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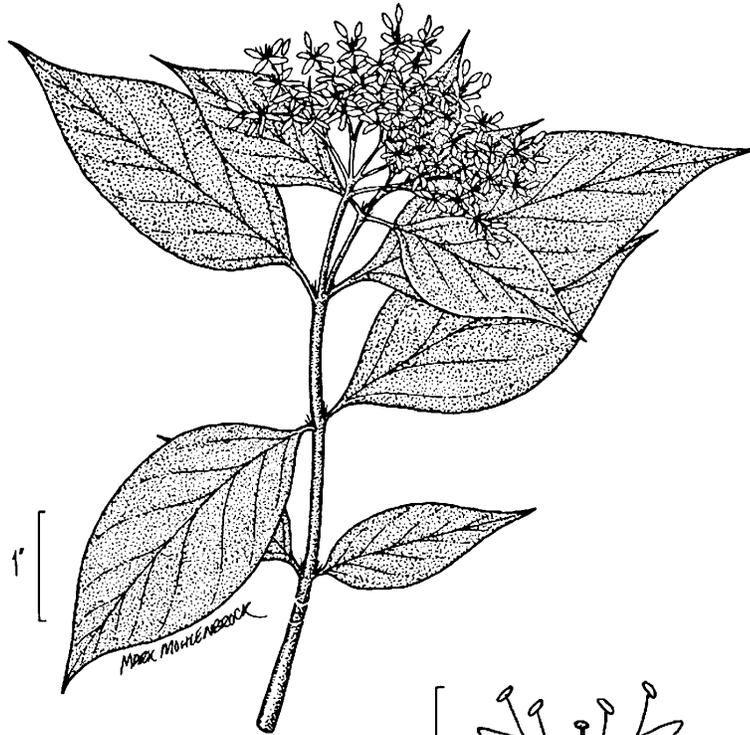
Plant Materials
Center

Bismarck,
North Dakota

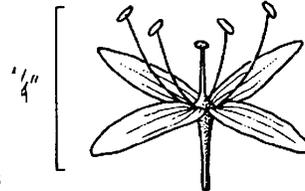
September 2016

Technical Report, 2015

Part 2 of 2: Trees and Shrubs



Roughleaf dogwood
Cornus drummondii



Credit: USDA-NRCS PLANTS
Database / USDA NRCS.
*Wetland flora: Field office
illustrated guide to plant species.*
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**United States Department of Agriculture
Natural Resources Conservation Service
Bismarck Plant Materials Center**

Technical Report

Part II (Trees and Shrubs)

2015

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PART II

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INTRODUCTION

INTRODUCTION: TECHNICAL REPORT – 2015

Objectives and Functions

The USDA Natural Resources Conservation Service (NRCS), Plant Materials Center (PMC), Bismarck, North Dakota, primarily serves the States of Minnesota, North Dakota, and South Dakota. Activities are directed toward meeting the needs and priorities set forth in the three States' long range programs.

The objectives and functions of the Plant Materials Center are to:

1. Identify, select, and improve plants to meet the resource conservation needs of the three States.
2. Determine techniques for successful propagation and establishment of these plants.
3. Assemble and comparatively evaluate materials on and off the Center.
4. Make comparative field plantings for final testing of promising plants and techniques with conservation districts and cooperators.
5. Work with universities, experiment stations, and other State and Federal agencies to cooperatively release improved conservation plants.
6. Produce limited quantities of foundation or foundation quality seed. This seed is made available to conservation districts, state seed certifying organizations, commercial seed growers, or other agencies for establishing seed increase fields or seed orchards.
7. Encourage conservation districts, commercial seed growers, and commercial and State nurseries to produce adapted plant materials and named cultivars.
8. Promote improved conservation plant materials in conservation programs.

One of the major objectives of the PMC is to improve the quality and quantity of native and introduced trees and shrubs available for field and farmstead windbreaks, erosion control on cropland and critical areas, recreation areas, wildlife habitat, edible fruits and nuts, and barrier plantings.

The NRCS has agreements with soil conservation districts, State universities, and other State, Federal, and local agencies at four locations in Minnesota, North Dakota, and South Dakota to provide cooperative off-center sites with long-term land tenure for testing woody plant materials. These agreements provide sites for assembly and initial evaluation of trees and shrubs under diverse soil and climatic conditions. They represent major land resource areas and key windbreak suitability groups. Initial evaluations are recorded on individual spaced plants or rows under uniform culture and management conditions.

