



FORESTRY DIVISION

Seedling Care and Planting Guidelines



Seedling Care and Planting Guidelines

2023 Edition

Table of Contents

General Guidelines	2
How to Hand Plant Seedlings.....	16
Weather Condition Classifications.....	20
Trees Per Acre by Spacing	23
Counties with Coolers.....	24

Arkansas Department of Agriculture
Forestry Division

Copyright © 2023

The Arkansas Department of Agriculture offers its programs to all eligible persons regardless of race, color, national origin, sex, age, or disability and is an Equal Opportunity Employer.

Forward

Forest tree seedlings must be handled carefully from the time they are lifted at the nursery, until they are transplanted in the field. This booklet will tell you how.

Proper seedling handling is complicated by the variety of environmental conditions that may occur during this critical time between lifting and transplanting.

Monitor environmental conditions continuously. Adjust field operations as necessary to adhere to these guidelines. By following these standards, you enhance the likelihood of a successful planting.

Reforestation costs are the landowner's primary forestry investment during a timber stand's life. Seedling survival contributes to both the landowner's returns on investment and the future strength of Arkansas's forest economy.

General Guidelines

These forest tree seedling handling and planting guidelines were developed for broad practical field use. They include a general description of seedling handling, followed by lists of specific “Do’s and Don’ts.” If you have questions regarding a particular field condition or planting project, contact the Forestry Division (Division) office at the Arkansas Department of Agriculture for professional recommendations.

Bare-root pine and hardwood seedlings are vulnerable plants that require careful handling. The four primary rules for tree seedling care between the nursery bed and out-planting are:

- Keep seedlings moist
- Keep seedlings cool
- Handle seedlings gently
- Keep storage duration short

Every effort must be made to keep roots moist while the tree is out of the ground. The nurseries usually spray seedling roots with a gel to reduce moisture loss. The trees are then commonly packed in moisture resistant kraft boxes/bags. These practices are effective. Once a box/bag is opened, the seedlings should be planted immediately. Keep root exposure to sun at a minimum.

If a box/bag of seedlings is only partially used, the box/bag should be closed and stored in a shady cool place. Seedlings use stored food to survive transplant shock. These critical food reserves are depleted quickly if the trees are stored warm. To conserve this stored energy and promote seedling survival, trees should be stored as cool as practical without freezing. Inside box/bag temperature guidelines for storing bare-root tree seedlings are:

Storage for 1-5 Hours
Ideal 34° - 40°F
Tolerable 40° - 50°F
Risky 50° - 60°F
Damage Probable 60° - 80°F
Damage Occurring more than 80°F

Storage for more than 5 Hours
Ideal 34° - 40°F
Tolerable 40° - 50°F
Risky 50° - 60°F
Damage Occurring more than 50°F
Damage Occurring less than 32°F

Keep Seedlings Cool

Talk to a Forester before planting trees that have experienced abnormally high or low temperatures. Seedling survival will suffer if seedlings are exposed to excessively high or low temperatures. The amount of mortality is directly related to length of exposure to these temperature extremes. An exposure to 80°F for two hours can significantly reduce survival.

Handle Trees Carefully

Seedlings must be protected from physical damage. Seedling boxes/bags should not be thrown or walked on. Physical abuse of the seedlings can lead to reduced seedling survival. Get professional advice before planting trees that have been excessively damaged.

Minimize Storage Time

As length of seedling storage increases, seedling vigor decreases. Under ideal conditions this loss in vigor is very slow. The further storage conditions are from ideal, the faster the loss in vigor. Seedlings should be stored without refrigeration only when weather conditions permit. Even under ideal conditions, seedling storage should be kept as short as possible.

Seedling Transportation

DO: ✓

- Transport seedlings in a refrigerated van with temperatures maintained between 34°F and 45°F whenever possible.
- Keep inside box/bag temperatures below 60°F.
- Keep truck bed free from pesticides and other chemicals.
- Keep truck bed free from sharp objects.
- Promptly repair or replace torn boxes/bags.
- Shield seedlings from direct sunlight, wind, and temperature extremes.
- Minimize transportation time.
- Consider transporting trees at night.

