

## *Tree and Shrub Establishment - Native Tree and Shrub Planting Recommendations For Wisconsin*

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### INTRODUCTION

This technical note is intended to be used by resource professionals as a guide for planting and direct seeding tree and shrub species for reforestation, afforestation and the installation of Alley Cropping (311), Tree and Shrub Establishment (612), Early Successional Habitat Development/Management (647), Farmstead and Feedlot Windbreaks (380), Field Windbreaks (392), Hedgerow Planting (422), Restoration and Management of Declining Habitats (643), Riparian Forest Buffer (391), Shoreland Habitat (643A), Wildlife Upland Habitat Management (645), Wildlife Wetland Habitat Management (644), and other conservation practices that include the establishment of trees and/or shrubs. Refer to the previous standards for specific practice purposes and requirements. This technical note is intended to be used for all programs and by resource professionals regardless of agency affiliation.

### BACKGROUND

Appendix A to this technical note includes most, but not all of the native tree and shrub species for Wisconsin. Other native species may be planted if they serve the intended purpose of the planting. The species identified here should be used as a guide.

Species selection should be based on local site conditions, professional judgment, and availability of planting stock/seed.

The Major Land Resource Area (MLRA) and county-specific tables provided in Appendix A can be modified by the NRCS State Forester with concurrence from WDNR Division of Forestry and local Resource Professionals.

### APPLICATION AND PROCEDURE

Site resource information such as microclimate, soil type, soil drainage classification and moisture regime, exposure and purpose of the planting must be gathered before deciding on species recommendations. Some county soil surveys contain information about the original vegetation for each soil type. Other references include the "Original Vegetation Cover of Wisconsin" map that can be found at [www.dnr.state.wi.us/org/](http://www.dnr.state.wi.us/org/)

[at/geo/map\\_gal/dancov/orgveg](http://at/geo/map_gal/dancov/orgveg). Early Vegetation of Wisconsin map found in Section I of the Wisconsin NRCS Field Office Technical Guide (FOTG), and "Vegetation of Wisconsin". Also refer to "Forest Communities and Habitat Types of Central and Southern Wisconsin" and "Forest Communities and Habitat Types of Northern Wisconsin", by John Kotar for information on natural forest communities and the sites on which they developed. These references along with Appendix A will allow the planner to develop sound planting/seeding species recommendations.

1. Identify the Major Land Resource Area (MLRA) and the county where the practice will be applied. The map titled "Major Land Resource Areas for Wisconsin" can be found in Section I of the Wisconsin NRCS Field Office Technical Guide.
2. Identify the soil type(s) and the drainage classification of the soils on site. Drainage class for each soil series on site can be found in the soil series description in the published County Soil Survey or at <http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx>. Manipulations of the natural drainage class identified in the County Soil Survey must be considered when developing species recommendations.
3. Consider the intended and potential uses of the planting.
4. Determine whether the planting will be in open (cropland or pastureland conversion), partial shade (under-stocked existing stand), or shade (100% canopy-mainly for shrub plantings) and aspect (exposure).
5. Select species based on the criteria identified in steps 1 through 4. See [Appendix A, Wisconsin Native Tree and Shrub Guides](#). Similar common name does not always mean same species. When in doubt, use scientific names to identify species selected.

### **Method of Establishment (Seeding vs. Planting)**

Direct seeding, if successful, allows the establishment of more trees per acre at a comparable cost to planting seedlings. It can be particularly useful on sites that otherwise are difficult to plant due to spring wetness or shallow soils. Areas that are difficult to plant with seedlings because of spring wetness can be seeded at a dryer time of year and areas with very shallow topsoil are easier to seed because of shallow seeding depths versus planting depths. It also allows a more natural-appearing stand of trees to develop which can be further encouraged by planting a variety of species.

Direct seeding is not well suited for under-planting in poorly stocked stands and may not be a viable option every year because many species only produce good seed crops every 3-5 years and seed may not be available. It should not be used on slopes steeper than 6% without considering a cover crop or other measure for erosion control. Direct seeding is **not** well suited for sites that will be used for specialty plantings (Christmas trees, windbreaks, and alley cropping).