Location

The Bismarck Plant Materials Center is located in south central North Dakota, near the center of the North American landmass. It is on the east bank of the Missouri River in a shallow basin 7 miles wide and 11 miles long. Elevation is 1,647 feet, latitude 46°46'N and longitude 100°45'W.

Physical Facilities and Evaluation Sites

The PMC does not own land but manages approximately 60 acres on Lincoln-Oakes Nursery. Three off-center evaluation sites are located in Minnesota, South Dakota, and North Dakota.

1. Lincoln-Oakes Nursery, Bismarck, North Dakota. The USDA Natural Resources Conservation Service, Plant Materials Center operates under a cooperative working agreement with the North Dakota Association of Soil Conservation Districts (NDASCD). The Association owns and operates the Lincoln-Oakes Nursery which in turn provides the PMC with 60 acres of land located on the nursery. This site is primarily used by the PMC for foundation quality grass seed production. The PMC shares a building site with the Nursery, with the NRCS buildings located on the north part of the acreage. Buildings include an office, greenhouse, lathhouse, old office/storage building, machine storage shed (housing tree and seed storage refrigeration units), seed cleaning building, chemical storage shed, and a two equipment storage buildings with one containing a shop.
2. Off-center evaluation sites in Minnesota, South Dakota and North Dakota. These three off-center evaluation sites, located in the three-State area, are cooperative with various State and Federal agencies. These locations provide long-term testing sites for trees, shrubs, and grasses evaluated under uniform culture and management. Refer to map, page 9.

Soils

At the PMC, the soil type is a Mandan silt loam. The Mandan series typically consists of deep, well-drained soils formed in silty sediments on uplands and terraces. The surface layer is dark grayish-brown and grayish-brown silt loam 20 inches thick. The subsoil is grayish-brown silt loam 9 inches thick. The underlying material is 28 inches of light brownish-gray silt loam over light brownish-gray loam. Slopes range 0 to 7 percent. Ordinarily, surface runoff is medium and fertility is high. Controlling erosion is the major concern in management. Both soil blowing and water erosion are hazards. This soil is well-suited to small grain, corn, and alfalfa. Soils are classed capability unit Iie5 and conservation tree and shrub group 3.

Climatological Information and Weather Summary

Climate of the area is semiarid, typically continental in character. During the summer, there are a few hot and humid days, but the winters are quite cold and fairly long. The relative humidity during the summer is generally low, and high temperature and high humidity are seldom experienced together.

Normal precipitation is 16.84 inches per year. Refer to Table 1 on page 4 for 2015 weather data. More than 75 percent of this falls during the six-month period of April through September, and 50 percent normally falls in May, June, and July. Most summer precipitation occurs during thunderstorms that occur about 34 days per year. Damaging hail occurs about once in 10 years.

The winter season begins in late November and continues until late March. Nearly all winter precipitation is snow, often associated with strong winds and low temperatures. Snow has been reported for all months except July and August. Occasional winter blizzards can be severe.

Temperatures range from an average mean of 6.7 degrees F in January to a mean of 70.4 degrees F in July. During short periods, the temperatures may climb as high as 100 degrees F in summer or drop as low as -40 degrees F in winter. Frequent clear and partly cloudy days contribute to a high percentage of possible sunshine, with the total annual average about 2,700 hours out of a possible 4,470 hours. The average wind speed is a little less than 11 miles

per hour, with a prevailing direction from the west-northwest. April and May are the windiest months. The average freeze-free period is 134 days from mid-May to late September.

