

BIRCH NURSERY PRACTICE

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OF THE forty or so species of trees that comprise this genera, seven are native to North America. Three are of silvicultural importance in North America: yellow birch, paper birch, and sweet birch (*USDA Forest Service 1965*). When ornamental, landscaping, and reclamation uses are considered, three additional species—gray birch, European white birch, and river birch—and numerous varieties would be included.

Birch is not widely produced in this country for reforestation. Fewer than 100,000 yellow birch seedlings were produced in 1968 for reforestation purposes. About 125,000 river birch and 116,000 European white birch were produced for reclamation planting. Sales of these species and numerous varieties for ornamental use were estimated at 1 million in 1968.

Flowering

The birches are monocious, producing both male and female flowers on the same tree. The male flowers are formed in midsummer in clusters of two or three, or solitary. They remain on the tree over winter, maturing in the spring; soon after pollen dispersal, they drop off the tree (*Harlow and Harrar 1950*). The female flowers mature with the leaves in the spring. Pollination, by wind, usually occurs before the leaves are fully expanded. The catkins ripen in late summer and early autumn—except river birch, which ripens in the late spring—becoming brown and woody when ripe. Catkins of paper birch are pendant, while those of most other birch species are erect. Catkins are 1 to 1½ inches long in most birch species. Seeds are borne on trident bracts in the cone; the seed is oval and laterally winged with two persistent stigmas at the base (*Harlow and Harrar 1950*).

Seed Collection

Speed ripening is a local thing, so it should be investigated before collection is begun.

Birch is judged to be ripe when the exterior of the seed has lost its green color and becomes brown. The interior of the seed should have lost its milky or watery condition, and the kernel should have attained a firm condition. This condition should develop in late August or early September over much of the birch range; however, confirm ripeness before collection is begun.

Seeds are collected by hand from standing trees or from felled trees. The shattering habit of the birch catkins make it advisable that collectors place the catkins into picking bags as picked instead of allowing them to fall on to tarps.

A bushel of collected fruit may weigh from .9 to 13½ pounds depending upon the species and year of collection (*Stoeckeler and Jones 1957*).

Extraction, Cleaning, and Storage

Collected seed should be spread on tarps or screen trays to dry, because fresh seed usually has high moisture content and injury to the seed may result from heat in confined storage such as burlap sacks or closed containers. The conelets disintegrate during the drying process, and some mixing with a rake by hand will complete the extraction.

Cleaning is desirable to improve the purity and avoid storing stalks, cone scales, and debris. One successful cleaning practice is to scalp the larger material off on a screen that allows the seed to pass through. Round-hole screens of 8/64-inch screens are suitable for yellow birch and paper birch; 10/64-inch screens are suitable for a river birch (*USDA Forest Service 1948*).

Most nurserymen do not bother to dewing the birch seed since the rudimentary wing is not a serious obstacle to seed handling, storage, and sowing. Average numbers in thousands of cleaned seed per pound for several birch

species are shown in the following tabulation (USDA Forest Service 1948):

	Low	Average	High
<i>Yellow birch</i>	278	447	907
<i>River birch</i>	287	375	548
<i>Paper birch</i>	610	1,380	4,120
<i>European</i>			
<i>white birch</i>	1,510	2,400	5,040

The variability in viability among seed lots make it imperative that the nurseryman determine the characteristics of each lot of seed so that accurate sowing rates can be computed. Bed density has a striking effect on the quality of seedlings produced. Overdense beds cannot be managed successfully except by expensive thinning. It is far more economical to determine number of seeds per pound and purity and germination percent for a seed lot, and then compute the desired sowing rate than to be faced with overdense beds or extremely thin beds. Bed densities of 15 to 25 seedlings per square foot are optimum. This range seems to yield the most high-quality plantable seedlings.

Germination of birch seed is generally prompt, beginning in 10 days and completed within 30 days. Germination tests of seed lots can be made quickly by placing the seeds in shallow dishes filled with water and exposing the dishes where they will receive light (Yelenosky 1961). For uniform results, it is best to use continuous artificial light from a desk lamp or similar source. The addition of fungicide to the water will avoid problems with fungi.

Birch seed has been successfully stored for several years at moisture contents of 1 to 5 percent at temperatures of $-4^{\circ}\text{C}.$ - $-25^{\circ}\text{F}.$ (Food and Agriculture Organization 1955). Recommendations in the *Woody Plant Seed Manual* are for dry storage at temperatures of 33° to $38^{\circ}\text{F}.$ (USDA Forest Service 1948).

Stratification of birch seeds is not necessary if they are sown in the fall. And fall-sown seeds often germinate early in the spring—sometimes even before the soil can be prepared for spring sowing. This early start provides a longer growing season. For these reasons, many nurserymen prefer fall sowing.

However, spring sowing is also successful. The need for stratification before spring sowing varies among seed lots. Stratification is usually not necessary if the seeds have been stored at low temperature. However, some lots

benefit by a stratification pre-treatment for 30 days before sowing. Stratification is accomplished by soaking the seed lot in tap water for 24 hours. The excess water is then drained off and the seeds are placed in a plastic bag under refrigeration at $34^{\circ}\text{F}.$ for 30 days. When the seed is removed, it should be surface-dried to facilitate sowing. If sowing is delayed, the seed should be returned to cold storage.

