



The Bismarck Plant Materials Program focuses on finding plant-based solutions for conservation issues. Field Plantings provide a way for plant species and technology to be evaluated across a variety of soils, climatic, and site conditions not found at the Bismarck Plant Materials Center (PMC). Typically, someone from a Natural Resources Conservation Service (NRCS) Field Office, Conservation District, or partner agency assists with planning and annual evaluations of the planting. The cooperator, usually a land operator/owner or partner, is responsible for planting and management at the site. The evaluation period is three years for herbaceous species and five years for woody species. Supplementary evaluations are sometimes necessary to ensure sufficient information.

Lodgepole Pine (*Pinus contorta*)

Purpose of Evaluation

Windbreaks are an integral part of conservation across the Great Plains. Due to climatic conditions, the number of tree species suitable for windbreak usage is limited. Tree pests such as emerald ash borer (*Agilus planipennis*) and gypsy moth (*Lymantria dispar*) continue to threaten the few adapted species. Additional tree species options are especially needed for windbreaks and other conservation plantings in western North Dakota and South Dakota. Lodgepole pine is a medium/tall, hardwood evergreen conifer that grows naturally in a wide variety of soils, elevations, and precipitation zones in the western United States and was therefore considered for adaptation testing in the Northern Great Plains.

Species Information

Lodgepole pine is native from the Yukon region in Canada, south to Baja, California and west to east from the Pacific Ocean to the Black Hills of South Dakota. The species has been divided geographically into four varieties. The inland form, *Pinus contorta* var. *latifolia* is the species growing in the Rocky Mountains and the Black Hills of South Dakota.

Lodgepole pine occurs in a wide range of soils and sites. It prefers well drained, moister soils but has been found to be drought tolerant in North Dakota once established. It is very tolerant of extreme cold temperatures, such as those found in USDA Hardiness Zone 2. It grows best in full sun and is intolerant of shade. Currently, recommendations in the North Dakota Tree Handbook (Herman et al.) are to plant lodgepole pine on the protected side of a farmstead.

Generally, lodgepole pine has a long, slender trunk with few lower branches and a high, thin crown (Figure 1). Needles are in groups of two, yellow-green, 1-3 inches long and often twisted (Figure 2). The bark is thin, orangish brown to gray and scaly. The cones are



Figure 1 Lodgepole pine in a provenance trial near Mandan, North Dakota grow tall and straight.

woody, and 1 to 2 inches long, with prickly scales. Generally, the crown height is 25-55 feet and width of the tree is 15-25 feet at maturity but can vary greatly depending on plant density and climatic conditions where it is growing.

Lodgepole pine is used for framing lumber, paneling, posts, poles and railroad ties. Its long straight growth provided excellent support poles for tepees and lodges of Native Americans, thus the common name lodgepole pine. It provides habitat for birds and squirrels.

Planting Locations

In 2014, lodgepole pine (Accession 9094433) bare root trees were planted at Field Planting sites in Minnesota (8), North Dakota (4) and South Dakota (7). Additional sites in North Dakota (2) and South Dakota (3) were planted in 2015. The county locations of the plantings (blue) are found in Figure 3. Generally, 25 trees were planted per site.



Figure 2 Needles of lodgepole pine are in bundles of 2.

