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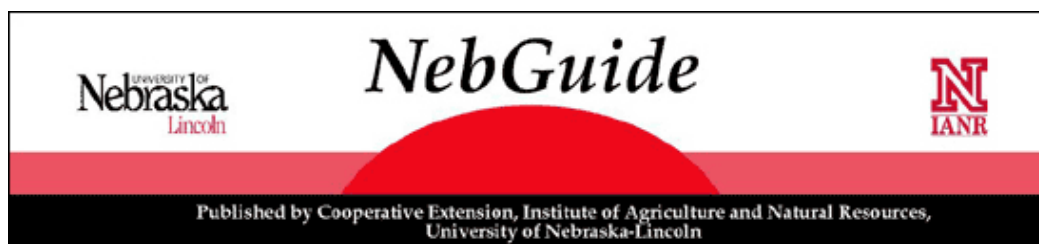


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Rasmussen, Steven D.; Josiah, Scott J.; and Wilson, John, "G03-1512 Establishing Conservation Plantings of Nut Trees and Shrubs by Direct Seeding Methods" (2003). *Historical Materials from University of Nebraska-Lincoln Extension*. 856.

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Establishing Conservation Plantings of Nut Trees and Shrubs by Direct Seeding Methods

This NebGuide explains how to plant and raise nut trees and shrubs from seed. Seeding methods, planting design, site preparation and post-planting care are discussed.

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Conservation tree and shrub plantings create wildlife habitat, improve water quality, produce marketable nuts, and enhance landscape diversity. Usually, nursery-grown seedlings are used to establish these plantings. However, a number of problems exist when using seedlings, including increased costs and reduced initial tree vigor and survival. Direct seeding of tree and shrub seeds avoids many of these problems, and is a proven, effective means to establish conservation plantings in Nebraska and elsewhere.

Many nut-producing trees and shrubs such as oak, black walnut, pecan, chestnut, hazelnut, buckeye and others can be successfully established by planting seeds (*Figure 1*). These seeds are easy to work with due to their relatively large size and local availability. Fall is the preferred time to sow tree seed since the collected seed will be fresh and most viable. Methods of direct seeding include broadcast spreading and machine row planting. Advantages of direct seeding over the traditional seedling planting include:



Figure 1. A thriving direct seeded black walnut

- planting tree seed closely replicates the natural **tree seedling** process of forest establishment;
- a greater initial density of trees per acre is possible with direct seeding;
- moisture conditions are less critical for dormant seed planting compared to the heavy immediate demand for moisture by roots of planted seedlings;
- seedlings develop undisturbed root systems and do not incur transplant shock;
- supplemental watering at planting is not necessary; and
- costs of tree establishment via direct seeding are comparable or cheaper than using seedlings, depending on how much seed is locally collected.

Potential disadvantages of direct seeding include:

- weed and grass competition control may be more difficult;
- landowners are unfamiliar with this non-traditional way of planting trees in Nebraska;
- local seed supplies may be variable or not available in some years;
- tree seed viability may not be known; and
- wildlife may eat tree seeds.

Tree seed plantings also can be established in the spring; however, this involves more careful handling and long-term seed storage. Long-term tree seed storage will not be addressed in this publication, but advice can be obtained by contacting your local Cooperative Extension office or Nebraska Forest Service forester.

Obtaining and Storing Tree and Shrub Seed

Species selection is determined by site conditions and the objective for your planting (e.g., wildlife habitat, timber production, edible nut production, etc.). A mixture of trees and shrubs usually will be recommended to obtain multiple benefits. Species such as green ash, boxelder, American plum, chokecherry and others may be included for establishing a "cover crop" to help reduce weed competition, or to create wildlife habitat and food.

In Nebraska, native acorns and most other nuts start dropping to the ground in early October. Avoid seed that drops in early August or September because these may be aborted and nonviable. Collect seeds that feel heaviest or have been held on the tree longest. Floating fresh seeds (of all nut species except hazelnuts) in water will help determine viability. Discard those seeds that are still floating after one hour in the water. Viability of dried seed may not be accurately determined using this method.