The direct seeding method is best suited to sites being converted from intensive agricultural production because of historic weed control practices. Weed control is very critical to establishment of trees and shrubs using the direct seeding method. Competition must be controlled for a minimum of 3 years after seeding and should be checked for follow up control measures until tree crowns are above the competition.

The large number of seeds per acre increases the chance that trees will benefit from the best available micro-sites. Enough trees will generally escape deer and rabbit browse to develop a stand of trees when heavily planted. Squirrels and other rodents can destroy much of the seed in years when snow cover is light.

Locally collected seed can be used to ensure compatibility with local conditions. However, seed should only be collected from high-quality source trees and at the right time of year. If unsure about seed collecting techniques, check with local resource professionals first.

Planting of nursery stock allows for better density control (specialty plantings such as windbreaks and Christmas trees) and is more desirable for sites that require intensive weed control, especially where mechanical control is the preferred option. By using seedlings, several years of development are realized with a new planting. Planting of seedlings is a more

efficient use of genetically improved seed. Sites that are excessively well drained are usually more successful if planted because the developed root systems have a better chance of obtaining enough moisture to become established. Nursery stock is better suited to slopes greater than 6% than is direct seeding, but additional conservation practices such as cover crops and planting on the contour should be considered when planting fields being converted from intensive agriculture (exposed soil).

For sites that have existing grass/herbaceous cover, planting seedlings is a better choice than seeding if the competing vegetation is controlled by band spraying within rows and/or by mechanical control between the rows. Nursery stock plantings produce a more uniform stand, and are well suited for under-planting in poorly stocked stands. Planting can be designed with future management/land use activities in mind.

### **Tree Planting/Direct Seeding Timeline**

**August/September** prior to planting nursery stock, begin site preparation on sites with existing vegetation (on row crop fields site preparation may begin after the crop is harvested). Site preparation will be site and species specific. Direct seeding is not recommended on sites with severe competition from existing vegetation (old hay fields with dense sod and or areas of Reed Canary Grass). Identify commercial or local seed sources for sites to be direct seeded. For commercially purchased seed, make sure the supplier can confirm the seed is from the Lake States Area and purchase from a source as close to the site to be seeded as possible.

- Order seed or begin collecting seeds in season and plant as soon after collection as possible. If buying commercially available seed, use the supplier's listing of percent sound seed, to determine final seeding rates. Most seed is very difficult to store and self-storage is not recommended.
- For locally collected seed, collect enough seed to meet the required rates and account for defective seed. Visually inspect seed looking for proper color, form, insect and mechanical damage. Separate debris, caps and wings from seed.
- The float test may be useful for separating good from poor acorns and nuts; floaters are removed off the top of the tub of water and discarded. However, it is not always accurate to determine that all sinkers are viable, as other factors are also important. The husks around nuts such as

black walnut and hickories, must be removed prior to floating. Always cut a sample of floaters and sinkers to be sure of the effectiveness of flotation to separate them. Seed embryo color should be white or creamy yellow.

- A cut test can be used to determine the amount of sound seed being collected. Inspect by species, at least 10 randomly selected seeds per 3,000 seeds collected. Cut open the seed to be sure that seed is filled, moist and normal colored.

### Site Preparation

The single most important part of planting trees is protecting them from competitive vegetation. All plants compete for light and water and many grasses produce natural chemicals that suppress tree and shrub growth. If not managed, competition from weeds, grasses and unwanted woody vegetation, will choke out the planting. Mechanical and/or chemical site preparation techniques can be used depending on site conditions and client objectives.

### Mechanical Site Preparation

Reduce the competition from a thick grass sod by moldboard plowing, disking and establishing a cover crop the year prior to planting. On slopes greater than 6%, leave strips of sod between 6-foot wide tilled strips and plant as near to the contour as possible to prevent erosion. For sites with a clean tilled row crop existing, address weed problems and see "Cover Crop" Standard 340 for ground cover options. Annual rye, winter wheat, and white clover perform well as cover crops for tree planting purposes.