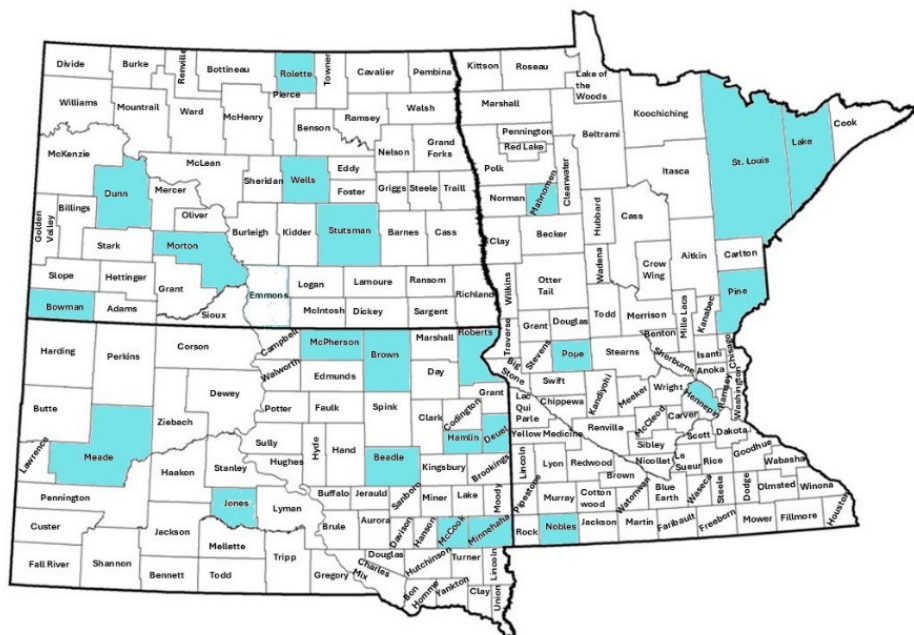


Figure 3 County locations of lodgepole pine Field Plantings.

Data and Trends

Field Plantings

Overall, survival and growth by the second growing season was not favorable for lodgepole pine in most plantings (Figure 4). The observed poor quality of the planting stock likely caused some establishment failures. Of the 24 Field Plantings, only three had 50% or greater survival three years after planting and tree heights that averaged 3-4 feet after five years (Table 1). These Field Plantings were in northeast Minnesota, where cold temperatures can be extreme, suggesting winterkill was not the primary cause of establishment failure at other Field Planting sites. Poor planting stock, extreme weed



Figure 5 Reducing weed competition helps lodgepole pine establishment.



Figure 4 Many lodgepole pine seedlings were dead by the end of the first growing season.

pressure, extensive browse by deer, and lack of moisture were noted for most of the failed plantings, and were the more probable causes for tree mortality. Trees that survived at least three years were generally healthy and vigorous unless weed pressure or browse became extreme (Figure 5). Field Planting data was not adequate to provide a 5-year tree height for lodgepole pine.

Off Center Evaluation Plantings

Lodgepole pine trees (accession 9057311 except Dickinson 9092231) were planted and evaluated at eight different Off-Center Evaluation Plantings (OCEPs), beginning in 1988. None of the sites had actively growing lodgepole pine remaining in 2025 (Table 2). The most successful lodgepole pine planting was at the OCEP in Highmore, South Dakota where weeds were meticulously controlled. As occurred in Field plantings, most plantings failed in the first few years, few trees established at the site, and those that did were generally healthy.

Seed Source Study Plantings

Lodgepole pine was successfully growing, after more than 25 years, in a provenance test planted in 1980 at the USDA, Agriculture Research Service (ARS), Great Plains Northern Research Laboratory, Mandan, North Dakota. This prompted a study to plant and evaluate some of the better performing provenance test accessions at Hettinger, North Dakota; Hebron, North Dakota; Grant County, North Dakota; and Angostura State Park near Hot Springs, South Dakota. Trees were planted in May 2008 at all sites. The study identified various parameters that affected establishment, survival and growth of lodgepole pine. Some mortality was attributed to poor planting stock, as no root development was found on many trees that died in the first two years. Tree performance was poor on sites with soils containing a tight clay component where there was ponded water. Deer browsing was extensive at all sites and negatively impacted survival and growth, except where trees were caged (Figure 6). Weed pressure negatively impacted survival and tree growth, particularly in the first few years after planting. A final report of the study, including accession origin and additional data can be found at

<https://www.nrcs.usda.gov/plantmaterials/ndpmcsr13344.pdf>



Figure 6 Lodgepole pine trees, 7 years old, near Hettinger, North Dakota. These vigorous trees have been protected from wildlife and weed competition.

