

PLANT MATERIALS TECHNICAL NOTE

BUR OAK *Quercus macrocarpa* Michx.

A Native Conservation Tree for Use in Montana and Wyoming

Joseph D. Scianna, Manager, USDA-NRCS, Plant Materials Center, Bridger, Montana
Jim Jacobs, Plant Materials Specialist, USDA-NRCS, Bozeman, Montana



Figure 1. Bur oak tree (left) and foliage (right)

General Description

Bur oak or mossycup oak is a North American deciduous tree widely distributed across the U.S., Southeastern Montana, and Northeastern Wyoming are on the western edge of its native range where its occurrence is limited to ponderosa pine woodlands and grasslands on low ridges and outcrops, hills and slopes, deep ravines and river bottoms at elevations ranging from 3,200 to 6,900 feet. It has several desirable attributes including strong branches, drought tolerance, winter hardiness, and freedom from serious insect or disease problems. It is a long-lived, deep-rooted species with an average mature height of 30 to 50 feet in the northern Great Plains, depending on location.

Adaptation/Range

Locations: Ekalaka Germplasm bur oak (Figure 2) is a composite of multiple seed sources originating in the northern Great Plains. Although geographic range testing of this selection has been limited, it should perform well across broad areas of eastern Montana and Wyoming, as well as western North Dakota and South Dakota (see Releases). Thick bark protects bur oak from low severity fires, and trees as small as three feet may survive a burn. Young trees will top kill by fire followed by vigorous sprouting. Trees greater than 12 to 45 years old can survive repeated fire. Since 1981 bur oak has been tested in 16 field plantings across Montana and Wyoming, with mixed results. In Montana, bur oak failures have been attributed to deer, winter kill, rabbits, gophers, leafcutter bees, and grasshoppers.

Soils: Bur oak favors rich bottomland alluvial soils, but can grow well on other marginal sites such as rocky hillsides, limestone soils, dry clays, and other marginal sites given full sun conditions. The species performed better than most others tested on coal-mine spoils of pH 5.6 in eastern Kansas. In the western United States, bur oak is considered a pioneer species and is capable of invading prairie grasslands. In the eastern Great Plains, it occurs primarily along stream bottoms and stream terraces in association with green ash (*Fraxinus pennsylvanica*), boxelder (*Acer negundo*), and cottonwood (*Populus* sp.). Bur oak is, however, intolerant of flooding. It is recommended in Montana for Conservation Tree and Shrub Suitability Groups 1, 3, 4, and 5. Soil salinity tolerance data is largely non-existent, but it is assumed to be relatively intolerant to soil salts based on its natural distribution.

Hardiness: Bur oak is listed as growing well in USDA Winter Hardiness Zone 4 (-29° to -34°C [-20° to -30°F]) but can be found growing well in Zone 3b, (-34° to -37°C [-30° to -35°F]) and may tolerate Zone 3a (-37° to -40°C [-35° to -40°F]).

Life History

Bur oak acorns germinate soon after seed fall. In the northern reaches of its range, some acorns remain dormant through winter and germinate the following spring, after which most non-germinated acorns are eaten by wildlife. Root growth of seedlings and saplings is rapid, developing a taproot capable of penetrating four feet, with three feet spread of lateral roots, in the first year. Trees growing in the wild reach reproductive maturity after about 35 years of age and bear seed up to 400 years old, older than any other North American oak. Cultivated stands may begin producing seeds at less than 10 years-of-age. Flowers are born on catkins and bloom shortly after leaf expansion, about mid-June. Seed and pollen flowers are on different catkins on the current year's branch growth and mature at different times favoring cross-pollination. Acorns ripen within the year and drop as early as August and as late as November. Acorns are dispersed predominantly by small mammals.

Conservation Uses

Bur oak is an excellent choice as a medium stature tree in windbreaks and shelterbelts, offering a long-lived, strongly-wooded component to these plantings. It can be used in field borders, living snowfences, wildlife applications (food, nesting, loafing), riparian restoration projects, woody draw restoration, mine-land reclamation, carbon sequestration, and native landscaping. Moose, elk, deer, and rabbits browse bur oak, and cattle will browse seedlings and saplings to the ground. Acorns are high in calories and are a food source for many species of wildlife, including black bears, squirrels, and mice. Wild turkeys favor bur oak acorns and utilize bur oak trees for roosting and nest under their cover. Bur oak provides cover and forage for sharp-tailed grouse, and habitat for other birds. Cavity nesting birds including mountain bluebirds, white breasted nuthatches, northern flickers, red-bellied woodpeckers, and downy woodpeckers use bur oak.