### Chemical Site Preparation

Weed and/or grass competition can be controlled with herbicide use. On sites with slopes greater than 6%, band spraying of the row is preferable over broadcast spraying of the entire site. Effective control depends on four factors:

- timing of application,
- herbicide selected,
- weather conditions, and
- application rate.

A combination of chemical and mechanical site preparation may be required on very difficult, heavy sod sites. Very dry conditions will limit the effectiveness of most herbicides. Be sure to follow label directions for application rates, as rates differ depending on soil type and herbicide being used.

### Direct Seeding

The amount of seed required for direct seeding varies by species and site conditions. Use Table 1 as a guide. Rates are based on single species planting. For drilling of mixed species, the total seeds/acre should be at least 3,000. For broadcasting mixed species, the total seeds/acre should be at least 1,000. Ideal seedings contain a mix of drilled and broadcast species.

The following chart shows the row spacing and seed spacing combinations that will result in 3,000 seeds per acre. Adjust planting rate based on sound seed percentage from seed inspection.

4-foot row spacing = 3.6-foot spacing within row  
5-foot row spacing = 2.9-foot spacing within row  
6-foot row spacing = 2.4-foot spacing within row  
7-foot row spacing = 2.0-foot spacing within row  
8-foot row spacing = 1.8-foot spacing within row  
9-foot row spacing = 1.6-foot spacing within row  
10-foot row spacing = 1.5-foot spacing within row

Heavy seeded species, those suitable for drilling, will usually comprise the main part of the stand. Lighter seeded species, those suitable for broadcast seeding, will be used for diversity and micro-site establishment within the stand.

Plant acorns 1-3 inches deep and nuts 2-5 inches deep. A good rule of thumb is to plant to a depth that is twice the diameter of the seed. For light seeded species that are broadcast, cultipack the site after seeding. Plant seed from seed suppliers or seed collected as close to the site as possible.

White oak, bur oak, and swamp white oak acorns must be planted as soon as possible after collection. It is extremely important that the site is prepared for planting before the acorns are received or collected. These acorns sprout in the fall and begin growing before the ground freezes and do not require the cold stratification that the red oak family, the walnuts, and the hickories require.

Red oak acorns can be stored, if necessary, if kept in cold damp conditions 35 to 40 degrees F. Fall seeding is preferred over storage and seeding should be done immediately after receiving or collecting seed. Many species require cold stratification to stimulate germination in spring and it is difficult to create the required conditions unless climate controlled storage is available. Immersing acorns in water prior to planting will restore any moisture lost during collection. Soak from 4 to 24 hours. If seeding is delayed more than a few days, seed will be

placed in porous bags, such as onion bags, in cold storage, 35 to 40 degrees F. Keep heavy seeded species moist, but not wet until planting. Keep light seeded species dry until planting. Do not allow seed to heat up and never place seed in the sun. Inspect seeds for storage losses prior to planting.

**October/November** of the year before planting, order nursery stock and/or begin direct seeding as appropriate for the species.

#### Nursery Stock Spacing

Density of plantings will vary by species, intent of the planting, soil site conditions, and other factors. For most multiple purpose plantings, use Table 2 when planning the amount of planting stock required. **Specific Program requirements (CRP, Managed Forest Law, etc.) may dictate the amount of stock needed and spacing.**

For specialty plantings (windbreaks, Christmas trees) consult specific standards and/or fact sheets.

**April/May** of planting year inspect sites to be planted for weed problems and apply chemical or mechanical weed control as needed prior to planting. Inspect sites direct seeded the previous fall for weed problems and treat as necessary. Plant tree and shrub seedlings from late March until early May as soon as they arrive. Seedlings may be planted by hand using a shovel or planting bar, or with a tree planting machine. Many counties have planting machines available for rent.

#### Planting Information

Plant seedlings as soon as they arrive. Do not allow seedlings to lay in the sun or dry out. Do not take large amounts of seedlings to the field where they will dry out before planting. Take small amounts and store the rest in a cool, shaded location and keep moist, but not wet until planted. Do not open the shipping containers until ready to plant. If stock in bundles has been exposed to warm temperatures, the bundles should be opened to prevent heating. Wet roots if needed. Keep tops dry.