Sowing Methods

Birch seeds may be either broadcast or sown in drills. Either way the seed should not be covered too deeply: $1/8$ -inch covering is the maximum that permits uniform seedling emergence. Seed that is covered too deeply may fail to germinate or it may take a long time to germinate, resulting in very uneven seedlings and high cull percent in 1-year-old planting stock. Satisfactory germination will result from sowing without covering if wind and excessive drying are not problems or can be controlled successfully.

Fall sowing is accomplished on prepared seedbeds when temperatures fall below the level where germination will occur. Birch species germinate satisfactorily at temperatures above $59^{\circ}\text{F}.$

For producing ornamental birch clumps, Pinney and Peotter (1966) germinate untreated paper birch seeds in flats in the greenhouse. When seedlings produce their second true leaf, they are transplanted three in a $2\frac{1}{4}$ -inch peat pot. When danger of frost is past the pots are lined out in the field and the seedlings are grown to produce birch clumps for ornamental planting.

Seedbed Preparation

Seedbeds are generally prepared by plowing to a depth of 8 inches or more, followed by disking and harrowing. Some general leveling of the seedbeds is normally performed before bed layout to insure good drainage. Seedbeds may be elevated above the level of paths to permit drainage. This is usually done in fine-textured soils or in areas where heavy rainfall is expected. Raising seedbeds is accomplished by a device using two disks that pull soil from paths located 66 to 72 inches apart, and deposit it on the bed. A shaper then forms the slightly crowned surface of the bed some 4 inches above the path level and 52 to 68 inches wide. Pre-planting fertilizer applica-

tions are generally incorporated during the bed-making process.

Many nurserymen now fumigate all seed-bed areas before sowing. Various chemicals are used; many are fungicides, nematocides and seedicides providing protection against damping-off and other soil-borne diseases. They also protect against nematodes and provide early-season weed control.

Ingestad (1957) has indicated that birch is a nitrogen-requiring species relative to other deciduous trees, but quite undemanding of other nutrient elements. Performance of certain birch species such as river birch and European white birch on spoil banks and in other reclamation work indicates that these species will survive and grow under adverse conditions even though growth does not approach the optimum.

Wilde (1946) gives the following standards of soil fertility for growing yellow birch in the nursery: pH of 5.3; exchange capacity 12 meq. per 100 gm.; 16 percent total N. or 35 pounds per acre available N.; 60 pounds per acre available P_2O_5 ; 175 pounds per acre K_2O ; 5 meq. per 100 gm. replaceable calcium; and 1.5 meq. per 100 gm. of replaceable magnesium.

Birch seedlings tend to be fragile for a period after emergence and may benefit from

overhead shade. In Pennsylvania, shade is installed after sowing is complete and is retained throughout the summer.¹ Shading is common practice in birch nursery practices to protect against wind, prevent drying during germination, and for summer protection. In Indiana, river birch is not shaded, but frequent irrigation is practiced during the germination period.²

Stock for reforestation planting should be a minimum 7/32-inch stem caliper at the ground line, with an 8-inch top. Stock of smaller size is sometimes preferred for reclamation planting. At most nursery locations this size is reached in 1 year when fertility level, irrigation, and density control are practiced. In northern locations it may be desirable to keep seedlings in the nursery 2 years to attain optimum size for field planting.

Birch is palatable to deer and may need protection in nurseries where deer are not fenced out or otherwise controlled. Shade frames are sometimes left in place over winter to protect against deer browsing.

¹ Personal communication with Pat Lantz and Joe Hill, Pa. Dep. of Forests and Waters.

² Personal communication with Richard McNabb, Indiana Div. of Forestry.

Literature Cited

- Food and Agriculture Organization of the United Nations.
1955. TREE SEED NOTES. FAO, Rome.
- Harlow, William M., and Ellwood S. Harrar.
1950. TEXTBOOK OF DENDROLOGY. 3rd Ed., 555 pp. McGraw-Hill Book Co.
- Ingestad, Torsten.
1957. STUDIES IN THE NUTRITION OF FOREST TREE SEEDLINGS. I. MINERAL NUTRITION OF BIRCH. *Physiol. Plant.* 10: 418-439.
- Pinney, Thomas S., and Gene W. Peotter.
1966. THE PROPAGATION OF BIRCH. *Plant Propagators Soc. Proc.* 16: 193-202. Newport, R. I.
- Stoeckeler, J. H., and Jones, G. W.
1957. FOREST NURSERY PRACTICE IN THE LAKE STATES. U.S. Dep. Agr. Agr. Handb. 110. 124 pp.
- United States Forest Service.
1948. WOODY PLANT SEED MANUAL, U.S. Dep. Agr. Misc. Pub. 654. 416 pp.
- United States Forest Service.
1965. SILVICS OF FOREST TREES OF THE UNITED STATES. U.S. Dep. Agr. Agr. Handb. 271, 761 pp.
- Wilde, S. A.
1946. FOREST SOILS AND FOREST GROWTH. *Chronica Botanica Co.*, Waltham, Mass.
- Yelenosky, George.
1961. BIRCH SEEDS WILL GERMINATE UNDER A WATER-LIGHT TREATMENT WITHOUT CHILLING. USDA Forest Serv. NE Forest Exp. Sta. Forest Res. Note 124, 5 pp. Upper Darby, Pa.