

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

**TREE/SHRUB ESTABLISHMENT
(Acre)**

CODE 612

DEFINITION

Establishing woody plants by planting seedlings or cuttings, direct seeding, or natural regeneration.

PURPOSE

To establish woody plants for forest products, wildlife habitat, long-term erosion control and improvement of water quality, treat waste, reduction of air pollution, sequestration of carbon, energy conservation, and enhance aesthetics.

CONDITIONS WHERE PRACTICE APPLIES

On any area where woody plants can be grown.

CRITERIA

General Criteria Applicable To All Purposes

Select tree and shrub species adapted to local soil and site conditions, suitable for the planned purpose(s) and that will accomplish the landowner's objectives.

NRCS Personnel should work closely with WV Division of Forestry personnel, the NRCS staff forester, and/or biologist when utilizing this practice.

Plant Guide and Plant information Sheets for individual species found in the USDA Plants Database will be utilized to supplement the

material in this standard.

<http://plants.usda.gov>

For selection of species to be encouraged through natural regeneration and a listing of those that may be planted, refer to one or more of the following:

A. Tables 1 and 2 found in Appendix 1 of this standard.

B. Veg Spec – See NRCS homepage – Technical Tools

C. Technical Guide Reference (Plant Materials) – Plant Selection Guide, Joe Ruffner

D. Technical Guide Reference (Plant Materials) – Conservation Plants for the Northeast, USDA-SCS

E. Technical Guide Reference (Biology) – Shrubs and Trees for Northeastern Wildlife, USFS General technical Report, NE-9, 1974

F. Technical Guide Reference (Forestry) – Conservation Tree and Shrubs Pocket ID Guide, USDA – SCS, 1993

G. Technical Guide Reference (Forestry) – Chesapeake Bay Riparian Handbook – A Guide for Establishing and Maintaining Riparian Forest Buffers, USFS, May 1997, Section VII – Site Evaluation, Planning and Establishment

H. Conservation Tree and Shrub Suitability Groups - Field Office Technical Guide - Section II

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service.

Note: Other species not listed in the above reference materials may also be suitable. Consult WV Division of Forestry personnel, NRCS staff forester and/or biologist concerning the suitability of other species.

Wet Areas/Soils – Use adapted species. Another consideration would be to plant in prepared ridges. See Bedding – 310.

Where feasible natural regeneration should be utilized. If desired, supplemental planting of tree/shrub plantings may be added. An adequate nearby or adjacent seed source must be present when using natural regeneration.

Methods used should be designed to minimize soil erosion.

Planting and/or seeding rates will vary with intended purpose and species and but shall be adequate to accomplish the planned purpose..

Timing and use of planting equipment will be appropriate for the site and soil conditions.

Selection of plants and spacing depend on the intended purpose.

Spacing between rows should allow sufficient room for necessary maintenance equipment.

Native plant materials should be used whenever possible.

The planned plant species must be tolerant of any nutrient, pesticide, mine drainage, or other chemical loading, where loading cannot be corrected.

Planting dates, and care in handling and planting of the seed, cuttings or seedlings will ensure that planted materials have an acceptable rate of survival.

Only viable, high-quality and adapted planting stock or seed will be used.

Site preparation shall be sufficient for establishment and growth of selected species. Site preparation is needed if competition from grass, weeds, and/or woody materials will interfere with plant establishment and growth. See Forest Site

Preparation - 490 and Brush Management - 314.

The acceptability and timing of coppice regeneration shall be based on species, age, and diameter.

Each site will be evaluated to determine if mulching, supplemental water or other cultural treatments will be needed to assure adequate survival and growth.

Comply with applicable federal, state, and local laws and regulations during the installation, operation and maintenance of this practice.

Additional Criteria For Improving Or Restoring Natural Diversity

Species selected will be indigenous to the site and will reflect species composition of the desired stands.

Additional Criteria for Care and Planting of Seedlings

See Appendix 2 of this standard.

Additional Criteria for Care and Planting of Balled /Burlapped and Containerized Stock

See Appendix 3 of this standard.

Additional Criteria for Protection of Plantings/Seedings

See Appendix 4 of this standard.

The planting will be protected from unacceptable adverse impacts from pests, wildlife, livestock damage, or fire. See Use Exclusion - 472, Fence - 382, Firebreak - 394 and Hedgerow Planting - 422.

Additional Criteria for Spacing Calculations

See Appendix 5 of this standard.

Additional Criteria for Timber Production

See Appendix 6 of this standard.

Additional Criteria for Christmas Tree Production

See Appendix 7 of this standard.

Additional Criteria for Ornamental Plantings

See Appendix 8 of this standard.

Additional Criteria for Hybrid Tree Species in Agroforestry Plantings

See Appendix 9 of this standard.

Additional Criteria for Surface Mine Reclamation

See Appendix 10 of this standard.

Additional Criteria for Riparian Buffer Plantings

See Appendix 11 of this standard.

See Riparian Forest Buffer -391.

Additional Criteria for Paulownia Plantings

See Appendix 12 of this standard.

Additional Criteria for Bioengineering Plantings

See Engineering Field Handbook - Chapters 16 and 18.

Agroforestry Notes 23 and 24.

<http://www.unl.edu/nac/afnotes/spec-6/spec-6.pdf>

<http://www.unl.edu/nac/afnotes/spec-7/spec-7.pdf>

Additional Criteria for Wildlife Plantings

See Upland Wildlife Habitat Management - 645

Additional Criteria for Windbreak/Shelterbelt Plantings

See Windbreak/Shelterbelt Establishment - 380

See Windbreak/Shelterbelt Renovation - 650

Additional Criteria for Direct Seedings

See Appendix 13 of this standard.

CONSIDERATIONS

When underplanting, trees should be planted sufficiently in advance of overstory removal to ensure full establishment.

Use locally adapted seed, seedlings or cuttings. Priority will be given to plant materials that have been selected and tested in tree/shrub improvement programs.

All plant materials should comply with a minimum standard, such as the American Nursery and Landscape Association, Forest Service, or state-approved nursery.

Plans for landscape and beautification plantings should consider foliage color, season and color of flowering, and mature plant height.

Where multiple species are available to accomplish the planned objective, consideration should be given to selecting species which best meet wildlife needs.

Tree/shrub arrangement and spacing should allow for and anticipate the need for future access lanes for purposes of stand management.

Residual chemical carryover should be evaluated prior to planting.

Species considered locally invasive or noxious should not be used.

Species used to treat waste should have fast growth characteristics, extensive root systems, capable of high nutrient uptake, and may produce wood/fiber products in short rotations.

For optimal carbon storage, select plant species that are adapted to the site to assure strong health and vigor and plant the full stocking rate for the site.

Consider associated insect, pest, and disease problems when selecting tree and shrub species (i.e. cedar-apple rust, etc.)

Consider shade tolerance when selecting tree and shrub species to plant.

Consider drainage class and soil type when making plant species selection.

PLANS AND SPECIFICATIONS

Specifications for applying this practice shall be prepared for each site and recorded using approved specification sheets, job sheets,

technical notes, and narrative statements in the conservation plan, or other acceptable documentation.

Substrate material and site preparation necessary for proper establishment of the selected plant/seed shall be included in the design.

At a minimum the following will be identified in the conservation plan (as appropriate):

- *Purpose of planting/seeding*
- *Field location / plan view*
- *Acreage to be planted*
- *Site conditions prior to planting*
- *Soil amendments (if needed)*
- *Site preparation methods (if used)*
- *Species to be used*
- *Plant Guides/Plant Sheets*
- *Stock size*
- *Spacing*
- *Planting method(s)*
- *Planting dates*
- *Protection methods*
- *Cultural practices (i.e. pruning, forest stand improvement, etc.) (if any)*
- *Operation and maintenance plan*
- *Replacement strategies*

OPERATION AND MAINTENANCE

The following actions shall be carried out to insure that this practice functions as intended throughout its expected life. These actions include normal repetitive activities in the application and use of the practice (operation), and repair and upkeep of the practice (maintenance).

If needed, competing vegetation will be controlled until the woody plants are established. Noxious weeds will be controlled.

Where practical, management activities will be performed outside the primary nesting season (March 15 - July 15). An exception may be for mowing or cultivation to control vegetative competition.

The planting should be inspected at least annually and after storm/fire events.

Pruning, thinning, and/or removal of dead or diseased plants should be performed and timed as to not interfere with the life cycle of the plants or the intended purpose of the planting.

Replanting should be considered when survival does not meet the objective of the practice.

Supplemental water will be provided as needed.

Trees and shrubs will be inspected periodically and protected from adverse impacts including insects, diseases or competing vegetation, fire and damage from livestock or wildlife.

Periodic applications of nutrients may be needed to maintain plant vigor.

Additional operation and maintenance requirements may be developed on a site-specific basis to assure performance of the practice as intended.

TREE/SHRUB ESTABLISHMENT

Appendices 1-13

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APPENDIX I

The following are explanations of the various headings for Tables 1 and 2. Refer to these tables when selecting tree and shrub species for planting in West Virginia.

water is commonly at the surface. Poor drainage may result from high water tables, slowly pervious layers within the profile, seepage or any combination of these factors.

¹ SOIL DRAINAGE CLASS:

- **Well drained:** Water is removed from the soil readily but not rapidly and available to plants most of the growing season. Wetness does not inhibit growth of roots for significant periods.
- **Moderately Well Drained:** Water is removed from the soil somewhat slowly during some periods. These soils are wet for only a short time during the growing season. They may contain a slowly pervious layer or receive periodic heavy rainfall or both.
- **Somewhat Poorly Drained:** Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of some plants. They commonly have a slowly pervious layer or receive periodic heavy rainfall or both.
- **Poorly Drained:** Water is removed so slowly that the soil remains saturated for significant portions or remains wet for long periods during the growing season. Free

² SHADE TOLERANCE: Describes the relative tolerance for this plant to grow in shade conditions

- **Intolerant:** Will not tolerate shaded conditions.
- **Intermediate:** Will tolerate partially shaded conditions.
- **Tolerant:** Will tolerate full shade and usually does not prefer full sun.

³ HEIGHT AT 20 YEARS: Under good conditions the approximate height at 20 years in feet.

⁴ MATURE HEIGHT: The approximate height of the plant at maturity under good conditions.

⁵ NATIVE: The plants marked "yes" in this column are considered native (i.e., they occur naturally in West Virginia). This listing of species is not all-inclusive. Many more native plants occur and could be suitable for use in conservation plantings.