DON'T: ⚡

- Allow seedlings to freeze.
- Ship trees without refrigeration when air temperature exceeds 70°F.
- Stack seedlings more than two boxes/bags deep without spacers to support weight.
- Walk on or stack heavy objects on seedlings.
- Routinely open seedling boxes/bags to inspect seedlings. (Open only if the box/bag has been damaged and/or been too hot or cold).

Refrigerated Seedling Storage

DO: ✓

- Store seedlings in coolers if possible.
- Maintain cooler temperatures between 34°F and 40°F.
- Provide good air circulation around all sides of the boxes/bags.
- Plant trees as soon as possible after removal from cold storage.

DON'T: ⊘

- Stack seedling boxes/bags over two deep without supports and spacers supporting weight.
- Store pesticides or other chemicals that could harm seedlings in cooler with seedlings.
- Store non-dormant seedlings. (Non-dormant trees should be planted within two days of lifting.)

Non-Refrigerated Storage

DO: ✓

- Plant seedlings as soon as possible.
- Protect seedlings from direct sunlight and temperature extremes.
- Allow space for air circulation between seedling boxes/bags.

DON'T: ⊘

- Allow seedlings to freeze. (If freezing briefly occurs, thaw slowly without artificial heat.)
- Plant seedlings that have been frozen for two or more days.
- Allow inside box/bag temperatures to get above 50°F.

Field Handling and Planting Guidelines

DO: ✓

- Protect seedling boxes/bags from exposure to wind, sun, and temperature extremes.
- Store seedling boxes/bags in shade or under reflective tarp.
- Keep seedling root exposure to an absolute minimum.
- Open only one box/bag of seedlings at a time.
- Remove only one handful of seedlings at a time from the seedling box/bag when sorting.
- Keep presorting to a minimum.
- Use care when separating roots.
- Transfer trees from seedling boxes/bags to mechanical tree planter boxes or hand planter bags quickly.
- Keep seedling roots covered with moist burlap, in planting bags, or in buckets with moist medium.
- Cull seedlings that do not meet established standards.
- Plant when there is good soil moisture.
- Train all personnel before allowing them to plant.
- Closely supervise the planting crew. (One foreman should supervise no more than 12 planters.)

- Replace planters who do not meet quality standards.
- Plant pine and wetland species as deep as possible while keeping roots straight in planting hole. Upland species should be planted slightly deeper than the depth they grew in the nursery. The swell at the root collar for oaks should not be seen after planting.
- Pack soil firmly around the roots and root collar of each seedling. (Dont leave the roots in an air pocket).
- Plant in accordance with instructions listed in this booklet.

Field Handling and Planting Guidelines (Cont.)

DON'T:

- Empty the whole seedling box/bag when sorting seedlings.
- Leave seedling boxes/bags open or seedlings exposed.
- Carry multiple seedlings from one planting hole to the next.
- Carry excess trees on machine planters.
- Expose seedling roots to the elements, especially the sun and wind.
- Allow seedling roots to dry out.
- Hit or vigorously shake roots to remove soil.
- Store seedling boxes/bags close to a fire.
- Use a fire to thaw frozen seedlings.
- Plant in unusually dry or hot conditions.
- Remove seedling from planting bag until planting hole has been made.
- Allow planted trees to have "L" or "J" roots since survival and growth will be sacrificed.
- Plant when soil is frozen.
- Plant in standing water.
- Allow planting foreman to plant. (The foreman should supervise.)

Root Pruning

Root pruning and root stripping should not be allowed by tree planters. All nurseries root prune before the seedlings are lifted to produce a balanced seedling.

Additional root pruning or root stripping by tree planters:

- Produces an unbalanced seedling.
- Reduces the ability of the seedling to rapidly produce new roots.
- May reduce seedling survival.
- Exposes the roots to sun and wind.
- Eliminates fine roots and mycorrhizae.