For fall planting, seeds should be planted as soon as possible after collecting. Some seeds like bur, white and swamp white oak acorns germinate in the fall and should not be kept more than a couple of weeks without refrigeration. Acorns and nut seeds like walnut, pecan, hickory, chestnut, and hazelnut only germinate after cold treatment (winter). Seeds from these species can be collected and planted in the fall. Store seed from these species in a cool location until planting, being careful not to let the seeds dry out.

Do not store large quantities of seeds together since these could quickly "heat up" through biological action and kill the seed. Store seed in feed sacks or onion bags along the north side of a building, in a root cellar or cool garage, or a refrigerated cooler until planting time. Protect the seed from squirrels and mice. If the seeds cannot be planted within one month of collection, they should be buried in containers of damp sand or stored in a refrigerated cooler at 35 to 40 degrees F. Seed can be purchased from commercial sources or collected locally. Locally collected seed will be better adapted to local climatic conditions than will seed produced in distant geographical locations, particularly more than 200 miles north or south of the site to be planted. Locally collecting seed can also greatly reduce the cost of the planting project. Before purchasing commercially available seed, ask the nursery where the seed was collected. Order seed in the summer to be delivered for planting in late October or early November.

Most seed is sold on a per pound basis and should come ready to plant. Average seed numbers per pound and approximate retail costs (2002) are listed in *Table I*. For more information on sources of commercially available seed, contact your local Nebraska Forest Service office.

Planting Design

Depending on objectives, it is usually better to establish a planting with more than one species. Mixing seeds of different trees and shrubs aids in diversity, distributes germination across a longer time period (ensuring greater potential for successful establishment during variable weather conditions), and produces a greater number of desired benefits. Seed can be planted evenly in rows or broadcast over the planting area. A heavy seeding rate compensates for poor germination, eating of seeds by wildlife, and creates a forest type environment that shades out grasses and weeds sooner. Seeding rates of 4,000 to 8,000 nut seeds per acre will allow for approximately 400 or more living stems per acre in five years. The lower seedling rate is appropriate for regularly spaced machine-planted rows. The higher seedling rate is recommended for broadcast planting (not in rows). If light seeds like ash or maple are planted as a cover crop, additional seed is required. Work with your local forester to design a planting with species that meets your needs, while addressing other aspects including soils and climate.

In Nebraska, some black walnut seed should be planted in almost any direct seeding project where nut trees are expected to grow. Black walnut seed does not need to be husked (unless necessary for machine planting) and generally has consistent germination rates averaging 30 percent to 50 percent. This is much higher and more consistent than for other nuts, which may experience germination rates of less than 10 percent. Black walnut also grows faster than most other nut seedlings, and acts as a good "row marker." Finally, black walnut has the best potential in Nebraska to become a valuable timber tree when planted on good sites. It is recommended that black walnut comprise 20 percent to 50 percent of the total nut seed mixture.

When broadcast planting, mix all seed thoroughly and scatter over the entire area. Machine planted seed are generally sown approximately 6 to 12 inches apart in rows. Mix black walnut with one or two other species per row. Spacing between rows depends on the equipment that will be used to maintain the site. Average between-row spacing and estimated seeds per acre are shown in *Table II*. Do not space rows more than 16 feet apart because it takes too long for the trees to shade the site and reduce weed/grass competition. Close spacings will allow for future thinning of inferior stems, and also promotes straighter stems. For example, using information from *Tables I and II*, consider a one-acre planting design with rows 12 feet apart, and seeds sown 6 inches apart in the row. This planting could include 30 pounds of black walnut seed (1,500 seeds), 15 pounds of northern red oak seed (1,875 seeds), 15 pounds of swamp white oak seed (1,800 seeds), 10 pounds of Ohio buckeye seed (600 seeds) and 5 pounds of hazelnuts (2,000 seeds), for a total of 7,775 seeds. Commercially obtained seed costs for this seed planting would range from \$165 to \$282, while the cost to plant the seed would be approximately \$25 to \$30. When established with seedlings, the planting stock and machine planting costs for 400 seedlings/acre at similar row spacings would range from \$275 to \$320 per acre.