Stock to be planted in a few days can be stored in a cellar, open shed, or similar cool place. Stock held over a week should be stored in a cooler.

During planting, keep roots wet. Dry roots mean dead trees/shrubs.

Plants developing "J" roots will die. Seedling roots should hang free and just touch the bottom of the

hole. When the root length on seedlings exceeds the depth of the planting tool being used, roots may be pruned to the proper length. Use a sharp tool such as a large scissors, pruning shears, or a machete. Root systems can be pruned at 8-10 inches below the root collar provided a shoot to root ratio of 2:1 or less can be maintained. Dip the roots in water immediately but do not leave roots submerged in water. Moisture enhancers or root gels may be used to keep roots moist and repack the trees in the original containers. Removal of any part of the root system will have an adverse impact on seedling vigor so pruning is not recommended. It is better to modify the depth of planting whenever possible, than to prune roots.

Tree planting machines are available in most counties. If the site is suitable for machine planting, this method is usually cheaper.

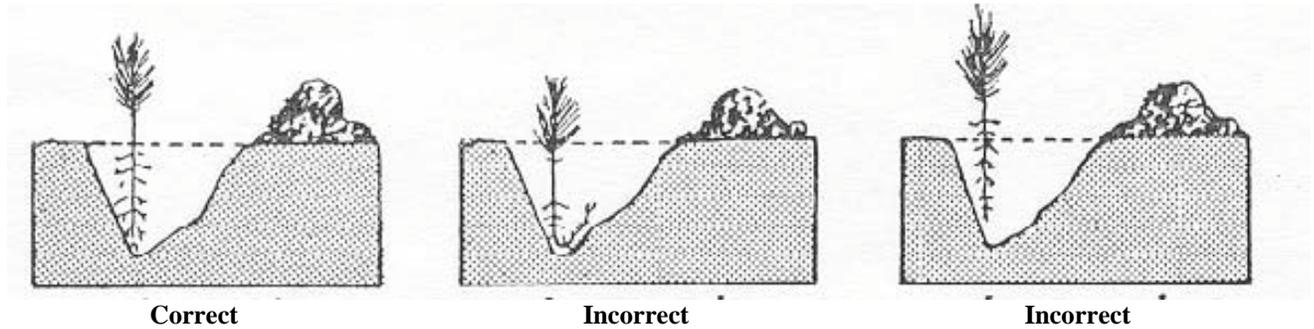
Hand planting may be done with shovel, hoe, planting bar, mattock, or other hand tool. The hole should be large enough to avoid doubling of roots.

If cuttings are used, they must be kept moist and cool until planted. Cuttings should be buried, except for exposed tip, with at least two buds above ground.

## REFERENCES

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**Figure 1**  
**Correct and Incorrect Planting Depths**



**Table 1**

Species	Planting Method	Collect	Sound Seeds/Ac	Lbs/Ac
Northern Red Oak	Drilled	Sept-Oct	3,000	24 lbs.
White Oak	Drilled	Sept-Oct	3,000	25 lbs.
Bur Oak	Drilled	Aug-Nov	3,000	40 lbs.
Swamp White Oak	Drilled	Sept-Oct	3,000	25 lbs.
Black Walnut	Drilled	Sept-Oct	3,000	75 lbs.
Shagbark Hickory	Drilled	Sept-Oct	3,000	30 lbs.
Ash	Broadcast	Aug-Oct	1,000	.13 lb.
Sugar Maple	Broadcast	Sept-Oct	1,000	.16 lb.
Red Maple	Broadcast	Apr-July	1,000	.04 lb.
Basswood	Broadcast	Oct-Nov	1,000	.2 lb.
Black Cherry	Broadcast	Aug-Oct	1,000	.2 lb.

**Table 2**

Row Spacing	Spacing Within Row			
	7 Feet	8 Feet	9 Feet	10 Feet
<b>6 Feet</b>	1037	908	807	726
<b>7 Feet</b>	889	778	691	622
<b>8 Feet</b>	778	681	605	544