Table 1: 2015 Weather Summary - Official Station - Bismarck, North Dakota					
Month	Mean Temperature		Precipitation (inches)		
	(degrees Fahrenheit)		Actual		Deviation from Normal
	2015	Normal*	2015	Normal*	2015
January	19.1	12.8	0.75	0.43	0.32
February	12.0	18.1	0.39	0.50	-0.11
March	36.1	29.9	0.45	0.86	-0.41
April	45.4	43.8	0.37	1.26	-0.89
May	53.9	55.5	5.31	2.39	2.92
June	66.4	64.6	4.98	3.16	1.82
July	71.8	71.1	1.51	2.88	-1.37
August	70.2	69.5	1.41	2.27	-0.86
September	64.4	58.5	0.37	1.59	-1.22
October	48.9	44.8	1.07	1.25	-0.18
November	33.3	29.2	0.21	0.71	-0.50
December	22.1	16.2	0.91	0.48	0.43
Annual	45.3	42.8	17.73	17.80	-0.05
* National Climate Data Center 1981-2010 Monthly Normals					
		<u>2015</u>			
	Last Frost (28 degrees)	19-May			
	First Frost (28 degrees)	16-Oct			
	Frost Free Period	149 days			

REGIONAL DESCRIPTION

REGIONAL DESCRIPTION: TECHNICAL REPORT – 2015

Major Land Resource Areas

The three States served by the PMC, Minnesota, North Dakota, and South Dakota, include portions of 23 Major Land Resource Areas in four Land Resource Regions. They are the Northern Great Plains Spring Wheat Region, Western Great Plains Range and Irrigated Region, Northern Lake States Forest and Forage Region, and the Central Feed Grains and Livestock Region.

Potential Natural Vegetation

Most of central and western North and South Dakota support a mixed grass prairie of predominantly western wheatgrass (*Pascopyrum smithii*), green needlegrass (*Nassella viridula*), needleandthread (*Hesperostipa comata*), slender wheatgrass (*Elymus trachycaulus*), and prairie junegrass (*Koeleria macrantha*). Little bluestem (*Schizachyrium scoparium*), sideoats grama (*Bouteloua curtipendula*), plains muhly (*Muhlenbergia cuspidata*), sedge (*Carex*), and blue grama (*Bouteloua gracilis*) are the principal climax species on xeric soils, steeper eroded slopes or thin uplands. Prairie sandreed (*Calamovilfa longifolia*) is important on sandy soils throughout the region. Moist sites support such species as big bluestem (*Andropogon gerardii*) and prairie cordgrass (*Spartina pectinata*). Whitetop (*Scolochloa festucacea*), bulrushes (*Scirpus*), and common reed (*Phragmites australis*) are typical of lowland meadows and marshes. Western snowberry (*Symphoricarpos occidentalis*), rose (*Rosa*), buffaloberry (*Shepherdia argentea*), and chokecherry (*Prunus virginiana*) are abundant shrubs in draws and narrow valleys. Rocky Mountain juniper (*Juniperus scopulorum*) is common in the western Badlands. Eastern South Dakota, southern Minnesota, and the Red River Valley support vegetation dominated by tall grass prairie species; principally big bluestem, switchgrass (*Panicum virgatum*), and Indiangrass (*Sorghastrum nutans*). Other important species include little bluestem, prairie dropseed (*Sporobolus heterolepis*), porcupine grass (*Stipa spartea*), green needlegrass, and prairie cordgrass. Bur oak (*Quercus macrocarpa*), basswood (*Tilia americana*), hackberry (*Celtis occidentalis*), cottonwood (*Populus deltoides*), and willow (*Salix*) follow major draws and floodplains. Green ash (*Fraxinus pennsylvanica*) is found in all three states. In the western Dakotas it comprises up to 70 percent of the tall trees in forests. The presence of emerald ash borer (*Agrilus planipennis*) in Minnesota puts the ash resource at risk.

Two distinct forested regions occur within the three-State area. The first is the Black Hills of South Dakota where Ponderosa pine forest (*Pinus ponderosa*) and pine/oak savannas dominate. The second is the northern and eastern sections of Minnesota, which support mixed hardwood and conifer forests. Principal species include oak (*Quercus*), maple (*Acer*), elm (*Ulmus americana*), aspen (*Populus*), jackpine (*Pinus banksiana*), red pine (*Pinus resinosa*), and balsam fir (*Abies balsamea*). Black spruce (*Picea mariana*), tamarack (*Larix laricina*), and white cedar (*Thuja occidentalis*) are typical of lowlands and swamps.