Table I. Tree and shrub seed numbers and prices per pound.		
<i>Tree seed species</i>	<i>Approximate number of seed/pound</i>	<i>Approximate 2002 retail price/pound does not include shipping</i>
Black Walnut*	50	\$1.50 - \$2.35
Northern Red Oak	125	\$1.25 - \$4.50
Chinkapin Oak	400	\$2.00 - \$5.00
Scarlet Oak	270	\$4.50 - \$6.50
Bur Oak	75	\$1.20 - \$1.75

Swamp White Oak	120	\$1.75 - \$3.00
Single Oak	400	\$5.00 - \$6.25
Shagbark Hickory	100	\$1.25 - \$4.25
Pecan	80	\$2.50 - \$3.00
Hazelnut**	400	\$10.00 - \$13.75
Horse Chestnut/O. Buckeye	60	\$2.50 - \$3.00
*Three gallons unhulled black walnut nuts equals 1 gallon hulled nuts. One 5-gallon pail holds 500 to 600 hulled walnuts and weights 15 to 20 pounds. **Hazelnuts in the husk are about 50 percent nut, by weight.		

Table II. Row spacing and seed/acre densities*.

<i>Between row spacing</i>	<i>Approximate number seed/acre (6 inch average spacing in-row)</i>
8'	10,900
10'	8,700
12'	7,260
14'	6,200
16'	5,450
*Initial planting density should be 4,000-8,000 nuts per acre.	

Site Preparation

Good site preparation is critical to ensure a successful planting. Firm seed-to-soil contact and coverage is required for adequate germination. Seeds left on top of the ground will quickly lose viability and die, or be eaten by wildlife. Site preparation activities will depend upon the type of existing vegetation (e.g., crops vs. pasture), and the planting method. For any direct seeding project, if the planting site is currently in perennial vegetation, (such as alfalfa or a cool season grass like smooth brome, bluegrass or fescue grass), shred or graze the grass, then spray a contact herbicide such as glyphosate (Roundup) in late September to kill the vegetation (*Figure 2*). Do not use a pre-emergent herbicide, as this may injure or kill tree seeds being sown.

When using the broadcast planting method, once the current vegetation has been killed the ground should be disked and worked ready as if a corn or soybean crop were to be planted, at least a few weeks before sowing tree seed. The ground needs to have settled before nut seeds are sown and disked in. A cover crop of oats or wheat could be planted to help reduce weed/grass seed germination and growth.

When planting in rows with a machine, the nut seeds are mechanically placed in a furrow to a depth of 2 to 4 inches. If the planting site is crop ground, no site preparation is necessary unless there is excessive stalk residue that needs to be disked. Nut seeds are then machine-planted directly into the stubble (*Figure 3*). If the site is in warm season grasses, shred or graze in the late season and plant directly into the short stubble. Cool season grasses or perennials such as smooth brome or alfalfa should be killed prior to mechanically planting tree seed.

Planting

Once the site is properly prepared, tree seed should be planted as soon after collection as possible to minimize loss of viability during storage. Planting can be done from October until the ground freezes. Planting later in

the season may help reduce wildlife pilfering.

With the broadcast planting method, scatter seed over the planting area with a fertilizer spreader, manure wagon, or by hand (Figure 4). Disk the seeds into the ground to a depth of 2 to 4 inches. For best results, disk from two directions. If a light seed such as ash or boxelder being used as a cover crop, first scatter and disk in nut seeds to the 4-inch depth. Then spread the lighter seed and conduct a second and more shallow disking. After disking, roll the ground with a culti-packer or similar equipment to get firm seed-to-soil contact.

When using a mechanized tree seed planter, the seeds are mixed in the hopper of the machine, which then drops a tree seed into the row, with the distance between seed depending on how the machine is calibrated (Figure 5). If a light seed like green ash is used for a cover crop, sprinkle the seed into the row by hand as the machine plants the nut seeds. A follow-up packing of the planted furrow is advised by driving over the row with a tractor, truck or ATV tire. This will ensure slot closure and reduce wildlife pilfering.



Figure 2. Tree rows direct seeded into killed sod strips.



Figure 3. Tree row direct seeded into stubble on former crop ground.



Figure 4. Broadcasting smaller seed over a prepared area.



Figure 5. Using a mechanical seed planter to sow tree and shrub seed.