6 WINDBREAKS SCREENS BARRIERS OR

OTHER: An entry in this column indicates that this plant is suited or could be utilized for linear plantings designed to hide unsightly areas from public view, reduce noise and wind, or for ornamental planting. Multiple row plantings should be spaced closer to the maximum range shown. Refer to the appropriate NRCS standard for more specific information concerning these types of plantings.

7 WILDLIFE

- **Food:** This plant is suited to provide wildlife food in the form of either browse or fruit.
- **Cover:** This plant is suited to provide winter or nesting cover by its growth characteristics.
- **Corridors:** This plant is suited to use in corridors or travel lanes, including riparian corridors, through which wildlife may travel between habitat types. Planted rows should be staggered.

8 WOOD PRODUCTION SPACING: This spacing range is recommended if wood production is desired. Depending on intent and management practices, the spacing will vary. Refer to the appropriate NRCS standard for more information concerning this type of planting.

9 ADDITIONAL PLANT INFORMATION AVAILABLE:

- **Fact Sheet:** Information from the USDA plants database that provides brief descriptions of a plant, its uses and often offers establishment recommendations. (Available at <http://plants.usda.gov>)
- **Plant Guide:** These are similar to plant sheets but are usually more extensive and more narrative, and are typically referenced to source documents. (Available at <http://plants.usda.gov>)

Fact Sheets and Plant Guides are also available on the WV NRCS website at <http://www.wv.nrcs.usda.gov/standard/appendices.htm>

10 COMMERCIAL AVAILABILITY

This column indicates the availability of planting stock for a particular species as follows:

- **Readily:** Many varieties exist and/or are routinely available through commercial, state nurseries and/or Plant Material Centers.
- **Somewhat Available:** Somewhat limited availability of planting stock especially from commercial nurseries and may be more readily available from nurseries specializing in native plants or from regional Plant Material Centers.
- **Rarely:** Often very difficult to locate plant stock or no known cultivated varieties exist. These species may only be available from native plant nurseries, Plant Material Centers or from localized sources.

Appendix 1 - Tree and Shrub Species Tables 1 and 2

SHRUBS	Soil Drainage Class ¹	Shade Tolerance ²	Height at 20 Years ³	Aprox. Height at Maturity ⁴	Native ⁵	Suitable Use(s)			Wildlife Spacing	Plant Information Sheet Available ⁸	Remarks	Commercial Availability ⁹	
						Visual Screens or Barriers ⁶	Wildlife ⁷						
							Food	Cover					Corridors
Alder, Smooth (<i>Alnus serrulata</i>)	Somewhat Poorly - Poorly	Tolerant	10 ft	20 ft	Yes		X		X	5-8 ft	Plant Sheet	Adapted to wetter sites and along streams below 2600 ft	Readily
Alder, Speckled (<i>Alnus rugosa</i>)	Somewhat Poorly - Poorly	Intermediate	12 ft	16 ft	Yes		X		X	5-8 ft	Plant Guide	Adapted to wetter sites and along streams above 2600 ft	Readily
Arrowwood (<i>Viburnum dentatum</i>)	Moderately Well - Poorly	Intermediate	10 ft	10 ft	Yes		X	X	X	3-6 ft	Plant Guide	Excellent wildlife food source. Adapted for wetter conditions	Somewhat Available
Blueberry, Highbush (<i>Vaccinium corymbosum</i>)	Moderately Well - Poorly	Intolerant	6 ft	10 ft	Yes		X			3-6 ft	Plant Guide	Adapted to acidic wet conditions. Sometimes hard to establish.	Readily
Buttonbush (<i>Cephalanthus occidentalis</i>)	Somewhat Poorly - Poorly	Tolerant	10 ft	20 ft	Yes		X	X		5-8 ft	Plant Sheet	Only suited for very wet sites. Will tolerate inundation. Provides food and cover for waterfowl.	Rarely
Chokeberry, Red (<i>Photinia pyrifolia</i>)	Moderately Well - Poorly	Intolerant	5 ft	5 ft	Yes		X			3-6 ft	No	Low-growing attractive shrub and wildlife food plant. Birds utilize the fruit throughout the winter months. Frequently used as an ornamental	Readily
Crabapple, Sargent's (<i>Malus Sargentii</i>)	Well - Somewhat Poorly	Intolerant	10 ft	10 ft	No	2-3 ft	X			3-6 ft	No	Has persistent fruit that is somewhat valuable to wildlife through winter months. Attractive and hardy.	Readily
Crabapple, Southern (<i>Malus angustifolia</i>)	Well - Moderately Well	Intermediate	15 ft	25 ft	Yes	2-3 ft	X			5-8 ft	Plant Sheet	If near red cedars keep a minimum distance of 500 ft to prevent spread of cedar apple rust.	Rarely
Cranberry, Highbush (<i>Viburnum trilobum</i>)	Moderately Well - Poorly	Intolerant	12 ft	12 ft	Yes	2-3 ft	X	X		3-6 ft	Plant Sheet Plant Guide	Attractive screen and hedgerow plant. Useful in ornamental and wildlife plantings.	Readily
Dogwood, Flowering (<i>Cornus florida</i>)	Well - Somewhat Poorly	Tolerant	30 ft	40 ft	Yes	2-3 ft	X	X		4-8 ft	Plant Sheet	Berries eaten by songbirds, grouse, turkey, quail, squirrels; browsed by deer, rabbits. Often used as an ornamental.	Readily
Dogwood, Gray (<i>Cornus racemosa</i>)	Moderately Well - Somewhat Poorly	Tolerant	10 ft	15 ft	Yes	2-3 ft	X	X		5-8 ft	Plant Sheet	Excellent for small screens, streambank stabilization and as an ornamental.	Readily
Dogwood, Redosier (<i>Cornus sericea</i>)	Somewhat Poorly - Poorly	Intermediate	10 ft	20 ft	Yes	2-3 ft		X	X	5-8 ft	Plant Guide	Excellent streambank cover. With some wildlife benefits.	Readily
Dogwood, Silky (<i>Cornus amomum</i>)	Well - Somewhat Poorly	Tolerant	12 ft	12 ft	Yes	2-3 ft	X	X	X	3-6 ft	Plant Sheet	Stoloniferous. Produces fruit in 3 -5 years. Excellent wildlife plant.	Readily
Elderberry (<i>Sambucus canadensis</i>)	Well - Somewhat Poorly	Intolerant	7 ft	7 ft	Yes		X	X	X	3-6 ft	Plant Sheet Plant Guide	Excellent all around wildlife plant. Suckers freely. Many species of birds and mammals utilize the fruit.	Readily
Hawthorn, Washington (<i>Crataegus phaenopyrum</i>)	Well - Somewhat Poorly	Intermediate	25 ft	25 ft	Yes	3-6 ft		X	X	5-8 ft	No	Provides excellent wildlife cover. Not as prone to spreading as some introduced hawthorns.	Somewhat Available
Hazelnut, American (<i>Corylus americana</i>)	Well - Moderately Well	Tolerant	10 ft	10 ft	Yes		X	X		3-6 ft	Plant Guide	Provides cover and nesting for wildlife. The leaves, twigs, and catkins are browsed by rabbits and deer.	Somewhat Available
Holly, American (<i>Ilex opaca</i>)	Well - Somewhat Poorly	Tolerant	20 ft	60 ft	Yes	3-6 ft		X	X	5-8 ft	Plant Sheet	Evergreen. It is important to plant males as well as females if berry production is desired. Used as winter cover and ornamental.	Readily
Hornbeam, American (<i>Carpinus caroliniana</i>)	Moderately Well - Somewhat Poorly	Tolerant	15 ft	40 ft	Yes		X		X	5-8 ft	Plant Guide	This species produces large amounts of seed eaten by many birds and mammals. Found along streams and rivers. Excellent riparian species.	Somewhat Available
Lespedeza, Bicolor (<i>Lespedeza bicolor</i>)	Well - Moderately Well	Intolerant	6 ft	6 ft	No		X			2 ft	Plant Sheet	This semi-woody sub-shrub provides an excellent food source for many species of wildlife. Best seeded directly.	Readily
Lespedeza, Shrub (<i>Lespedeza thunbergii</i>)	Well - Somewhat Poorly	Intolerant	8 ft	8 ft	No		X			2-3 ft	Plant Sheet	As above - This semi-woody sub-shrub provides an excellent food source for many species of wildlife. Best seeded directly.	Readily
Locust, Bristly (<i>Robinia hispida</i>)	Well - Moderately Well	Intolerant	7 ft	7 ft	Yes	3-6 ft				--	Plant Sheet	Excellent for erosion control. Minimal wildlife value. Mainly used for reclamation of mined sites. Many varieties available.	Readily
Nannyberry (<i>Viburnum lentago</i>)	Well - Poorly	Tolerant	25 ft	25 ft	Yes	3-6 ft	X	X	X	5-8 ft	Plant Guide	Excellent wildlife, hedgerow, screen and ornamental shrub suited to a variety of sites. Commercially available and common throughout WV.	Readily
Ninebark (<i>Physocarpus opulifolius</i>)	Well - Somewhat Poorly	Intolerant	10 ft	10 ft	Yes		X			5-8 ft	Plant Guide	Tolerates a wide variety of conditions including nuclear attack. Difficult to eradicate once established. Used by a variety of riparian birds.	Readily
Pawpaw (<i>Asimina triloba</i>)	Moderately Well - Poorly	Tolerant	30 ft	35 ft	Yes		X			4-8 ft	No	Site specific and often difficult to establish. Common in floodplains in the understory. Good wildlife food source.	Somewhat Available
Pepperbush, Sweet (<i>Clethra acuminata</i>)	Well - Somewhat Poorly	Tolerant	8 ft	15 ft	Yes	2-6 ft		X		5-8 ft	No	Attractive summer-flowering shrub usually found on sandstone based soils.	Rarely
Sourwood (<i>Oxydendrum arboreum</i>)	Somewhat Poorly - Poorly	Intermediate	20 ft	35 ft	Yes		X			5-8 ft	No	Beautiful native ornamental often difficult to establish. Wildlife browse the sour tasting foliage.	Readily

Appendix 1 - Tree and Shrub Species Tables 1 and 2 (continued)