Figure 2. Ekalaka Germplasm bur oak seed orchard

Establishment

Bur oak establishes well given proper site conditions and preparation. Use standard conservation tree and shrub establishment practices such as controlling of rhizomatous grasses and forbs one to two years prior to planting and using high quality woven weed fabric. In a study at the Bridger Plant Materials Center, the growth rate of bur oak was four times greater on a cultivated site compared to a vegetated site, i.e., refer to Plant Materials Technical Note MT-66 for details. Supplemental water at planting time increases soil-to-root contact, prevents root desiccation, and increases seedling survival. Preferred stock type includes various sizes of 1- and 2-year-old container plants, especially stock grown in tall, narrow containers. Dormant spring planting is recommended.

Limitations

Acceptance of bur oak for use in windbreaks and shelterbelts has been limited by slow initial height growth and a multi-stemmed growth habit. The Ekalaka Germplasm bur oak selection was made to address these limitations and to improve plant survival, growth, and form. Controlling competing vegetation in a planting using clean cultivation or weed cloth will increase height growth rate.

Bur oak is a favored browse for deer and rabbits and therefore requires immediate protection from livestock and wildlife. Bur oak field plantings in Blaine and Hill Counties, Montana, both failed because of deer depredation. For long-term protection from large animals, exclusion fencing is ideal, although electric, double-fencing works well if maintained. For long-term protection from small animals, exclusion fencing such as welded wire is preferred. Seedlings may be protected from small and large animals with individual tree shelters, but these devices are quickly out grown, and have demonstrated functional limitations.

Bur oak seedlings grown in deep (tall) containers have better transplant survival and growth than root-pruned bareroot stock and seedlings grown in shallow containers. Reports of insect damage in Montana have been minimal, although infestations of aphids at Bridger stressed plants and

reduced growth. Soil moisture stress resulting from grass and shrub competition also limits seedling survival and growth. Bur oak is shade intolerant, and should be planted in full sun for best performance. It is not recommended for excessively wet, compacted or poorly-drained sites, heavily saline or sodic soils, or soils classified as “unsuitable” for tree and shrub planting.

Releases

Ekalaka Germplasm bur oak was released in 2009 by the Bridger Plant Materials Center in cooperation with the Agricultural Experiment Stations of Montana State University and the University of Wyoming. It was selected for superior rate of height growth, seedling survival, and vigor rating, primarily for use in windbreaks and shelterbelts from among 24 seed sources and 384 test trees. The Ekalaka seed orchard consists of 67 selected trees and is a composite of nine parent trees¹ (accessions) from Nebraska, Montana, and South Dakota. Heights of 15 to 20 feet can be expected with this selection at 20 years-of-age given clean cultivation and in a 10- to 12-inch annual precipitation zone on a well-drained site. Supplemental water may increase growth rate. Although geographic range testing of this selection has been limited, it should perform well across broad areas of eastern Montana and Wyoming, as well as western North Dakota and South Dakota. Based on the performance data in Bridger, Montana, and in its native range, Ekalaka Germplasm bur oak is best adapted to elevations of 2,000 to 4,000 feet, but is expected to perform well below ~5,000 feet in most locations, given other favorable conditions.

‘Boomer’ (1994) and ‘Lippert’ (1993) are cultivars of bur oak released from the Texas and Kansas Plant Materials Centers, respectively. These releases are from seed sources well-adapted to the service areas of these two Centers, but not tested or currently recommended in Montana and Wyoming.

¹ A parent tree is the mother plant from which seed was collected and used to produce test seedlings.

Additional Information

Windbreaks for Montana – a landowner’s guide. 1986. Cooperative Extension Service, Montana University, Bozeman, MT. Bulletin 366.

Creating Native Landscapes in the Northern Great Plains and Rocky Mountains. USDA NRCS Montana State Office, Bozeman. Available at:
<http://www.mt.nrcs.usda.gov/technical/ecs/plants/xeriscp/index.html>.

Plant Fact Sheet for bur oak *Quercus macrocarpa*, electronic availability at <http://plants.usda.gov>.

Plant Guide for bur oak *Quercus macrocarpa*, electronic availability at <http://plants.usda.gov>.

For proper seed source selection, see [Plant Materials Technical Note MT-67](#), *Seed Source Selection, Use of Certified Seed, and Appropriate Seed Release Class Improve Conservation Planting Success* on the Montana NRCS or national Plant Materials websites.

For proper seedling storage and handling, see [Plant Materials Technical Note MT-51](#), *Temporary Storage and Handling of Container, Bareroot, and Cutting Stock* on the Montana NRCS or national Plant Materials websites.

For proper bareroot and container seedling planting, see *Hand-Planting Guidelines for Bareroot Trees and Shrubs* and *Planting Guidelines for Containerized and Balled and Burlapped Stock* on the Montana NRCS website.