of moist cold. This period of "stratification" can be satisfied by planting in the fall, storing the seed over winter in a moist stratification pit, or with moist cold storage over the winter. It is important to recognize that seed purchased from vendors is not stratified seed, unless otherwise stated.

Fall planting of nuts is preferred and recommended to take advantage of the natural stratification of dormant seeds. In the fall, plant as soon as the seed has been collected so that seeds can germinate as soon as conditions are favorable. It is important to maintain moisture in the majority of seed used for direct seeding.

Seed can be planted by hand or mechanically. Tree seeds are very particular with respect to depth of planting. Tree seeds generally respond best when seeded to a depth of 1 to 3 times the diameter of the seed. For example, ash and maple seed should be planted ¼ to ½ inch deep, while acorns, walnuts, and hickory, should be planted ½ to 2 inches deep.

Large seeds, such as walnut or acorn, can be broadcast seeded using a fertilizer or lime spreader followed by a light discing operation. Small seeds, such as sycamore or ash, can be broadcast seeded followed by a light harrowing operation. Following the planting operation, the area should be rolled or cultipacked.

To calculate the amount of seed needed:

- Determine the desired number of trees per acre.
- Determine the percent composition of the desired stand.
- Estimate the percent of sound seed, percent germination (can be derived from woody production manuals), and percent survival (predation may be significant) during the first year.

For example, the goal is to have 1,600 trees of a particular species per acre. The seed used is estimated to be 50 percent sound, the average germination is 30 percent, and the initial survival is estimated to be 50 percent. To meet the desired goal, 21,333 seeds per acre would be required [1,600 / (.50 x .30 x .50)]. To estimate the number of seeds per pound, make several seed counts to arrive at this figure.

Planting – Natural Regeneration

It is important to understand the reproductive requirements and characteristics of the species before considering using natural regeneration as an establishment technique. Upstream or adjacent plant sources should be examined during the planning process to determine if desirable species are present. With the exception of species like cottonwood, most species do not produce a good seed crop every year. All nut or mast bearing trees should be observed early in the season to predict the type of seed crop to be expected.

To determine suitability of the site for natural regeneration, refer to Exhibit A.

ESTABLISHMENT CRITERIA

Where natural regeneration is used as the establishment technique, the site shall be monitored for a minimum of three years to document species composition and establishment.

Documentation of establishment should be performed no earlier than August of the third growing season after the initial planting. Table 5 provides establishment criteria. A random sampling method may be used to arrive at percent survival by sampling 10 percent of the planted trees/shrubs or as a minimum for smaller plantings, 100 trees/shrubs should be sampled.