SHRUBS	Soil Drainage Class ¹	Shade Tolerance ²	Height at 20 Years ³	Approx. Height at Maturity ⁴	Native ⁵	Suitable Use(s)			Wildlife Spacing	Plant Information Sheet Available ⁸	Remarks	Commercial Availability ⁹	
						Visual Screens or Barriers ⁶	Wildlife ⁷						
							Food	Cover					Corridors
Spicebush, Northern (<i>Lindera benzoin</i>)	Moderately Well - Poorly	Intermediate	12 ft	15 ft	Yes		X			5-8 ft	Plant Guide	Attractive fragrant understory tree common throughout the state. Sometimes planted as an ornamental.	Readily
Steeplebush (<i>Spiraea tomentosa</i>)	Somewhat Poorly - Poorly	Intolerant	4 ft	6 ft	Yes	2-3 ft	X		X	3-6 ft	No	Rhizomatous growth form that provides dense wildlife cover relatively quickly. Usually found on wetter sites.	Rarely
Swamp Rose (<i>Rosa palustris</i>)	Somewhat Poorly - Poorly	Tolerant	8 ft	8 ft	Yes	2-3 ft		X	X	3-6 ft	No	Prefers permanent saturation. May spread under suitable conditions.	Somewhat Available
Wild Raisin (<i>Viburnum cassinoides</i>)	Somewhat Poorly - Poorly	Tolerant	15 ft	15 ft	Yes			X	X	5-8 ft	No	Excellent wildlife shrub in wetter conditions. Suited to the eastern mountain counties.	Rarely
Winterberry (<i>Ilex verticillata</i>)	Somewhat Poorly - Poorly	Intermediate	10 ft	10 ft	Yes	3-6 ft	X	X	X	3-6 ft	Plant Sheet	Fruit is poisonous to humans. Higher elevation deciduous holly suited to the eastern mountain counties. Excellent for wildlife.	Readily
Willow, Purpleosier (<i>Salix purpurea</i>)	Well - Poorly	Intolerant	10 ft	10 ft	No	2-3 ft				--	Plant Sheet	Excellent streambank stabilization and bio engineering plant suitable to dormant whip type plantings. Many cultivars are available.	Somewhat Available
Witch Hazel (<i>Hamamelis virginiana</i>)	Well - Somewhat Poorly	Intermediate	15 ft	20 ft	Yes		X			5-8 ft	No	Good native wildlife food source. Sometimes hard to establish.	Somewhat Available
Yew, American (<i>Taxus canadensis</i>)	Well - Moderately Well	Tolerant	5 ft	5 ft	Yes	2-3 ft		X		3-6 ft	No	Used as an ornamental. Birds eat the flesh covered berries. Adapted to high elevations in the mountain counties of the east. Browsed heavily by	Readily

Appendix 1 - Tree and Shrub Species Tables 1 and 2 (continued)

TREES	Soil Drainage Class ¹	Shade Tolerance ²	Height at 20 Years ³	Aprox. Height at Maturity ⁴	Native ⁵	Suitable Use(s)					Plant Information Sheet Available ⁹	Remarks	Commercial Availability ¹⁰	
						Windbreaks Screens Barriers or Other ⁶	Wildlife ⁷			Wildlife Spacing				Timber Production Spacing ⁸
							Food	Cover	Corridors					
Alder, European Black (<i>Alnus glutinosa</i>)	Well - Moderately Well	Intermediate	40 ft	60 ft	No	8-12 ft *			X	8-12 ft		Plant Sheet	Excellent for reclamation. Nitrogen fixer. Good for hedgerow and windbreaks where non-natives are acceptable.	Readily
Ash, Green (<i>Fraxinus pennsylvanica</i>)	Moderately Well - Poorly	Intermediate	50 ft	80 ft	Yes	8-12 ft	X		X	8-12 ft		Plant Sheet	The seeds are eaten by a number of birds and mammals. Extensively planted as a shade and ornamental tree.	Readily
Ash, White (<i>Fraxinus americana</i>)	Well - Somewhat Poorly	Intermediate	50 ft	80 ft	Yes	8-12 ft	X	X	X	8-12 ft	20 X 20 ft	Plant Guide	Excellent all purpose ornamental, wildlife, and shade tree. Has commercial timber value.	Readily
Basswood (<i>Tilia americana</i>)	Well - Moderately Well	Intermediate	45 ft	80 ft	Yes	8-12 ft	X		X	8-12 ft	6 - 8 ft	Plant Guide	Basswood is good browse and buds are important for birds and deer in winter. Planted as a shade tree or ornamental.	Readily
Birch, Black (<i>Betula nigra</i>)	Well - Somewhat Poorly	Intolerant	40 ft	80 ft	Yes			X	X	8-12 ft		Plant Sheet	Native riparian tree. Its young twigs, buds, foliage and seeds are used by a variety of wildlife.	Somewhat Available
Blackgum (<i>Nyssa sylvatica</i>)	Well - Somewhat Poorly	Tolerant	30 ft	95 ft	Yes		X			8-12 ft		Plant Sheet	Black bears, foxes, wood ducks, wild turkeys, robins, brown thrashers, thrushes, and flickers frequently eat the fruit.	Readily
Boxelder (<i>Acer negundo</i>)	Well - Poorly	Intermediate	35 ft	60 ft	Yes				X	8-12 ft		Plant Guide	Very quick growing. Found along streams and frequently flooded areas. Relatively short lived and often disease prone.	Readily
Cedar, Northern White (<i>Thuja occidentalis</i>)	Well - Somewhat Poorly	Intermediate	25 ft	50 ft	Yes	8-12 ft			X	8-12 ft		Plant Guide	Also called Arborvitae. Popular ornamental for screens and hedgerows in limestone areas. Provides some nesting cover.	Readily
Cedar, Atlantic White (<i>Chamaecyparis thyoides</i>)	Moderately Well - Poorly	Tolerant	20 ft	90 ft	No	8-12 ft			X	8-12 ft		Plant Guide	Similar to Arborvitae. A coastal species not native to WV. Tolerant of wetter conditions.	Readily
Cherry, Black (<i>Prunus serotina</i>)	Well - Somewhat Poorly	Intolerant	40 ft	100 ft	Yes	8-12 ft	X		X	8-12 ft	20 X 20 ft	Plant Guide	Valuable food source for many wildlife species. Used for commercial timber and ornamental purposes on a wide variety of soils.	Readily
Chestnut, Chinese (<i>Castanea mollissima</i>)	Well - Moderately Well	Intolerant	25 ft	70 ft	No	8-12 ft	X			8-12 ft		No	Mostly planted as an ornamental. Some wildlife utilize the chestnuts.	Readily
Cucumber-Tree (<i>Magnolia acuminata</i>)	Well - Moderately Well	Intolerant	40 ft	100 ft	Yes	8-12 ft			X	8-12 ft	6 - 8 ft	No	Beautiful native tree common throughout WV. Minimal wildlife value. Sometimes used as an ornamental and timber species.	Readily
Cottonwood, Eastern (<i>Populus deltoides</i>)	Well - Somewhat Poorly	Intermediate	50 ft	120 ft	Yes	8-12 ft			X	8-12 ft		Plant Sheet	Fast growing and used in reclamation. Hybrids make good selections for windbreaks in multi-row installations.	Readily
Fir, Douglas (<i>Pseudotsuga menziesii</i>)	Well - Moderately Well	Intermediate	40 ft	200 ft	No	8-12 ft			X	8-12 ft		Plant Guide Plant Sheet	One of the world's most important timber species. Excellent as wildlife, windbreak, and Christmas tree.	Readily
Hackberry (<i>Celtis occidentalis</i>)	Well - Somewhat Poorly	Intermediate	40 ft	70 ft	Yes	8-12 ft	X		X	8-12 ft		Plant Sheet	Birds use the mature trees for nesting sites and feed on the fruit. Young stands also provide shelter for game birds and rabbits.	Readily
Hemlock, Eastern (<i>Tsuga canadensis</i>)	Well - Somewhat Poorly	Tolerant	20 ft	100 ft	Yes	8-12 ft			X	8-12 ft		Plant Guide	This tree is versatile as a hedge, large timber species, screen and wildlife tree. Different cultivars exist. Native and attractive.	Readily
Hickory, Shagbark (<i>Carya ovata</i>)	Well - Moderately Well	Intermediate	15 ft	90 ft	Yes		X			8-12 ft		No	Develops deep taproot in the first few years. Needs deep alluvial soils. Slow growing. Excellent nut producer. Some timber value.	Readily
Honeylocust (<i>Gleditsia triacanthos</i>)	Well - Somewhat Poorly	Intolerant	35 ft	80 ft	No	8-12 ft						Plant Guide	Planted as a hardy and fast-growing ornamental. Minimal wildlife value. Highly regarded in urban settings with many cultivars.	Readily
Larch, Japanese (<i>Larix kaempferi</i>)	Well - Somewhat Poorly	Intolerant	20 ft	100 ft	No	8-12 ft *						No	Deciduous conifer used primarily as an ornamental and timber trainer. Very minimal wildlife value.	Readily
Locust, Black (<i>Robinia pseudoacacia</i>)	Well - Somewhat Poorly	Intermediate	40 ft	80 ft	Yes	8-12 ft *	X		X	8-12 ft		Plant Sheet	Easy to establish. Early successional species and may be relatively short lived. Bee attractant. Nitrogen fixing species.	Readily
Maple, Red (<i>Acer rubrum</i>)	Well - Poorly	Intermediate	40 ft	90 ft	Yes	8-12 ft			X	8-12 ft		Plant Sheet Plant Guide	Valued as native ornamental. Early blooming and important as an early pollinator for many insects. Grows in almost any condition.	Readily
Maple, Silver (<i>Acer saccharinum</i>)	Moderately Well - Poorly	Intermediate	45 ft	80 ft	Yes	8-12 ft			X	8-12 ft		Plant Guide Plant Sheet	Important as cavity tree and somewhat important as a wildlife food source. May be disease prone and susceptible to storm damage.	Readily
Maple, Sugar (<i>Acer saccharum</i>)	Well - Somewhat Poorly	Tolerant	20 ft	100 ft	Yes	8-12 ft			X	8-12 ft		Plant Guide	Popular and long-lived shade and ornamental tree. Tolerates a wide range of conditions. Important for cavity nesting wildlife.	Readily
Mulberry, Red (<i>Morus rubra</i>)	Well - Somewhat Poorly	Intermediate	45 ft	70 ft	Yes		X		X	8-12 ft		No	Excellent wildlife tree for a variety of species especially birds. Sometimes hard to establish. Very site specific.	Somewhat Available
Oak, Chinquapin (<i>Quercus muehlenbergii</i>)	Well - Moderately Well	Intolerant	40 ft	80 ft	Yes	8-12 ft	X		X	8-12 ft		No	Rare throughout its range. Site specific to alkaline soils and limestone outcropped areas. Good riparian species.	Readily
Oak, Northern Red (<i>Quercus rubra</i>)	Well - Moderately Well	Intermediate	35 ft	100 ft	Yes	8-12 ft	X		X	8-12 ft	20 X 20 ft	Plant Guide	One of our most important and handsome oaks. Important as a wildlife food source, timber species and ornamental.	Readily
Oak, Overcup (<i>Quercus lyrata</i>)	Moderately Well - Poorly	Intermediate	30 ft	80 ft	No	8-12 ft	X		X	8-12 ft	20 X 20 ft	Plant Guide	Often planted for timber and as an ornamental and to improve wildlife habitat for bottomland restoration. Native to the mid-west.	Readily