Containerized Loblolly and Shortleaf Pine

All of the guidelines for proper bare root seedling handling and planting contained in this booklet apply to the proper handling and planting of containerized loblolly and shortleaf pine, with the addition of the following guidelines that are specific to containerized loblolly and shortleaf pine.

DO: ✓

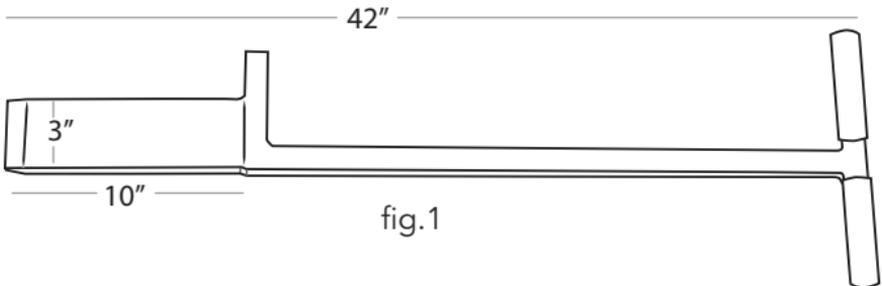
- Plant containerized loblolly and shortleaf pine as early in the fall as September, as long as adequate rainfall has occurred.
- Plant containerized loblolly and shortleaf pine deep. For example, the top of the soil ball should be 2 to 4 inches below the soil line, even for shortleaf pine.

DON'T:

- Plant containerized loblolly and shortleaf pine late in the planting season. The planting season is extended by using containerized pine seedlings, the extension of the planting season is at the beginning of the planting season, not at the end. Planting seedlings in March is pushing the envelope for seedling survival.
- Plant containerized loblolly and shortleaf pine shallow. If the containerized soil ball is level with, or even close to the soil line, moisture will wick out of the soil ball and the roots will dry out. This is particularly true if containerized pine are planted late in the season and root growth has not yet extended into the new soil profile to capture available moisture.

Summary

- Keep seedlings cool.
- Keep seedlings from freezing.
- **Keep seedlings moist.** Seedling roots must never be allowed to dry out even for a few minutes.
- Handle seedlings carefully.
- Keep storage duration short.
- Don't plant small, weak seedlings.
- Don't plant when soils are dry.
- Don't plant when weather conditions are critical. See Page 20.
- Use a "Dibble Bar" tool to plant saplings at accurate depths (fig.1).



- Carry Seedlings in a canvas bag (fig.2) or a planting tray (fig.3).
- Do not carry seedlings with roots exposed to sun and wind (fig.4).
- **Important!** Do not let roots dry out!



fig.2

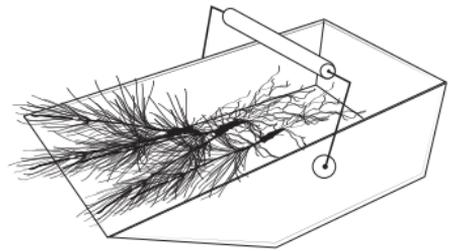
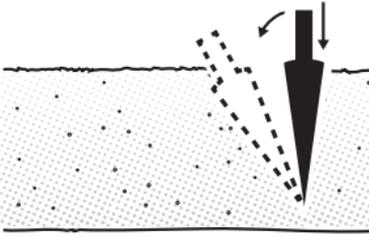