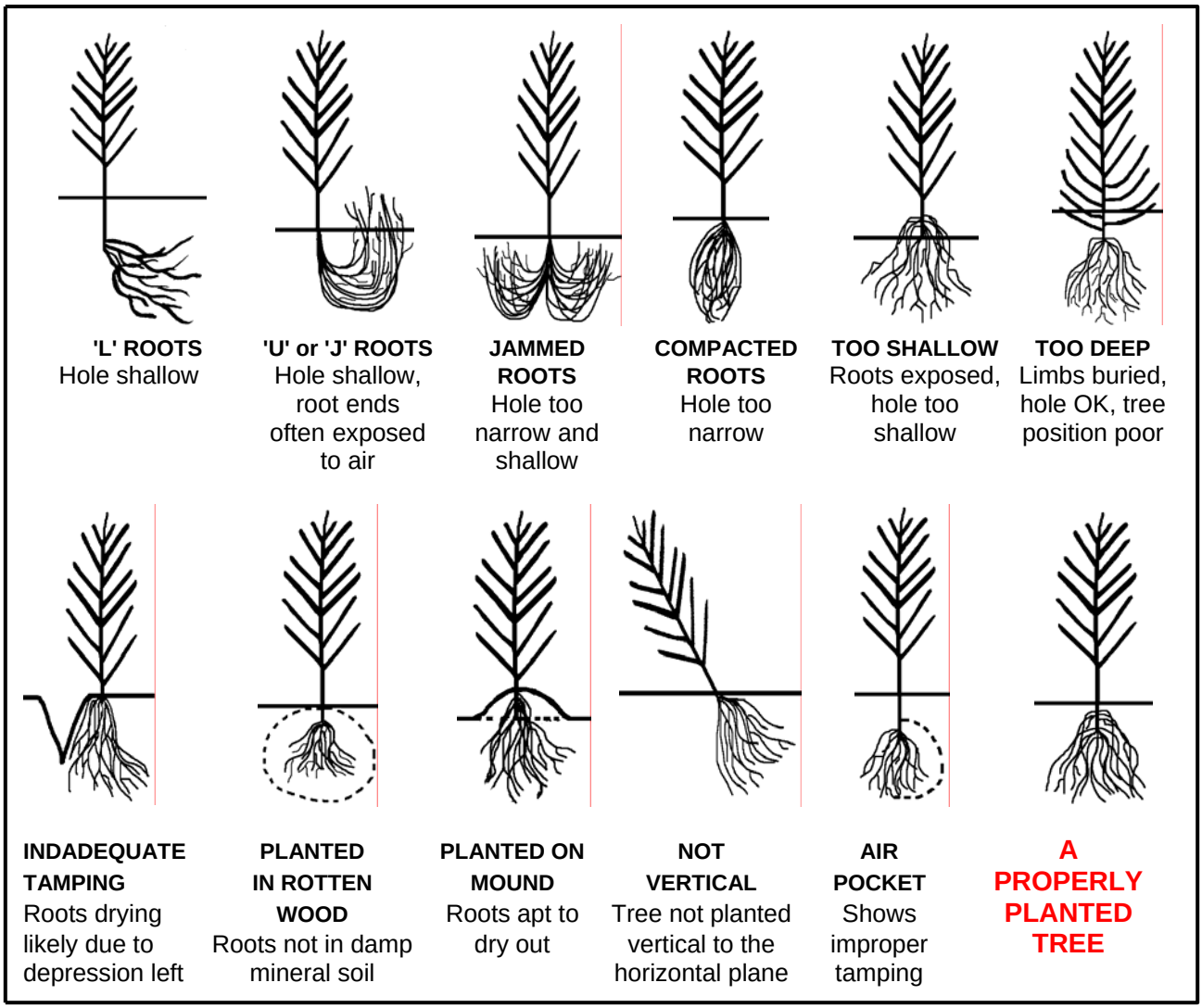


Figure 4: Examples of improperly planted trees.

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PRACTICE	ESTABLISHMENT CRITERIA
380 WINDBREAK/SHELTERBELT ESTABLISHMENT	One or two row planting - 90 percent survival
391 RIPARIAN FOREST BUFFER (ZONE 1)	Three or more row planting - 80 percent survival
311 ALLEY CROPPING 391 RIPARIN FOREST BUFFER (ZONE 2) 422 HEDGE ROW PLANTING 612 TREE/SHRUB ESTABLISHMENT 645 UPLAND WILDLIFE HABITAT MANAGEMENT	70 percent survival required on all trees/shrubs planted
DIRECT SEEDING ESTALISHMENT METHOD NATURAL REGENERATION ESTABLISHMENT METHOD	Minimum of 300 trees/shrubs established per acre

Figure 5: Survival rates for woody practices

Replanting

Any tree or shrub that fails within the first three years should be replaced with a similar plant. Replanting is essential to maintain the intended function of the planting and should be compatible with soils and climate. Growth rates of most replants (when replanted within 3 years of the original planting date) are usually such that little if any size difference is noted, across the planting, after 10 years. Dead trees should be flagged late summer before leaf drop. Delays in replanting of longer than 3 years will allow adjacent established tree roots to create greater competition to the replants, resulting in slower growth. On some sites with older established plantings (over 15 years old), replants rarely put on substantive growth nor function as desired.

MAINTENANCE AFTER PLANTING

Competitive vegetation will be controlled for at least 3 years after planting. Specific recommendations for vegetative control should be listed in all tree planting plans for the first 3 years.

Livestock shall be excluded from the planting area.

Mechanical Weed Control

Use caution when tilling around trees and shrubs. Poor tillage techniques (too deep, too close to the trunk) can damage trunks, limbs, and roots. Erosion that may result from indiscriminate tillage may remove several inches of soil exposing roots to severe damage by future tillage operations.

Use tillage only when needed to maintain or improve the health and vigor of the planting. Tillage, when weeds are not growing, wastes moisture and fuel and increases the risk of mechanical injury to trees.

Chemical Weed Control

Specific herbicides, application rates, and timing of application should be listed in tree planting plans for the first 3 years. Plantings should be scouted annually to identify specific vegetation needing control to aid in herbicide selection. Follow label directions when applying the appropriate chemical to control weeds. Adhere to state or local rules that apply to chemical applications on tree and shrub plantings.