Appendix 1 - Tree and Shrub Species Tables 1 and 2 (continued)

TREES	Soil Drainage Class ¹	Shade Tolerance ²	Height at 20 Years ³	Aprox. Height at Maturity ⁴	Native ⁵	Suitable Use(s)					Plant Information Sheet Available ⁸	Remarks	Commercial Availability ⁹	
						Windbreaks Screens Barriers or Other ⁶	Wildlife ⁷			Wildlife Spacing				Timber Production Spacing
							Food	Cover	Corridors					
Oak, Pin (<i>Quercus palustris</i>)	Moderately Well - Poorly	Intolerant	40 ft	100 ft	Yes	8-12 ft	X			8-12 ft		Plant Sheet	Adapted to wetter sites. Good mast producer and attractive ornamental. Utilized by various wildlife especially wood ducks.	Readily
Oak, Post (<i>Quercus stellata</i>)	Well - Moderately Well	Intermediate	25 ft	80 ft	Yes	8-12 ft	X		X	8-12 ft		No	Tolerates harsh conditions and drought. Slow growing and may be susceptible to chestnut blight. Sometimes used as an ornamental.	Somewhat Available
Oak, Shingle (<i>Quercus imbricaria</i>)	Well - Moderately Well	Intolerant	30 ft	45 ft	Yes	8-12 ft			X	8-12 ft		No	An ornamental and shade tree, it is suitable for hedges, screens and windbreaks. Relatively low wildlife value among oaks.	Readily
Oak, Sawtooth (<i>Quercus acutissima</i>)	Well - Moderately Well	Intermediate	50 ft	70 ft	No		X		X	15-20 ft		Plant Sheet	Wildlife oak that produces heavy amounts of small acorns attractive to many animal species. Relatively fast growing.	Somewhat Available
Oak, Swamp White (<i>Quercus bicolor</i>)	Somewhat Poorly - Poorly	Intermediate	30 ft	100 ft	Yes		X		X	8-12 ft		Plant Guide	Requires moist acidic conditions. Important food for wildlife such as squirrels, black bear, ducks and turkey. Often hybridizes.	Readily
Oak, White (<i>Quercus alba</i>)	Well - Moderately Well	Intermediate	30 ft	100 ft	Yes	8-12 ft	X		X	8-12 ft	20 X 20 ft	Plant Sheet	Extremely important as a timber and wildlife food tree. Slow growing and often difficult to establish.	Readily
Paulownia, Royal (<i>Paulownia tomentosa</i>)	Well - Moderately Well	Intermediate	60 ft	70 ft	No						10 - 20 ft	No	Rapidly growing introduced species. Specialized commercial timber species. Often escapes and has no known wildlife value.	Readily
Persimmon, Common (<i>Diospyros virginiana</i>)	Well - Somewhat Poorly	Intermediate	25 ft	50 ft	Yes		X			8-12 ft		Plant Guide	Used by raccoon, opossum, and various birds, including quail, wild turkey and cedar waxwing. Slow growing and difficult to transplant.	Somewhat Available
Pine, Austrian Black (<i>Pinus nigra</i>)	Well - Somewhat Poorly	Intermediate	35 ft	100 ft	No	6-7 ft			X	8-12 ft		No	Non-native used mainly for ornamentals, screens and as a reclamation plant. Used as winter cover for various bird species.	Readily
Pine, Eastern White (<i>Pinus strobus</i>)	Well - Somewhat Poorly	Intolerant	40 ft	130 ft	Yes	6-7 ft			X	8-12 ft	6 - 8 ft	Plant Sheet	Squirrels and 16 species of songbirds have been known to eat the seed. Native pine with commercial timber and ornamental value.	Readily
Pine, Loblolly (<i>Pinus taeda</i>)	Well - Somewhat Poorly	Tolerant	50 ft	100 ft	No	6-7 ft			X	8-12 ft	6 - 8 ft	No	Important timber species. Provides some cover and browse in winter months to wildlife.	Readily
Pine, Scotch (<i>Pinus sylvestris</i>)	Well - Moderately Well	Intolerant	30 ft	110 ft	No	6-7 ft			X	8-12 ft		Plant Sheet	Used in windbreaks as the central or leeward rows of multi-row plantings. Important Christmas tree species. Some wildlife use.	Readily
Pine, Virginia (<i>Pinus virginiana</i>)	Well - Moderately Well	Intermediate	25 ft	70 ft	Yes	6-7 ft	X	X		8-12 ft	6 - 8 ft	No	Native pine used primarily as pulpwood. Provides some wildlife food and cover. Sometimes used in windbreaks and screens.	Readily
Poplar, Yellow (<i>Liriodendron tulipifera</i>)	Moderately Well - Somewhat Poorly	Intolerant	60 ft	120 ft	Yes		X		X	10-15 ft		Plant Sheet	Fast growing. Attractive ornamental but very large. Important timber species in WV. Provides some secondary wildlife food.	Somewhat Available
Redbud, Eastern (<i>Cercis canadensis</i>)	Well - Somewhat Poorly	Tolerant	16 ft	16 ft	Yes		X			5-8 ft		Plant Guide	Many birds, including bobwhite quails, eat the seeds. Honeybees use the blossoms. Often planted as an ornamental.	Readily
Redcedar, Eastern (<i>Juniperus virginiana</i>)	Well - Somewhat Poorly	Intermediate	25 ft	80 ft	Yes	8-12 ft	X	X		8-12 ft		Plant Sheet Plant Guide	Eastern redcedar provides habitat for a variety of wildlife. Specific to limestone associated sites. Cedar-apple rust host.	Readily
Serviceberry, Common (<i>Amelanchier arborea</i>)	Well - Somewhat Poorly	Tolerant	20 ft	50 ft	Yes	8-12 ft	X			8-12 ft		Plant Guide	At least 40 bird species, rabbits, chipmunks, mice, voles, foxes, and black bears eat the fruit. Widely used as an ornamental.	Readily
Spruce, Norway (<i>Picea abies</i>)	Well - Somewhat Poorly	Intermediate	35 ft	120 ft	No	8-12 ft *			X	8-12 ft		No	Important as a windbreak, screen and ornamental. Winter cover for some resident birds. Mourning doves utilize this tree for nesting.	Readily
Spruce, Red (<i>Picea rubens</i>)	Well - Moderately Well	Tolerant	25 ft	110 ft	Yes	8-12 ft	X	X	X	8-12 ft		Plant Sheet	One of the most important timber and wildlife species in North America. Site specific above 3000 feet in eastern counties of WV.	Readily
Spruce, White (<i>Picea glauca</i>)	Well - Somewhat Poorly	Intermediate	30 ft	100 ft	No	8-12 ft	X	X		8-12 ft		Plant Guide	Important as a screen, timber and ornamental. Winter cover and food for some birds. Hybridizes freely. Native to the northeast.	Readily
Sycamore, American (<i>Platanus occidentalis</i>)	Moderately Well - Poorly	Intermediate	65 ft	100 ft	Yes				X	8-12 ft		Plant Guide	Very quick growing and large. Slow decaying leaves. Prone to disease. Found along streambanks and a variety of other sites.	Readily
Sweetgum (<i>Liquidambar styraciflua</i>)	Well - Somewhat Poorly	Intolerant	50 ft	100 ft	Yes	8-12 ft			X	8-12 ft		Plant Sheet Plant Guide	Prefers deep soils for root development. Important as a timber, wildlife and ornamental. Tolerates a variety of sites and conditions.	Readily
Walnut, Black (<i>Juglans nigra</i>)	Well - Moderately Well	Intermediate	35 ft	100 ft	Yes		X		X	10-20 ft	20 X 20 ft	Plant Sheet	Prefers deep well drained soils. Important as a timber and nut crop tree. Produces juglone that inhibits competition.	Readily

* These species may be utilized as stock trainers for high quality timber production.

Appendix 2 - Care and Planting of Seedlings

Planting Time

Trees/shrubs can be planted in the fall from the time growth stops until the soil is frozen; or in the spring after the soil has thawed until bud break which usually occurs by April 15th in most places in West Virginia.

Avoid fall planting in clay soils due to frost heaving.

Care, Handling, Size Requirements for Woody Planting Stock

The following should be done when seedlings are received to increase survival rates:

Planting stock should be free of disease, insects, and mechanical injury and have a well-developed root system. All conifers must have dormant buds.

Unwrap bundles, check plants for heating, molding, and dryness. Water seedlings, if necessary, and rewrap. If they are satisfactory, store them in a cool, moist environment (34-38 degrees F). During all stages of handling and storage, keep stock tops dry and free of mold and roots moist and cool. Destroy stock that has been allowed to dry, to heat up in storage (e.g., within a bale, delivery carton or container), or that has developed mold or other pests. Live cuttings that will not be immediately planted shall be promptly placed in controlled storage conditions (34-38 degrees F) and protected until planting time.

If controlled storage is not available and seedlings cannot be planted within two days of receipt, dig a trench about one foot deep and bury the seedling roots in soil. This is called "heeling-in". See Figure 1. Pack the soil firmly, water thoroughly, and make certain all roots are covered. Evergreens require extreme care. When heeling in evergreens, split bundles and spread out the seedlings in the trench to make sure the root system of each seedling is protected by soil. Seedlings may also be stored in a cooler as long as the plants are still dormant.