Conclusion

Some general conclusions can be made regarding lodgepole pine adaptability in the Northern Great Plains. In the provenance test at the ARS, lodgepole pine were able to establish, survive and grow long-term at Mandan, North Dakota. After more than 30 years, many accessions were large and thriving. Based on outcomes from Plant Materials trials (Field Plantings, OCEPs, Study) growing conditions in the first few years after planting play a critical role in establishment and survival of lodgepole pine. The condition of the planting stock had a great impact on survival and establishment. Poor planting stock was noted for most of the failed plantings. Extra care when handling, storing and planting will be needed for successful establishment of lodgepole pine. Browse from deer caused extensive damage at many of the planting sites. Protecting trees in wildlife dense areas should be strongly considered. Heavy weed pressure negatively affected establishment and growth of lodgepole pine. Weed pressure and tree mortality was greatest at sites where there was no weed barrier fabric. Tree growth was greatly reduced at sites where sod became dense after trees had established, which may affect tree survival in times of stress.

Lodgepole pine did poorly on clay soils. Lodgepole pine trees that established and survived for more than three years grew and thrived, except where severe unusual weather events, human damage or dense sod formed. This suggests that the species has potential to survive climatic conditions found in the Northern Great Plains.

Results indicate that further investigation of soils, CTSGs, moisture requirements, stock handling, and weed pressure impacts are needed to determine the feasibility of lodgepole pine as a field windbreak species for Minnesota, North Dakota, or South Dakota.

References

Herman, D. E., Stange, C. M., & Quam, V. C. (Eds.). (n.d.). *North Dakota Tree Handbook*. NDSU Extension Service. <https://www.ag.ndsu.edu/trees/handbook/ndhand-1.htm>

Table 1 Field Planting locations and survival percentages of lodgepole pine.

Planting ID	Yr Planted	State	County	MLRA	2014 Survival %	2015 Survival %	2016 Survival %	2017 Survival %	2018 Survival %
MN1401	2014	MN	Hennepin	-	100	44	32	32	32
MN1404	2014	MN	Noble	103	8	0			
MN1405	2014	MN	N. St Louis	-	75	72	70	70	64
MN1408	2014	MN	Lake	-	75	65	80	55	60
MN1409	2014	MN	Lake	104	75	80	80	73	57
MN1412	2014	MN	Pine	90	48	0			
MN1416	2014	MN	Pope	102A	64	0			
MN1417	2014	MN	Mahnomen	-	52	28			
ND1403	2014	ND	Stutsman	53B	95	56	0		
ND1406	2014	ND	Wells	55B	40	8	0		
ND1418	2014	ND	Dunn	54	84	52	32	32	28
ND1421	2014	ND	Morton	54	40	0			
ND1501	2015	ND	Rolette	55A	64	36	30	15	
ND1504	2015	ND	Bowman	54	0				
SD1404	2014	SD	McPherson	53B	30	Removed			
SD1406	2014	SD	Brown	55B	40	12	12		
SD1409	2014	SD	Minnehaha	102B	88	12			
SD1412	2014	SD	Deuel	102A	44	12	4		
SD1418	2014	SD	Meade	60A	82	8			
SD1419	2014	SD	McCook	55C	30	20			
SD1421	2014	SD	Hamlin	102A	40	10			
SD1501	2015	SD	Beadle	55C	0				
SD1502	2015	SD	Roberts	102A	0				
SD1503	2015	SD	Jones	63A	48	0			

Table 2 Off-Center Evaluation Plantings of lodgepole pine.

Location	State	Area	Accession	Planting year	Removed/Dead year
McKenzie	ND	central	9057411	1988	1989
Dickinson	ND	western	9057411	1988	1989
Dickinson	ND	western	9057411	2009	2023
Cottonwood	SD	western	9057411	1988	1989
Highmore	SD	south central	9057411	1988	2002*
Brookings	SD	southeast	9057411	2014	2016
Morris	MN	west central	9057411	1988	1991
Becker	MN	central	9057411	2009	2018**

*Lodgepole pine trees were thriving when OCEP was terminated.

**Some lodgepole pine trees were still growing when site was sold.