Some approved herbicides are nonselective and will kill most weeds but must not come in contact with any part of the tree or shrub. Other approved chemicals prevent weeds from germinating or kill newly germinated weed sprouts but will not kill emerged weeds.

Effectiveness of most herbicides used to control weeds in tree and shrub plantings is very sensitive to different application rates, considerably more so than the common herbicides used to kill weeds in lawns. Too little chemical applied will not provide adequate weed control. Applying too much of some chemicals may damage or kill trees and shrubs.

Use chemicals only when needed to maintain or improve the health and vigor of the windbreak.

Organic Mulches

Organic mulches may include straw, wood chips, chopped corncobs, or other organic byproducts. Mulches are most effective when maintained to the dripline of the tree or beyond. For newly planted stock, they should be placed in a 3- to 4-foot diameter circle around each plant to a depth of about 4 inches. When mulching shrub rows, mulch can be applied in a contiguous 4-foot-wide band (2 feet each side of the plants).

In situations of higher precipitation, frequent irrigation, or on tighter wetter soils, it may be appropriate to maintain a 4-inch mulch-free circle around each trunk to minimize potential trunk problems. In high moisture situations, mulch against the trunk may hold moisture and encourage bacterial growth resulting in bark injury, which could shorten the life of the tree.

If organic mulch is used, a post-emergent herbicide application is sometimes necessary to control unwanted vegetation.

Synthetic Mulch (Fabric) Weed Control

Synthetic Mulch (Fabric)

Fabric shall be of such quality that the manufacturer guarantees the product for at least 3 to 5 years.

Fabric must be black or capable of preventing underlying plant growth.

Fabric may be pin-punched plastic, solid polyethylene, woven polypropylene, or some other rot-resistant material. It must prevent plant shoots from pushing through from below.

The minimum width for continuous rolls of fabric applied by machine will be 6 feet, nominal 4-foot weed control width after installation. Individual fabric squares may be as small as 4 feet square since the full 4-feet, when stapled or pinned, effectively prevents weed growth. In certain planting designs a profusion of root suckers is desired. For these applications, 4- foot-wide rolls of fabric, yielding a nominal 2-foot weed free zone (1-foot each side), are appropriate. This narrow fabric is only appropriate on shrubs capable of profuse suckering. Some shrubs, such as plum, that sucker close to the trunk still may not sucker to any great degree outside the fabric edges . Consider not using fabric on suckering shrubs where a dense thicket is desired.

Improper Weed Control Fabric Installation	Proper Weed Control Fabric Installation
Tree planted in furrow. Fabric bridged over limbs Creates an "oven." Plants can be killed by heat.	Fabric flush to ground surface. All limbs above fabric. Soil around tree is cool and moist.

Figure 6: Improper & Proper Fabric Installation

Fabric Installation

Tilled sites should be firmed and leveled in such a way that the fabric will lie flat against the ground across the entire area covered by fabric. (Sites should be firmed to barely show an adult foot print, prior to planting.) (See Figure 6.)

Fabric should not be bridged over ridges or valleys left by planting operations. Fabric not flush to the ground around the tree can provide a runway for rodents and trap summer heat sufficient to damage or kill the young plant.

If fabric is installed under a no-till situation, excessive vegetation should be removed from the area where fabric will be placed, to reduce rodent habitat and to allow fabric to lie flat against the soil surface.

Openings shall be +, X, C, L or J-shaped. Length of slit should not exceed 12 inches. Do not use I-shaped (straight) slits as abrasion of tree bark can occur. “l”-shaped cuts may also constrict the tree trunk as the diameter increases.

When fabric is placed over plants before openings are made, use care to avoid cutting the plant when making the opening. Trees and shrubs must be pulled through the fabric within minutes after installation to avoid damaging temperatures created by the fabric "oven."

Fabric is not recommended within flood plains. One flooding event could cover the fabric with silt, eliminating its effectiveness, or flood flows could tear out the fabric.

Do not cover weed control fabrics or plastics with organic mulches or gravel. These materials will delay the breakdown of the fabric or plastic, possibly causing damage to the plant, and providing a medium in which weeds can flourish.

Installation of Continuous Fabric Strips.