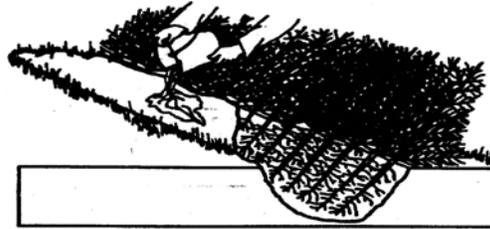


Figure 1 – Healed-In Seedlings

(Source: WV Department of Agriculture Form FM-18)

Seedlings shall not be less than ¼" in caliper at 1" above the root collar. For cuttings, avoid using material less than ¾" in diameter, cut off tops with apical buds, remove side branches, and produce lengths long enough to reach adequate soil moisture required by the individual species during the growing season. Tops of dormant-season collected cuttings may be dipped into latex paint, paraffin or sealing wax to prevent desiccation and mark the up-end. Rooted planting stock must not exceed a 2:1 shoot-to-root ratio and have a minimum of a 1:1 root shoot ratio.

General size guidelines are as follows:

Hardwoods - seedlings should have a minimum height of 6-12 inches and a minimum root length of 10 inches.

Hardwood Cuttings - 18 inches minimum length

Rooted Cuttings - 8 inches minimum length

Conifers - seedlings should have a minimum height of 6-12 inches and a minimum root length of 8 inches

Planting Methods

Seedlings may be planted with any of the following: mattock, planting dibble, hoedad, planting bar, tile spade, post hole digger, tractor/auger, or tree planting machine. The method of planting will depend on the terrain and the type of seedlings being planted. The technique used should ensure the proper depth and placement of planting stock roots.

Roots of bareroot stock shall be kept moist during planting operations by placing in a water-soil (mud) slurry, peat moss, super-

absorbent (e.g., polyacrylamide) slurry or other equivalent material. Rooting medium kept moist at all times by periodic watering. Pre-treat stored cuttings with several days of soaking just before planting. Stock shall not be planted when the soil is frozen or dry. Rooted stock will be planted in a vertical position with the root collars approximately ½-inch below the soil surface. Insert cuttings to the depth required to reach adequate soil moisture. 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. After planting of rooted stock or cuttings, pack soil around each plant firmly to eliminate air pockets. See Figure 2.

Dibble Planting Technique

- (1) Insert the dibble straight down into the soil to the full depth of the blade and pull back on the handle to open the planting hole. (DO NOT rock the dibble back and forth as this causes soil in the planting hole to be compacted, inhibiting root growth.
- (2) Remove the dibble and push the seedling roots deep into the planting hole. Pull the seedling back up to the correct planting depth (the root collar should be 1 to 3 inches below the soil surface). Gently shake the seedling to allow the roots to straighten out. DO NOT twist or spin the seedling or leave the roots J-rooted.
- (3) Insert the dibble into the soil several inches in front of the seedling.
- (4) Push the handle forward to close the hole and hold the seedling in place.
- (5) Pull back on the handle to close the planting hole eliminating air pockets around the roots.
- (6) Remove the dibble and close and firm up the opening with your heel. Be careful to avoid damaging the seedling.

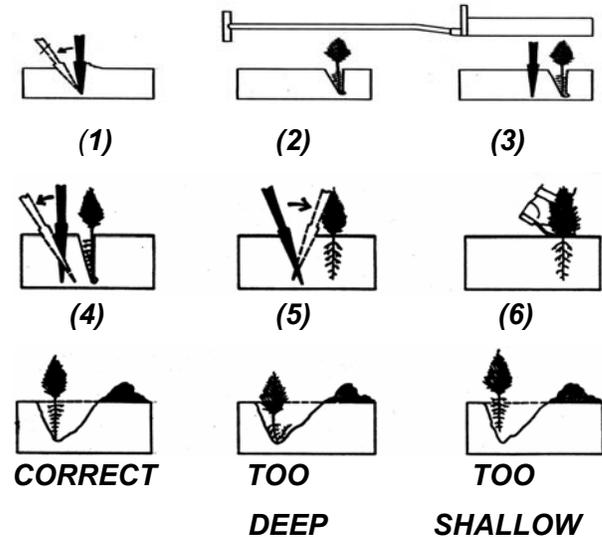


Figure 2 – Correct Dibble Planting Technique

(Source: WV Department of Agriculture Form FM-18)

Maintenance and Cultural Practices

Routine surveillance is necessary to detect insect, disease, and animal damage. Competition should also be evaluated while plantings are becoming established.

Control competing vegetation during the first 2 or 3 years by mowing, cultivating, mulching, herbicides, or plant mats.

Mowing – Mowing should be done with extreme caution to avoid damage to the seedlings. Vegetation between rows can be left for wildlife food and cover. For optimum wildlife habitat, do not mow during the primary nesting season (April 15 to August 15).

Mulching - When used, mulch should be placed two to four inches deep and extended as far as possible from the base of the plant (at least two feet for young specimens). When possible mulch should extend two or three times the branch spread of the plant specimen.

An adequate mulch layer is two to four inches of loosely packed organic material such as shredded leaves, pine straw, peat moss or composted wood chips. Mulch

layers in excess of five inches may inhibit gas exchange.

Plastic should not be used because it interferes with the exchange of gases between the soil and air and inhibits root growth.

*Herbicides – **NOTE: NRCS does not make pesticide recommendations.** Landowners should be told to read product labels and follow product specifications. Landowners may contact the West Virginia Division of Forestry or the WVU Cooperative Extension Service for pesticide recommendations. Herbicides can be spot sprayed around seedlings or applied to the planting strip. Pre-emergent herbicides are most effective if applied to the planting strip. Seedlings should be protected during herbicide applications. Herbicides should not be planted on windy days when drift can damage surrounding seedlings.*

References

Forest Management Handbook, West Virginia Division of Forestry, 1985.

Service Foresters Handbook, USDA Forest Service, NE State and Private Forestry, February 1978.

West Virginia Forest Stewardship Incentive Program Training, Reference, and Procedures Manual, West Virginia Division of Forestry, WVDOP-TR-92-1, Revised 12/97.

Appendix 3 - Care and Planting of Balled/Burlapped and Containerized Stock

Planting Time

Trees/shrubs can be planted in the fall from the time growth stops until the soil is frozen; or in the spring after the soil has thawed until bud break which usually occurs by April 15th in most of West Virginia.

Avoid fall planting in clay soils due to frost heaving.

Stock should be kept in a shady area and kept moist until planting.

Planting Methods

Hand or machine planting may be used. The techniques used should ensure the proper depth and placement of planting stock roots.

Dig a large planting hole. CAUTION: Be sure you have had all underground utilities located prior to digging. The planting hole should be dug as deep as and at least 24 inches wider than the root ball. A large-sized hole is important because as the tree begins to take hold in the ground, its roots must push through the surrounding soil. Roots have difficult time if the soil is rocky or compact; however, if the soil has been loosened by digging and backfilling, the roots will have room to establish well.

Prune sparingly. Examine the specimen closely for injury to roots or branches. If any roots are crushed, cut them at a point just in front of the break. On the top, prune only broken branches, making sure to leave the branch collar (swollen part where one branch meets another) intact. Begin corrective pruning after a full season of growth in the new location. See *Tree/Shrub Pruning* – 660.

Prepare the hole and soil. While some newly transplanted trees may benefit from an application of plant food, it is best not to use fertilizer until the plant is well-established. Good, rich native soil is usually adequate. Never apply high nitrogen fertilizer at planting as it may burn tender roots. To reduce the possibility of planting the

specimen too deep, the excavated hole is recommended to be no deeper than the depth of the root ball. Use the material excavated from the hole as backfill if at all possible. In cases where soil conditions are fair to poor, peat moss is recommended as an additive, not to exceed 1/4 by volume.

Place tree at the proper height. To avoid damage, when setting the plant in the hole, always lift the tree by the root ball, never by the trunk. Add a sufficient amount of soil to the hole to bring the plant to its original growing level. This level is indicated by a dark stain on the trunk which marks the difference between root and trunk bark. Keep in mind that on balled and burlap plants, the point at which the burlap is tied can be much higher than the original soil line. Planting at the proper height is important because if a plant is set too deep, its roots may suffocate; on the other hand, if the plant is set too shallow, the roots may dry out in the air and sun. See Figure 3.

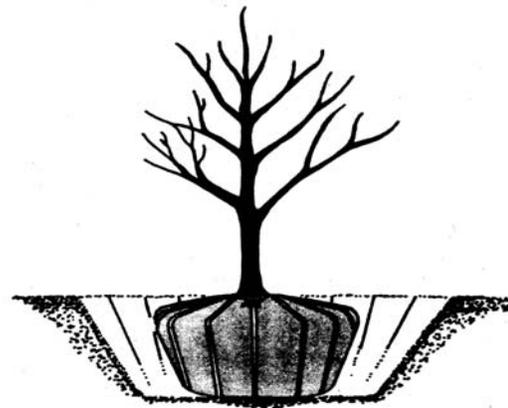


FIGURE 3. Correct planting of balled and burlap specimen.

Source: *New Tree Planting* - International Society of Arboriculture

Stake the plant, if necessary. Staking a plant can cause bark damage and hinder root and plant stability, so it should be avoided where possible. However, if a specimen is too tall to stand alone, is planted in a windy area, or has a weak root system (such as a dwarf fruit tree), it should be staked to avoid shifting during heavy rains or high winds, as such movement can easily

damage tender roots. Staking must be done carefully with soft strapping material such as woven belt fabric or padded wire. Drive two or three stakes in the ground just outside the perimeter of the planting hole, spacing them an equal distance apart. For each stake, attach one end of the strapping material to the plant at the lowest practical level to maintain it upright and fasten the other end to the stake. Remove the stakes as soon as the plant has firmly rooted itself in the soil. As a rule, the stakes should not be left in place for more than a year. See Figure 4.

Mulch the base of the plant. Mulch should be applied to the area at the base of the plant. Some good choices of material are leaf litter, pine straw, shredded bark and twigs, peat moss, and composted wood chips. A two to four-inch layer is adequate. Mulch should not be placed directly against the root collar and a saucer along the outside edge of mulch is not recommended. Mulch helps conserve moisture, minimize grass and weed competition and protects the tree from lawnmowers and weed cutters..