Post-Planting Care

In Nebraska, seeds planted in the fall will emerge in late April (southern Nebraska) through early May (northern Nebraska). Some species may not emerge until late May. Black walnut is the fastest grower and should be 12 to 18 inches tall by the end of the first growing season. Oaks will be 4 to 7 inches tall. Other nut species will vary in height. Some seeds may stay dormant for a full year and germinate the following spring.

Chemical or mechanical weed control will be needed during the first several years after planting to keep

competing vegetation away from developing tree seedlings. Shredding or mowing vegetation alongside the tree rows (if they exist) several times during the summer will help reduce weed competition but not eliminate it. Early spring weed or grass growth can be controlled with a contact herbicide (e.g., glyphosate) sprayed directly over the planted tree seeds (spring after sowing). This must be done before tree seedlings begin to emerge. Do not use pre-emergent herbicides as these could damage or kill the germinating tree seed.

After tree seedlings have emerged in machine row plantings, broadleaf weeds and grasses less than 8 inches in height can be controlled by contact herbicides applied as a carefully aimed directional spray around the tree seedlings. Extreme caution must be used not to get the herbicide spray or drift on the young tender seedlings (*Figure 6*). If only grasses are present, then a grass herbicide (e.g., Fusilade) can be used. Another option is to rope wick a contact herbicide on weeds/grasses that are 4 to 6 inches taller than the trees. Shredding or mowing over the tree row above the seedling heights several times a growing season is third option. Weed control on broadcast plantings can be problematic, as there are no "rows" that permit access. However, broadcast herbicide treatments or mowing can be done. Contact your local forester, Natural Resources Conservation Service, Natural Resources District, or Extension office for weed and grass control recommendations and potential herbicide choices appropriate for your situation.

Watering and fertilizing emerging seedlings should not be necessary. One of the primary advantages of seed planting verses seedling planting is that the germinating nut seedling has an undisturbed root and does not undergo "transplant shock." This makes it less susceptible to moisture stress and competition. If weeds and grasses are kept away from the seedlings, there will be adequate moisture on most sites in normal years. Animal control devices may be needed if there is a limited number of germinated seedlings and/or high rodent/animal feeding pressure (*Figure 7*). Putting animal control devices around the best 50 to 100 seedlings per acre may be a wise investment. Tree shelters can be homemade from wire mesh or purchased. Shelters should not be necessary until after a full growing season in late summer or early fall.

Thinning out crowded areas in the seed row may be necessary after several years if seed germination rates are very high. The poorest trees can be pulled, cut out or transplanted to other locations. On the average, allow a 12-inch separation between seedlings for each year of age for walnuts or a 12-inch separation for each two years of age with other slower growing species. This will allow adequate growing space and yet keep trees



Figure 6. A homemade device to protect seedlings from herbicide spray.



Figure 7. Several tree shelter designs used to minimize animal damage.

close enough to shade out weeds and grasses. Closely growing trees also "force" each other to grow in a straighter, more upright manner. These straight-growing trees may eventually produce high-value veneer timber.

Finally, if nut production is an objective, selections of black walnut, northern pecan, hybrid hazelnut and Chinese chestnut have been identified that produce high quality, commercially valuable nuts. Branches from these superior selections or cultivars can be grafted onto seedlings in your direct seeded planting to enhance production of high quality nuts. Superior seed can also be planted. Seed and grafting material from superior selections, and grafting advice is available from the Nebraska Nut Growers Association, the Northern Nut Growers Association, or private individuals.

Summary

Conservation nut tree plantings can be successfully established from seed plantings in the fall. Successful projects will include proper seed collection and short-term storage, timely planting, weed and grass control, prevention of wildlife damage and potential thinning of crowded seedlings. Planning and attention to these details will help ensure healthy, diverse plantings that provide woodland products, wildlife habitat, environmental protection and landscape diversity. For additional information and assistance, contact your local office of UNL Cooperative Extension, USDA Natural Resources Conservation Service, Natural Resources District, or Nebraska Forest Service.

File G03-1512-A under: FORESTRY

B-17, Tree Planting

Issued August 2003, 2,500

Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Elbert C. Dickey, Director of Cooperative Extension, University of Nebraska, Institute of Agriculture and Natural Resources.

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