fig.3

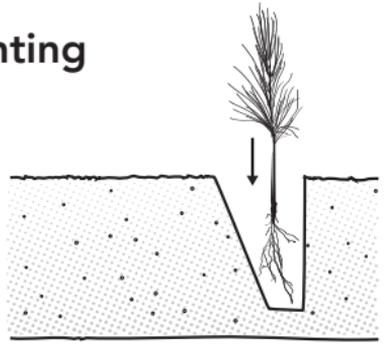


fig.4

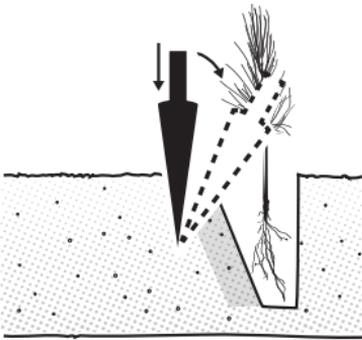
Hand Planting



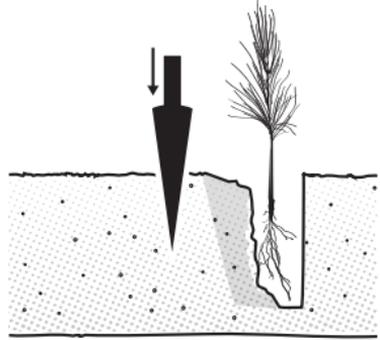
Insert dibble straight down.
Pull backward to open hole.



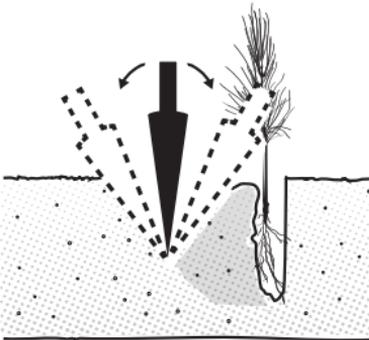
Remove dibble and place
seedling at correct depth.



To hold seedling in place,
insert dibble part deep into
the soil - pushing forward,
closing top of planting slit.



Insert dibble
straight down into soil
behind last hole.

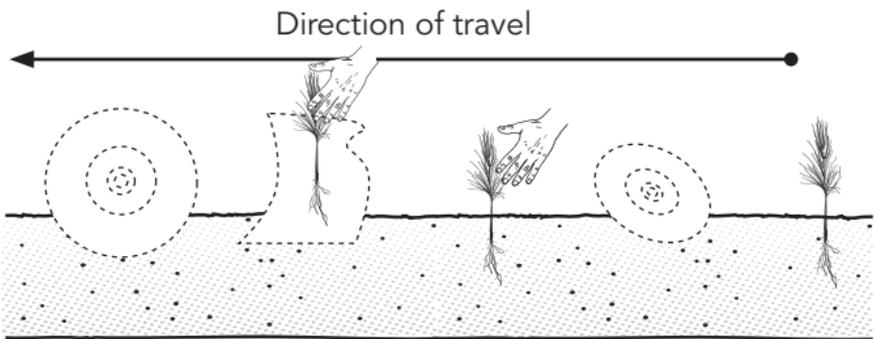
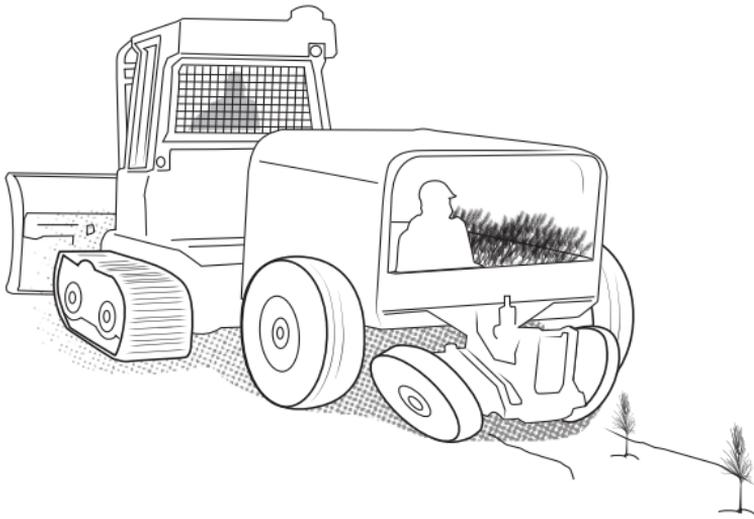


Pull dibble backward, then
push forward, packing soil
firmly against roots.