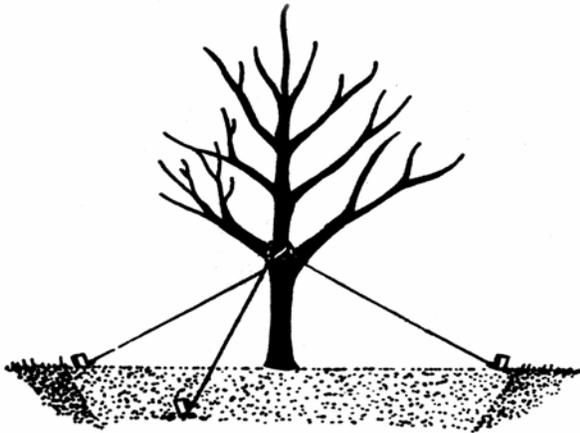


Figure 4. Correct staking of balled and burlap specimen.

Source: *New Tree Planting - International Society of Arboriculture*

Planting Stock

Large (Balled and Burlap) Stock – Caliper and minimum ball diameters can be determined by referring to the *American Standard for Nursery Stock* which is located in the NRCS State Office.

Planting Time

Containerized Plants/Seedlings – Containerized items usually have better survival. Containerized specimens can be stored for extended periods if they are protected. Store the plants in partial to full shade and water frequently.

Maintenance and Cultural Practices

Since many roots were removed when the plant was dug in the nursery, regular watering is important to aid the development of a strong new root system at the new site. Keep the soil moist but not soaked, as overwatering will cause leaves to turn yellow or fall off. Water plants at least once a week if there is no soaking rain, and more frequently in hot weather. When the soil is dry four inches below the surface, it is time to water. Continue until mid-fall then taper off, as this is the time for the plant to stop growing and harden off.

Inspect specimens at least once a year. During the inspection, be sure to evaluate: tree vigor, new leaves or buds, leaf size, twig growth, and crown die-back, if any. Also look for insect, disease, and / or animal damage.

A reduction in the extension of shoots or in the size of leaves is a fairly reliable cue that the plant's health has recently changed.

The use of fertilizer in the backfill at the time of planting is not recommended.

Apply fertilizer, in the according to soil test results. Fertilizer is best applied in the fall or early spring, although it is not harmful to apply fertilizer at any time during the year.

In the absence of soil test results, apply a slow release fertilizer containing 5% nitrogen, 10% phosphorous, 5% potash, and trace elements.

Fertilizer should be applied within the dripline of the plant at the rate of one cup per caliper-inch for trees and 1/2 cup per foot of height for shrubs.

Fertilizer application once every two to three years will usually suffice.

Replace mulch as needed.

See Tree / Shrub Pruning - 660.

References

American Standard for Nursery Stock - American Association of Nurserymen, Inc.

Mature Tree Care, International Society of Arboriculture, 1991.

New Tree Planting, International Society of Arboriculture, 1991.

Recommended Trees for Cities and Communities, West Virginia Division of Forestry.

Shade Tree Care. West Virginia Department of Agriculture, 07-P006.

Tree Selection, International Arboriculture, 1991.

Appendix 4 - Protection of Plantings/Seedlings

Seedlings may be protected from browsing, grazing, or gnawing with tree shelters, however, their expense should be taken into consideration when deciding whether or not to use them. These should be installed according to manufacturer guidelines. Shelter heights of 5 feet or greater are recommended. **Coniferous seedlings generally do not do well in tree shelters.**

Shelters should be maintained for a minimum of five years or until they disintegrate naturally. Competing vegetation should be removed from around the protected seedlings a distance of two feet for a period of 3 – 5 years.

Only commercially treated, fiberglass, or plastic stakes should be used to support the shelter. If it is not possible to obtain treated, fiberglass, or plastic stakes then oak, black locust or other rot resistant hardwood can be substituted.

Nets are also available to protect seedlings. They too should be installed according to manufacturer guidelines.

Repellents may also be used. Their effectiveness varies. Repellents should be applied according to manufacture guidelines.

Protection may also be provided by other means. See Fencing – 382 and Use Exclusion – 472.

Access / Fire Lanes

Allow room in plantations for access and fire lanes.

Pulpwood/Timber plantations – approximately 12 -16 foot wide every 400 – 600 feet.

See Firebreak – 394.

References

Forest Management Handbook, West Virginia Division of Forestry, 1985.

Service Foresters Handbook, USDA Forest Service, NE State and Private Forestry, February 1978.

West Virginia Forest Stewardship Incentive Program Training, Reference, and Procedures Manual, West Virginia Division of Forestry, WVDOF-TR-92-1, Revised 12/97.

Appendix 5 -Spacing Calculations

The following are some typical spacings that are used:

<i>Spacing (feet)</i>	<i>Trees Per Acre</i>
6x6	1210
8x6	908
8x7	778
8x8	681
10x6	726
10x7	622
10x8	544
10x10	436
12x12	302
15x15	194
16x16	170
20x20	109

The number of trees per acre for spacings can be determined by dividing the square footage of an acre (43560 square feet) by the square footage of the spacing. For example, the number of trees per acre for a 7' x 7' spacing would be:

$$\frac{43,560}{7 \times 7} = \frac{43560}{49} = 889$$

Shrub spacing should usually range from 3' to 6' feet for shrubs less than 10 feet in height and 5 to 8 feet for shrubs 10 to 25 feet in height (includes columnar trees).

Anticipated size of the shrub at maturity and aesthetic appeal should be considered when selecting shrub spacing.

Use closer spacing on areas with erosion hazard or where quick crown closure is desired.

Use wider spacing on plantings where the site is favorable for good survival, or on very steep slopes where the tendency is to plant too close.

Appendix 6 - Plantings for Timber Production

Spacing

Normal spacing for conifers should be a minimum of 6 x 7 feet or a maximum of 8 x 8 feet. The minimum spacing for hardwoods should be 10 x 10 feet. The maximum spacing should be 15 x 15 feet.

The spacing for high quality hardwood (black walnut, black cherry, oak, white ash, and paulownia) plantations should be at least 20 x 20 feet. Wider spacings needed to fit field proportions, mowing or other plantation requirements, available machinery and specific management objectives are acceptable but at least 70 trees per acre should be established.

Trainers can be established in conjunction with high quality hardwood plantings. Some suggested trainer species are Japanese larch, European alder, black locust, and Norway spruce.

Site Preparation

The planting site should be cleared to mineral soil in two foot diameter circles. Brushy sites should have all vegetation removed by either mechanical or chemical means. Prior to planting, cutting undesirable woody vegetation without follow-up chemical treatment is unacceptable. Pre-emergent herbicides, cultivation, or other weed control methods should be followed for at least three growing seasons. When using chemicals, read and follow label directions. See Forest Site Preparation - 490.

Planting Stock

Planting stock should be 1 to 2 year old seedlings with a minimum 1/4 inch stem caliper 1 inch above the root collar. Long lateral roots should be pruned.

Planting Methods

See Appendix 2 - Care and Planting of Seedlings

When planting high quality hardwoods for timber production an adequate sized hole should be prepared for seedlings with a post hole digger, mattock, or auger. A hole at least 12 inches deep should be dug. Fill the hole back in with loosened soil until the seedling can be planted a deep or slightly deeper than grow in the nursery. The holes should be at least the depth of the root length to prevent "J" rooting.

Cultural Practices

Provide intensive management to improve timber quality especially to species such as black walnut and paulownia.

See Tree/Shrub Pruning - 660 and Forrest stand Improvement - 666.

References

Black Walnut Advisory Sheets, USDA Forest Service, NE State and Private Forestry, Upper Darby, PA, 1970-1971.

Forest Management Handbook, West Virginia Division of Forestry, 1985.

Managers Handbook for Black Walnut, General Technical Report NC-38, North Central Forest Experiment Station, USDA-USFS, 1977.

Service Foresters Handbook, USDA Forest Service, NE State and Private Forestry, February 1978.

West Virginia Forest Stewardship Incentive Program Training, Reference, and Procedures Manual, West Virginia Division of Forestry, WVDOF-TR-92-1, Revised 12/97.

Appendix 7 - Christmas Tree Production

Christmas tree farming is not a “get-rich-quick proposition”. However, in many instances, growing Christmas trees has been shown to be an appropriate use of land.

Among the more important aspects that should be considered when discussing Christmas tree production with a landowner are: site, species, consumer preference, planting, insect/disease problems, shaping and shearing, weed control, fire control, and marketing.

Species Selection

Select Christmas tree species adapted to local soil and site conditions that will accomplish the landowner’s objectives.

Technical Guide Section II – Forestland Interpretations

Tables 3 and 4, may be used as a guideline when choosing Christmas tree species in West Virginia.

Site Preparation - See site preparation in previous section. Seedlings.

Spacing

Christmas trees – Usually 5’ x 5’ for spruces and firs and 6’ x 6’ for pines. Spacing may also be determined by mowing equipment, access requirements, and/or landowner desires.

Access / Fire Lanes

Allow room in plantations for access and fire lanes.

Christmas trees – approximately 8 foot wide every 200 – 300 feet.

Planting Methods - See planting methods in Appendix 2 of this standard.

Planting Stock - See planting methods in Appendix 2 of this standard.

Planting Time - See planting methods in Appendix 2 of this standard.

Maintenance and Cultural Practices

Christmas tree shearing should begin as needed after the third year.

See Tree/Shrub Pruning – 660.

See Technical Guide Reference (Forestry) – Christmas Tree Culture and Marketing, WVU-CES, Publication 525.

Fertilizer is best applied in the fall or early spring, although it is not harmful to apply fertilizer at any time during the year.

When applying fertilizer, nitrogen can be applied directly on the soil surface, whereas phosphorous and potassium, like other insoluble nutrients should applied via holes in the soil.

Maintain Christmas tree stocking at 100%.

References

Christmas Tree Culture and Marketing, WVU-CES, Publication 525.

Forest Management Handbook, West Virginia Division of Forestry, 1985.

Service Foresters Handbook, USDA Forest Service, NE State and Private Forestry, February 1978.