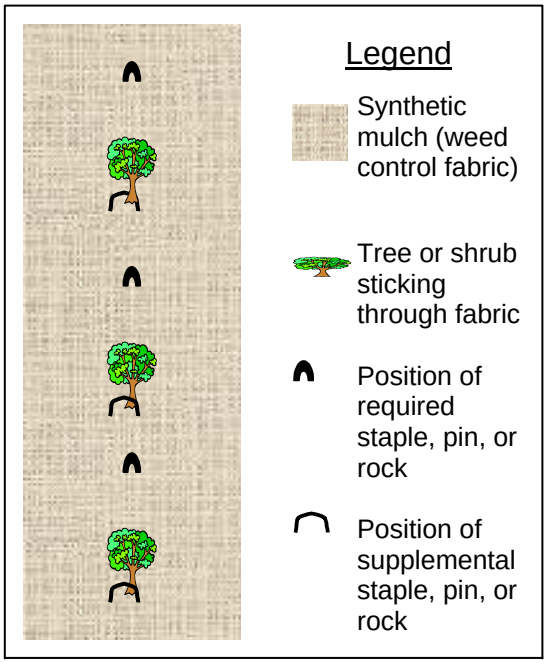

Figure 7: Positions of staples, pins, or rocks for continuous fabric strips.

Site preparation, if tilled, shall be at least 10 feet wide to allow enough loose soil to proper anchor fabric.

Fabric strip splices shall be anchored with staples, pins, or rocks. Staples and pins shall be of a length recommended by the manufacturer for the particular soil texture. Rocks must weigh at least 5 pounds. Do not anchor splices with soil.

About every 10 feet, or between each tree, whichever is greater, the fabric should be anchored with pins, staples, or rocks. In lighter soils, or in high wind areas, an additional pin, staple, or rock may be needed near each opening in the fabric. (See Figure 7.)

Machines must be adjusted to ensure 10 to12 inches of fabric edge are firmly anchored in the soil. After installation, it is often necessary to run a tractor wheel over the edge of the fabric to get a firm seal.

Check-dams across the furrow or slight grading of the site may be necessary on sloping land to prevent water from running along the edge of and uncovering the fabric.

Where fabric crosses larger waterways or areas of concentrated flows, the fabric shall be spliced on either side of the waterway. This is to prevent heavy runoff events from washing out an entire strip of fabric and potentially damaging 300 to 500 feet of tree row. The smaller spliced section may still wash out, but only a small amount will have to be repaired or replaced.

Pins or staples, instead of soil, may be used to anchor fabric edges. The fabric must lay flat against the soil and the pins or staples must be placed every 3 feet along the fabric edge. On sites exposed to extremely high winds or on loose soil, pins or staples may need to be closer than 3 feet.

When installing fabric on curves, use extra care to ensure that 10 to 12 inches along each edge get covered and packed with soil. Ensure the fabric is not so tight that temperature changes pull the fabric loose. Use pins, staples, or rocks to tack excessively large "puckers" to prevent wind damage.

Where fabric is desired on a curved planting with a short radius, it may be better to break the curve into short, straighter segments to ensure better quality and easier fabric installation.

Most fabric mulch will last beyond 5 years. Plantings should be checked annually to make sure that the fabric does not girdle trees as their diameter increases.

Annual Inspection

Inspect plantings annually to spot weather and animal damage needing repair, plants needing replacement, fabric or mulches needing repair, weeds needing treatment, or insect and disease threats that may be developing. Time of the inspection will depend upon the particular threat, but early spring is a good time to spot most problems.

Insects and Diseases

Inspect plantings at least annually to determine if insects or diseases are threatening the planting. If insects or diseases are observed, contact your local county extension agent to determine if control is possible or warranted.

Protective Tree Shelters

A wide assortment of tree shelters exists in the market place. They range from 1 foot tall to 5 feet tall, from solid tubes, to flat sheets that fold into tubes, to plastic meshes. All are effective in preventing certain kinds of damage.

One of the more common tree shelters consist of tubes, or flat sheets that fold into tubes, that range from 2 to 5 feet in height and form a 3 to 5 inch cylinder around the tree. These shelters protect the tree from wind, sun, small mammals, rodents, and deer; encourage faster initial growth; and provide an opportunity for much easier herbicide applications. Once trees grow out of shorter tubes, deer may browse the tops. For this reason, 5-foot shelters are best to prevent deer damage.

Tubes are usually tied to wood stakes with plastic ties. Tubes should not be removed for several years after the tree has emerged from the top of the tube. This period of time is needed for the tree to develop adequate stem diameter to withstand wind. Removal of the tree shelter just as the tree reaches the top of the tube will often result in a tree that "lays on the ground" or is broken off at the first strong wind.

There may or may not be merit in raising the tubes a few inches off the ground in the fall to help the tree "harden off." There is no conclusive evidence to indicate one way or the other. However, some shelters are perforated to aid in this process.