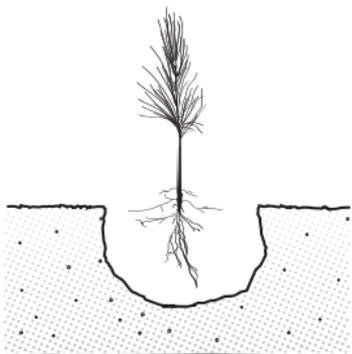
Fill last hole by
firming with heel.

Mechanical Planting



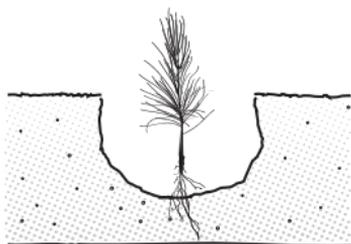
1. Insert seedling in vertical position well forward in open trench.
2. Hold seedling in vertical position until soil closes around roots.
3. Release seedling ahead of packing wheels.

Common Planting Errors



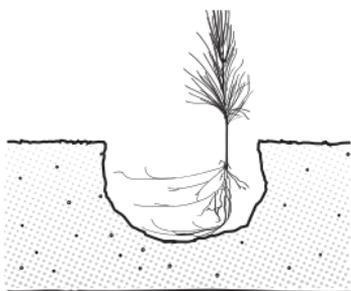
Too Shallow

Root collar and roots exposed, drying out roots.



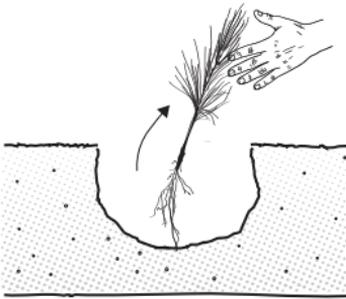
Too Deep

Hard to plant pine and wetland species too deep. Upland species 2" or more above root collar could be too deep.



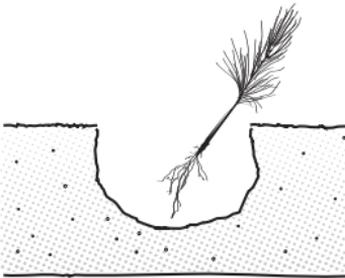
"J" or "U" Roots

Roots form "J" or "U" shape resulting in poor or weak root development.



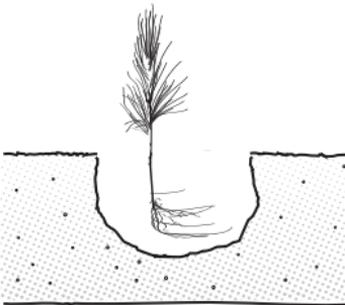
Too Loose

A firm pull on one needle cluster moves plant.



Not Erect

The tap root should not be planted at more than 30° off perpendicular.



"L" or Drag Root

Seedling pulled along in trench by planter.

Weather Condition Classification

Day Classification	Weather Conditions	
--------------------	--------------------	--

Best	Temperature	33° - 75° F
Plan to do most planting during these days.	Relative Humidity	50%+
	Wind	Less than 10 mph
	Available Soil Water	75% to field capacity

Marginal	Temperature	76° - 85° F
Be extra careful and take precautions if planting on these days.	Relative Humidity	30% - 50%
	Wind	10 - 15 mph
	Available Soil Water	50% - 75%

Critical	Temperature	Less than 32° or more than 85° F
Do not plant on these days.	Relative Humidity	Less than 50%
	Wind	15+ mph
	Available Soil Water	Less than 50%

Note: Day classification should drop to that of the weather condition with the poorest rating.