Table 3. Christmas Tree Species Selection Guidelines

<i>Elevation</i>	<i>Moist Soil</i>	<i>Dry Soil</i>
<i>Above 3,000 Feet</i>	<i>Balsam Fir Red Spruce White Spruce Norway Spruce Red Pine White Pine</i>	<i>Red Pine White Pine</i>
<i>1,500 – 3,000 Feet</i>	<i>Balsam Fir Norway Spruce Red Spruce White Spruce Blue Spruce Douglas-Fir* Scotch Pine White Pine Eastern Red Cedar</i>	<i>Scotch Pine White Pine Austrian Pine Eastern Red Cedar</i>
<i>Below 1,500 Feet</i>	<i>Norway Spruce Blue Spruce Douglas-Fir Scotch Pine Austrian Pine Eastern Red Cedar</i>	<i>Scotch Pine White Pine Eastern Red Cedar</i>

**(Mountain Form)*

Source: WVU-CES Publication 525

Table 4. Characteristics of Some Christmas Tree Species

SPECIES	SCOTCH PINE	WHITE PINE	NORWAY SPRUCE	BLUE SPRUCE	WHITE SPRUCE	FRAZIER FIR	BALSAM FIR	WHITE FIR	DOUGLAS FIR
NEEDLE RETENTION	<i>Very Good</i>	<i>Good</i>	<i>Good</i>	<i>Good</i>	<i>Good</i>	<i>Very Good</i>	<i>Very Good</i>	<i>Very Good</i>	<i>Very Good</i>
BRANCH FIRMNESS	<i>Excellent</i>	<i>Fair</i>	<i>Good</i>	<i>Excellent</i>	<i>Excellent</i>	<i>Good</i>	<i>Very Good</i>	<i>Fair</i>	<i>Fair</i>
FRAGRANCE	<i>Good</i>	<i>Very Good</i>	<i>Good</i>	<i>Good</i>	<i>Good</i>	<i>Excellent</i>	<i>Excellent</i>	<i>Excellent</i>	<i>Excellent</i>
EXPOSURE	<i>S or W</i>	<i>Any</i> <i>Prefer E</i>	<i>Any</i> <i>May burn on W</i>	<i>W, S, E</i>	<i>Any</i> <i>May burn on W</i>	<i>N or E</i>	<i>N or E</i>	<i>Any</i>	<i>Best on W, N, E</i>
PERCENT SLOPE	<i>15% or less</i>	<i>30% or less</i>	<i>25% or less</i>	<i>15% or less</i>	<i>25% or less</i>	<i>30 % or less</i>	<i>30% or less</i>	<i>25% or less</i>	<i>30 % or less</i>
FROST TOLERANT	<i>Yes</i>	<i>Fairly</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>
TOLERANT OF SHALLOW SOIL	<i>Yes</i>	<i>Fairly</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>Best on deep soil, slow on shallow</i>	<i>No</i>
DROUGHT TOLERANT	<i>No</i>	<i>Fairly</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>Yes, but slow to establish</i>	<i>No</i>
SHADE TOLERANT	<i>No</i>	<i>Fairly</i>	<i>Yes</i>	<i>No</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes, if not too dense</i>	<i>Yes</i>
ROTATION LENGTH (Years)	<i>6-9</i>	<i>6-9</i>	<i>8-11</i>	<i>10-15</i>	<i>8-11</i>	<i>8-12</i>	<i>10-15</i>	<i>10-15</i>	<i>8-12</i>

Source: Service Forester's Handbook, West Virginia Division of Forestry

Appendix 8 - Ornamental Plantings

Species Selection

When determining what species to plant, it is important to consider the following: function, location, soil conditions, and pest and environmental problems.

Plant Function. *Most plants in landscaped areas are selected for their amenity value, that is, they serve to make our lives more agreeable, and pleasant by increasing physical or material comfort and, at the same time, increasing the value of residential and commercial real estate. A tree that is large at maturity will provide shade. An ornamental plant may have beautiful flowers, leaves, or bark. Plants with dense, persistent leaves will provide a windbreak, a screen, or privacy. Plants that drop their leaves in the fall allow the sun to warm buildings in winter. A tree or shrub that produces fruit will attract birds and wildlife. A landscape plan that is prepared for a property should be designed to get the greatest benefit from each plant.*

Plant Location. *Trees and shrubs are living organisms that grow larger each year in height, crown width, and in size of root system. Consult publications to see what size the tree will be at maturity before selecting a species. A common mistake is to plant too many trees or shrubs in a limited space. They look good at first but soon will become overcrowded. Consider mature tree shape. Trees vary in height, width and branching pattern. Trees and shrubs may be short or tall. Crowns may be columnar, oval, rounded, pyramidal, upright, or wide spreading. Overhead utility lines will restrict selection to small trees or shrubs. Plants with low spreading branches are appropriate for screens but not for placement along street where good visibility is essential. The amount of sunlight available will affect tree and shrub species selection for a particular location. Most woody plants require full sunlight for proper growth and bloom, some others do well in light shade. Few tree species perform well in dense shade. Reflected light and heat and soil compaction*

from buildings and pavement will also affect plant growth and vigor. See Table 1.

Soil Conditions. *The amount/volume of soil and quality of soil in a given area can limit planting success. In their natural environment, tree and shrub roots grow in topsoil. This is often deep, well-drained soil that contains mineral elements, air, water, and organic matter required for adequate growth. In urban areas, the topsoil has often been disturbed and is frequently shallow, compacted and subject to drought. Under these conditions, plants are continually under stress. Proper maintenance is necessary to ensure adequate growth and survival. The physical aspects of the soil are as important as the chemical aspects, but the chemical aspects can be more easily managed. The physical aspects include soil profile, texture, compaction, and water holding capacity. Texture is a major factor in establishing water holding capacity. Under optimum conditions for best plant growth, the pore space in the soil should be 50% air and 50% water. Compaction increases stress by reducing the availability of oxygen to roots. The chemical aspects of the soil include available nutrients, soil pH, and organic matter content. Soil tests are helpful in establishing the physical and chemical conditions of the soil. A pH of 5.5 to 6.5 is optimum for most trees and shrubs. Soil moisture should also be considered.*

Pest and Environmental Problems. *Insect pests and disease organisms affect almost every tree and shrub species. Fortunately, these are usually not life threatening to the plant. Every locality has its particular pest problems and their severity varies geographically. Select plants to minimize pest problems. Environmental problems (temperature, moisture, soil, light, plant competition, pesticides) are more likely to affect plant growth than insects or disease. Zones of hardiness have been established and many sale tags and catalogs specify a hardiness range.*

Select tree and shrub species adapted to local soil, site, and space conditions that will accomplish the landowner's objectives.

*Recreation Area Improvement – 562
contains information on transplanting trees
and shrubs. It also contains information on
the correct ball size for various plant sizes.*

Appendix 9 - Hybrid Tree Species in Agroforestry Plantings

Hybrid poplars and willows may be well-suited for some agroforestry applications. Their convenient propagation and rapid growth allow them to establish and provide conservation benefits more quickly.

Site Selection

Poplars prefer well-drained soils such as sandy loams or silt loams. They will also grow in Clayey poorly-drained soils, but growth and yield are lower. Poplars can tolerate short periods of flooding when they are dormant, but cannot tolerate standing water in the summer months. The summer water table should be at 1.5 feet below the soil surface. Growth and yield on upland sites where the water table is deeper than 6 feet may not be acceptable due to soil depth, pH, fertility, and moisture availability.

Species Selection

Make sure clones or cultivars selected are suited to the climate and site where they will be planted. Use varieties that produce quality fiber or wood and have shown local disease and disease resistance.

Planting Stock

Cuttings 3/8 inch to one inch in diameter are made from one-year old shoots harvested during the dormant season. Length can range from 8 inch cuttings to 6 foot whips, depending on the purpose of the planting. On lowland sites with shallow summer water tables (1.5 to 3 feet deep), or sites that will be irrigated, cuttings can be 8 to 12 inches and planted with one bud above the ground. In all cases, buds should be "pointing up" after planting.

Longer cuttings called "whips", planted 2 to 6 feet deep are recommended for nonirrigated plantings where the water table is deeper than 3 feet. On rich bottomland sites a planting depth of 2 feet should be sufficient.

Site Preparation

For successful establishment and fast growth, site preparation is extremely important. Contact herbicides can be used to kill vegetation followed by deep tillage or ripping to allow easier planting and better rooting. **NOTE: NRCS does not make pesticide recommendations.** Landowners should be told to read product labels and follow product specifications. Landowners may contact the West Virginia Division of Forestry or the WVU Cooperative Extension Service for pesticide recommendations.

Spacing

Tree spacing will depend on the target diameter, buffering or site remediation needs, maintenance methods, and product goals. Biomass plantings of poplar or willow with cutting cycles of 1 to 3 years are spaced 2'x 4' to 4'x 4'. Most poplar plantations for fiber production with cutting cycles of 6 to 7 years are spaced 8'x 8', 9' x 9', or 7'x 10'. As the rotation lengthens, the tree spacing will increase, e.g. for a 10 to 12 year rotation, trees are spaced 12'x 12' to 10'x 16'. Between row spacing is influenced by maintenance equipment used for weed control.

Thinning can also be used when longer rotations are needed for long-term resource protection and/or lumber or plywood products are desired. Trees could be spaced at 7'x 10' and thinned for fiber in 6 to 7 years, leaving a spacing of 14'x 10', 7'x 20', or 14'x 20'. **CAUTION:** on irrigated plantings in wind prone areas, thinning can cause blow down if roots are shallow. Pruning to 18" is recommended to produce clear wood for quality lumber, veneer, or plywood. Rotation age ranges from 10 to 25 years depending on the site.

Planting Time

Planting should begin in the spring when the soil temperature reaches 50 degrees F. When planting in late spring, soak the lower fourth of the cuttings in water for at least 24 hours before planting to speed up rooting.

Maintenance and Cultural Practices

Within-row and between-row weed control is done with preemergent herbicides and or shallow tillage for at least 2 to 3 years until the trees have shaded out competing vegetation. Landowners should read and follow all herbicide label directions.

For plantings in riparian buffers or wastewater treatment plantings, legumes or non-rhizomatous grasses can be used in the early years between the rows as long as they are mowed to reduce rodent habitat and the tree rows have at least a 6 foot weed/grass-free strip for root development. On riparian sites where herbicide use may not be preferred and competing vegetation will be difficult to control, long cuttings (whips) are needed and should be planted to the depth of the summer water table. The above ground portion of the whip should be above the height of competing vegetation so leaves can capture sunlight.

References

Establishment and Cultural Guidelines for Using Hybrid Tree Species in Agroforestry Plantings, Kuhn, Gary A., Rietveld, W.J., Riemenschneider, Agroforestry Note 11, USDA, USFS/NRCS.

Forest Management Handbook, West Virginia Division of Forestry, 1985.