Supplemental Watering

Supplemental watering may be by hand, drip systems, sprinkler, furrow, flood, or other methods. The minimum water requirements discussed below will apply regardless of the watering method.

A common form of providing supplemental water is through drip systems.

The inclusion of a drip watering system as a component part of a tree/shrub conservation practice should be considered a temporary part of the planting. It will help ensure survival of new plantings and provide supplemental water during periods of drought and promote faster growth for more protection and wildlife cover.

Drip watering is based on the concept that prevention of moisture stress (as opposed to correcting moisture stress) will be realized by maintaining favorable soil moisture conditions on only a portion of the root system. Water is applied at slow rates (1 to 2 gallons per hour) for a sufficient period of time to maintain part of the soil at or near field capacity.

Special Considerations:

Usually the installation of a drip watering system is for establishment purposes and is normally limited to new plantings 3 years or less in age.

An adequate water supply shall be required before the system is installed.

Preference should be given to those woody species which are both deep rooted and long lived.

Preference should be given to those plantings which can produce multiple benefits.

Design and Installation:

For design procedure and sample problem, refer to Kansas Irrigation Guide, Procedure for Drip Watering Design for Tree Plantings.

Watering Requirements:

If practical, trees should be watered in at the time of planting. It is impractical to give a standard recommendation on watering rates or water requirements following planting because of varied soil types and variations in weather conditions. The following general guidelines should be followed:

Soak the soil profile thoroughly to a depth of 18 inches to 2 feet when watering and do not water again until the profile has dried. Thorough watering at less frequent intervals is more desirable for root development than frequent, light watering.

Watering two to three times per week will probably be needed for newly planted trees.

The first watering in the spring after the last frost and the last watering in the fall before the first frost are most important to maintain plant vigor.

ADDITIONAL INFORMATION

“Common Insect Pests of the Trees of the Great Plains,” Great Plains Agricultural Publication No. 119.

“Diseases of Trees of the Great Plains,” Rocky Mountain Forest and Range Experiment Station, General Technical Report RM-129.

"Tree Planting Guide"
http://www.kansasforests.org/publications/conservation.htms

"Tips on Planting Trees and Shrubs"
http://www.kansasforests.org/publications/conservation.htms

"Weed Control Options in Tree Plantings"
http://www.kansasforests.org/publications/conservation.htm

"Chemical Weed Control in Tree Plantings"
http://www.kansasforests.org/publications/conservation.htm

"Tips on Installing Weed Barrier Fabric"
http://www.kansasforests.org/publications/conservation.htm

"Weed Barrier Fabric Mulch"
http://www.kansasforests.org/publications/conservation.htm

"Wick Application of Herbicides for Weed Control"
http://www.kansasforests.org/publications/conservation.htm

References

General Resource Reference, Tree Care and Management, Craig Stange, North Dakota NRCS FOTG, Sec 1, Jan 2002.

USDA Forest Service, Seeds of Woody Plants In the United States, 1974. USDA Agriculture Handbook 450.

Exhibit A

NATURAL REGENERATION SUITABILITY KEY

This key is to be used by planners to determine if natural regeneration is feasible as an establishment technique. Natural regeneration may only be used on a wetland site or sites within a riparian zone where hydric soils or frequently flooded soils exist.

1. Hydrology and soil condition marginally altered.	**Go to 2**
1. Hydrology and soil condition significantly altered.	**Go to A**
2. Propagules already exist on site.	**Go to 3**
2. Propagules do not exist on site.	**Go to 5**
3. Desirable species occur on site.	**Go to 4**
3. Desirable species do not occur on site.	**Go to 5**
4. Seed source and crop is adequate to meet planning objectives.	**Go to B**
4. Seed source and crop is inadequate to meet planning objectives.	**Go to 5**
5. Restoration site is adjacent to surrounding seed wall.	**Go to 6**
5. Restoration site is not adjacent to surrounding seed wall.	**Go to A**
6. Seed wall contains desirable species.	**Go to C**
6. Seed wall does not contain desirable species.	**Go to A**

A. Natural regeneration not recommended. Another establishment technique should be considered.
B. Natural regeneration may be recommended for the entire area.
C. Natural regeneration should be considered for the area no greater than 200 feet from the surrounding seed wall.

Seed wall is defined as desirable wetland/riparian plants on adjacent lands that have a good seed crop capable of dispersing to the restoration site by natural drop, wind, water, and or animals.

Propagule is defined as any piece of plant material that will develop into a new plant (i.e. seeds, nuts, rhizomes, or other vegetative material).

USDA, KS
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