Seedling Specifications

Hardwood Shoot Length = $1\frac{1}{2}$ - $2\frac{1}{2}$ Root Length
Examples Below

Root Length	Min. Height	Max Height
6"	9"	15"
7"	10.5"	17.5"
8"	12"	20"
9"	13.5"	22.5"

- Diameter must be at least .25" at root collar
- Healthy first order laterals and fibrous roots must be present
- *Certain soft mast, pecan and other hickory species have min height requirements of only 6" but require a good root system (please contact nursery if you have any questions)

Pine Shoot Length = $1\frac{1}{2}$ - $2\frac{1}{2}$ Root Length
Examples Below

Root Length	Min. Height	Max Height
5"	7.5"	12.5"
6"	9"	15"

- Diameters must be at least $\frac{1}{8}$ " at root collar
- Healthy first order laterals and fibrous roots must be present

Spacing

Conventional pine planting range between 436 and 681 seedlings per acre with a preferred distance of at least 10 feet between rows.

Conventional Hardwood planting densities range between 302 and 436 seedlings per acre with a preferred distance of at least 12 feet between rows.

Special purpose plantings for agroforestry (carbon sequestration, silvopasture, or windbreaks) can vary and will be as planned.

For Natural Resources Conservation Service conservation program specifications, refer to the NRCS Field Office Technical Guide located at <https://efotg.sc.egov.usda.gov>.

Spacing (ft.)	Trees per Acre
8 x 6	907
8 x 8	681
10 x 5	871
10 x 6	726
10 x 7	622
10 x 8	545
10 x 9	484
10 x 10	436
12 x 6	605
12 x 7	519
12 x 8	454
12 x 9	403
12 x 10	363
12 x 12	303
15 x 6	484
15 x 7	415
15 x 8	363
15 x 9	323
15 x 10	290
15 x 12	242
15 x 15	194

Spacing (ft.)	Trees per Acre
18 x 8	303
18 x 10	242
18 x 12	202
18 x 15	161
18 x 18	134
20 x 8	272
20 x 10	218
20 x 12	182
20 x 15	145
20 x 18	121
20 x 20	109
25 x 8	218
25 x 10	174
25 x 12	145
25 x 15	116
25 x 18	97
25 x 20	87
30 x 30	48
40 x 40	27

Cooler Locations

Baucum Nursery

1402 Highway 391 N.
North Little Rock, AR 72117
(501) 907-2485 or (501) 907-2486

DISTRICT 1

Forrest City
1690 Linden Rd.
Forrest City, AR 72335
(870) 633-6693

Monticello
1327 Scogin Dr.
Monticello, AR 71665
(870) 367-6767

Stuttgart
1302 West Airport Rd.
Stuttgart, AR 72160
(870) 673-2851

DISTRICT 2

Dierks
106 Forestry Dr.
Dierks, AR 71833
(870) 286-2137

DISTRICT 4

El Dorado
2159 Champagnolle Rd.
El Dorado, AR 71730
(870) 863-7051

Stamps
1171 Lafayette Dr. #31
Stamps, AR 71860
(870) 953-1578

DISTRICT 5

Malvern
207 Airport Rd.
Malvern, AR 72104
(501) 332-2081

DISTRICT 6

Clarksville
130 Massengale Rd.
Clarksville, AR 72830
(479) 754-2701

Fayetteville
2752 N. Garland Ave.
Fayetteville, AR 72704
(479) 587-1442

DISTRICT 7

Greenbrier
#20 Industrial Park Blvd.
Greenbrier, AR 72058
(501) 679-5316

Kensett
101 E. Searcy St.
Kensett, AR 72082
(501) 742-5446

DISTRICT 8

Ash Flat
#40 Arnhart St.
Ash Flat, AR 72513
(870) 994-2188

Jonesboro
2301 Fox Meadow Ln.
Jonesboro, AR 72404
(870) 932-2251

Mountain View
208 State St
Mountain View, AR 72560
(870) 448-5014

Questions? We're here to help.

agriculture.arkansas.gov



FORESTRY DIVISION

Arkansas Department of Agriculture
Forestry Division
1 Natural Resources Drive
Little Rock, AR 72205
agriculture.arkansas.gov
(501) 225-1598