Service Foresters Handbook, USDA Forest Service, NE State and Private Forestry, February 1978.

West Virginia Forest Stewardship Incentive Program Training, Reference, and Procedures Manual, West Virginia Division of Forestry, WVDOF-TR-92-1, Revised 12/97.

Appendix 10 - Surface Mine Reclamation

Individuals should contact the West Virginia Division of Forestry (WVDOP) for direct assistance when planning at tree planting as part of a surface mine reclamation project. WVDOP approval of the tree planting plan may be needed.

Table 3 of Critical Area Planting -342 contains a listing of trees and shrubs recommended for planting in critical areas.

Appendix 11 – Riparian Buffer Plantings

Tables 1 and 2 in Appendix 1 of this standard list some trees and shrubs associated with and suited for riparian areas. Review the key attributes for each species to assist in selection and the design process for establishing buffers.

Other species may also be suitable. Consult with West Virginia Division of Forestry personnel, NRCS staff forester and/or biologist concerning the suitability of other species.

Initial plant-to-plant densities for trees and shrubs will depend on their potential height at 20 years of age. Heights may be estimated based on: 1) performance of the individual species (or comparable species) in nearby areas on similar sites, or 2) predetermined and documented heights using Tables 1 and 2, Trees and Shrubs Suitable for Establishment located in Appendix I of this standard. Planting density recommendations for planting open areas are:

*Plant Types/Heights: Plant-to-Plant Spacing
in feet:*

- Shrub less than 10 feet in height 3 to 6
- Shrubs and trees From 10 to 25 feet in height (includes columnar trees) 5 to 8
- Trees greater than 25 feet in height 12 to 25

Interplanting between existing trees and or shrubs at spacings greater than those listed above is also acceptable.

Appendix 12 - Paulownia Production

It is important to note that paulownia is non-native and can be invasive if not managed. Landowners should be made aware of these issues prior to making the decision to plant this species.

Plantation Size It is best to start small. Plant no more than 100 root stocks on ¼ acre of land to start.

Site Selection. The site selected should be:

- a. Near a convenient source of water for irrigation if required;
- b. Readily accessible by truck, tractor etc.;
- c. Sloped enough to drain reasonably well;
- d. Positioned such that it has at least exposure to direct afternoon sun. This will minimize future bark damage from sun scald.
- e. Free from flooding.

CAUTION: Do not plant in bottomland or any area subject to prolonged flooding.

Site Preparation. Clear the site of all brush and trees, grass, and weeds. See Forest Site Preparation - 490.

Soil analysis. WVU - CES may have file data already on hand, i.e. test results of soil in your area. If such data is not available, submit a soil sample from your site for analysis and recommendations for corrective treatment.

Planting Layout. The planting rows should be a minimum of 20 feet apart. Straight rows are preferred, but they can bend and vary in length in accordance with the contour and boundaries of the site. Temporarily mark the rows to permit you to subsoil the rows.

Subsoil Site. Subsoil the rows to a minimum depth of 3 feet, then harrow them once to break up the clumps of soil.

Tree Spacing. After harrowing the rows, with a ball of twine or a 100 foot tape, stakes, or sticks, mark the center of the rows. Now proceed to mark the planting spots for each tree at your predetermined intervals (at least 20 feet).

Planting Stock. Root cuttings, measuring 5-6 inches in length and a minimum of ½ inch up to 2 inches in diameter are preferred.

When ordering, ask the supplier to identify the smaller ends of the cuttings since some do not taper and are difficult to identify until bud stems develop. If, when received, there are no signs of buds, their development can be stimulated by "stratification," i.e., storing them for a few days in an unsealed box of damp sand, vermiculite, etc.

Planting Operation.

- a. Using a garden trowel, open holes at the marked spots in the rows. These holes should be deep enough to drop the cuttings into, small end down, without harming or breaking any of the buds.
- b. Next, with your hands, carefully firm the soil around the cuttings, leaving them covered with about ¼ inch of soil.
- c. With a garden spray can, spread ½ gallon of water around the cutting, leaving the soil damp (not mucky). This light watering should be done as necessary to maintain this damp condition. A thin layer of hay, straw, etc. will help to keep the soil damp. Do not use grass clippings which will dry out and form a sealed mat and retard stem growth.

Sprout Pinching. Stem sprouts will shoot up rapidly, likely in a few days. When the sprouts are 10-12 inches tall, pinch off all but the 2 healthiest looking ones. Two weeks later, pinch off the weaker of the two. Once the planting operation is completed, the developing stems must be routinely cared for as follows:

Removing Branch Buds. Without harming the leaves, pinch off the branch buds as they appear. These should be removed when they are 3-4 inches in length. If allowed to grow, the branch will leave a knot that devalues the log when marketed.

Fertilization. Do not over fertilize. Give the trees time to respond to each treatment, grow before repeating fertilization. The soil analysis may have revealed a major nutrient deficiency which should have been corrected

at the time of site preparation. As a safeguard, 2 months after planting, sprinkle 2 tablespoons of a commercial 10-10-10 slow release fertilizer around and away from the stems. Repeat this treatment as necessary prior to the beginning of each growing season. Increase the dose to trees which are laggards, i.e., slow growers.

Weed Control. This is very important, especially during the first 2 years. Use a rugged type domestic lawn mower, commercial brush mower, and/or a weed eater. Be careful to avoid contacting the stems.

Insect Control. Inspect the trees monthly, especially the terminal bud and the leaves, top side and underneath. Verify and leaf damage such as: yellowish areas, excessive holes, etc., and recommended treatment.

Coppicing. Cutting the stems off 1 inch above ground level, will allow the root system to grow, producing better stems. Use a fine tooth saw to avoid loosening bark at the cut line.

Opinions vary as to when and how often the stems should be coppiced, i.e., after one or more growing seasons or after consecutive seasons. Stem growth is often irregular, some growing 10'-12' or more in the first growing season, others lagging behind. For the small introductory "learning" plantation, Selective coppicing, after the first growing season, is suggested for trees that:

- a. Are less than 4-5 feet tall;
- b. Have broken, split, crooked, bent, or forked stems;
- c. Contain bark damage such as splits, bare spots, deer rubs, etc.;
- d. Are diseased. All diseased trees, including their root ball, should be removed from the site and burned. Do not replant in these spots, the soil may be contaminated.

After the stumps resprout, repeat the best sprout selection procedure. Following the second growing season, most of the stems should be 9'-10' tall. Let them grow during this period, debudding them as necessary. Continue to debud any "laggards" as they eventually grow to the 9'-10' level.

Summary Note: Taller trees (20'-35') of some growers have been seriously damaged by strong winds, water soaked soil giving way under storm conditions, ice and heavy snow accumulations. It is strongly recommend that trees in the small introductory "learning" plantation be cultivated to yield just one 9'-10' branch free log.

References

Forest Management Handbook, West Virginia Division of Forestry, 1985.

Service Foresters Handbook, USDA Forest Service, NE State and Private Forestry, February 1978.

Some Simple Practical Suggestions for Cultivating Paulownia Trees, American Paulownia Association. Volume 11, No. 1, January 2002.

West Virginia Forest Stewardship Incentive Program Training, Reference, and Procedures Manual, West Virginia Division of Forestry, WVDOF-TR-92-1, Revised 12/97

Appendix 13 - Direct Seeding

There are severe limitations on the use of direct seeding. It does not yield consistent, satisfactory results and should not be considered as a large scale substitute for tree/shrub planting. Careful control of seed storage and treatment is necessary. Loss of seed to rodents and birds often presents a problem. This information provides a basis for discussion with landowners who express an interest in the practice. Hydroseeding may improve results.

Additional information may be found at:

<http://www.directseeding.org/>

Specifications for Conifers

Species

Conifers – Virginia pine, shortleaf pine, white pine, red pine and pitch pine are possible candidates, although white pine is a slow starter and is strongly affected by plant competition.

Protection

Protect from livestock and fire. See Forest site Protection – 490 and Firebreak – 394.

Site Preparation

See Forest Site Preparation – 490.

Rate of Seeding

Seed spotting 6' x 7' to 8' x 8' spacing: 3-5 seeds per spot.

Broadcast seeding ½ to 1 pound of seed per acre.

Note: Only treated seed is used and seed is scarified for spring planting.

Time of Seeding

The preferred seeding time is November 1 – April 15.

Specifications for Hardwoods

Species

Oaks, black walnut, shagbark hickory, and Asiatic chestnut are possible candidates.

Protection

Protect from livestock and fire. See Forest Site Preparation – 490 and Firebreak – 394.

Site Preparation

Seed spots of at least one square foot are scalped, chemically treated, or heavy sod is plowed to control grass. Single furrows may increase losses from rodents. See Forest Site Preparation – 490. A freshly prepared seedbed will give the best conditions for germination and establishment.

Seeding Rate

5 seeds per spot or 1000 seeds per acre.

Time and Method of Seeding

Spring seeding between March 1 and April 30. Stratified seed is preferred. Seeds should be covered about ½" deep. If handplanting, press seeds into soil with foot. If broadcasting apply seed with a cyclone seeder, hydroseeder, helicopter, or fixed wing aircraft. However, large quantities of seed are required and unless disking or some other treatment is applied, the seed may not be covered properly. Spot seeding or drilling uses less seed and provides better germination.

Selection of Seed

If seed is collected locally, oak acorns should be selected from straight, sound, forest grown trees. Black walnuts should be selected from healthy trees that are free of canker and anthracnose. Shagbark hickory nuts and Asiatic chestnuts should be selected from well formed trees known to produce good quality nuts. Nanking strain of the Chinese chestnut is a possible selection.

Mixtures

Oaks and shagbark hickory may be planted in pure stands or mixed with hardwoods in any proportion. Black walnut may be planted in pure stands or with other hardwoods such as white ash (seedlings) or red oak so that the walnut makes up about 50 percent of the mixture and is uniformly distributed.

Spacing

6' x 7' to 8' x 8' – oaks and hickory; 5 seeds per spot.

12' x 12' to 16' x 16' black walnut and chestnut; 5 seeds per spot.

References

Direct Seeding for Forestation, Trees for Reclamation in the Eastern United States, Walter H. Davidson, 1980, Symposium, Lexington, KY, October 27-29, 1980.

Illinois Direct Seeding Handbook - A Reforestation Guide, Association of Illinois Soil and Water Conservation Districts, Illinois Department of Natural Resources, USDA Natural Resources Conservation Service, October 2000.