Climate and Species Adaptation

North Dakota and Minnesota are the two coldest States in the nation excluding Alaska. Mean annual temperatures range from 36 degrees F to 48 degrees F for all reporting stations. Plant hardiness zones (USDA) vary from 2 to 5 with mean minimum temperatures between -10 degrees F and -50 degrees F. Annual precipitation varies from 13 inches in western North Dakota to 30 inches or more in southeast Minnesota. Growing seasons are short, averaging from 110 to 150 days. The central and western Dakotas are principally semiarid in nature while the eastern Dakotas and Minnesota are considered subhumid.

The diversity of woody species is limited because of cold and drought, especially in the Dakotas. The scarcity of native tall tree species for windbreaks has relegated at least a portion of the tree improvement effort in the Northern Great Plains to improving upon existing cultivars of native species or increasing survival and pest resistance of hardy exotics such as Siberian elm. Species from Siberia, Russia, Manchuria, or Mongolia are among the most viable introductions for prairie plantings where precipitation is generally less than 20 inches annually. There is generally little shortage of shrub species suited for shelterbelt, barrier, or wildlife plantings except in the most hostile environments or specific cases related to pest resistance.

The short growing season limits the potential annual growth rate of trees. Late spring frosts can affect fruit set of early flowering fruit trees following a week or so of warm temperatures. However, hardy native shrubs like plum, chokecherry, and hawthorn are well adapted and regularly produce abundant crops. Indigenous species may rely on a secondary bud flush to produce foliage in some years. Winter desiccation of needle leaved evergreens is not uncommon on exposed sites, making conifer establishment a challenge for vast areas of the Northern Plains. Symptoms of winter injury on hardwoods may be as mild as tip dieback on exterior limbs to complete death of above ground stems and subsequent resprouting. Damaged trees are ideal sites for insects and disease infection.

The importance of adapted seed sources and the need for provenance tests is especially critical in the extreme and variable environment of the Northern Plains. In the three-State region served by the PMC, winter hardy, drought, and pest resistant cultivars are in demand by the nursery trade. Seed sources from regions further south frequently express superior growth rates but are more susceptible to winter injury.

MAPS

ASSEMBLY AND INITIAL EVALUATION STUDIES

Off-Center Evaluation Plantings

OFF-CENTER EVALUATIONS: TECHNICAL REPORT – 2015

Study 38I316K North Dakota State University, Dickinson Research Extension Center, Dickinson, North Dakota.

Study Title: Field Evaluation of Woody Plant Materials.

Introduction: There is a need to evaluate the performance of shrub and tree species/cultivars for windbreaks, wildlife, and recreational plantings under diverse soil and climatic conditions. To meet this need, field evaluation planting sites representative of the Major Land Resource Areas were located in the three States served by the PMC. These sites provide planting locations under long-term land tenure, for assemblies of trees and shrubs to be evaluated under uniform culture and management. New material can be added on an annual basis. Comparisons are then made with previously released cultivars and area of adaptation determined.

Objective: The objective is to assemble and evaluate woody plant materials for conservation use. Superior cultivars will be selected and released for increase by commercial nurseries.

Cooperators: The USDA Natural Resources Conservation Service, Plant Materials Center, Bismarck, North Dakota, in cooperation with the North Dakota State University, Dickinson Research Extension Center (DREC), Dickinson, North Dakota. The cooperative agreement expired January 20, 2010, and a new 15-year agreement was finalized in 2012.

Location: This project is located on the west edge of Dickinson, North Dakota, on the NDSU Dickinson Research Extension Center. Legal description: NE 1/4 sec. 5, T. 139 N., R. 96 W., Stark County, North Dakota.

Major Land Resource Area: The site is located in Major Land Resource Area 54, Rolling Soft Shale Plain. This moderately dissected rolling plain is underlain by calcareous shales and sandstones. Strongly dissected areas of sharp local relief or badland topography border major streams and valleys in some areas. Elevation is 2,411 feet. Sixty percent of the area is rangeland.

Soils: The soil type is a Parshall fine sandy loam. The Parshall series consists of deep, well-drained soils formed in fine sandy loam alluvium on terraces and outwash plains and in upland swales. The surface layer and subsoil is dark grayish-brown fine sandy loam. The underlying material is dark grayish-brown fine sandy loam and loamy fine sand. Permeability is moderately rapid. The available water capacity is moderate. Organic matter is high and fertility is medium. This soil is in North Dakota conservation tree and shrub group 5.

Climate: For MLRA 054, the average annual precipitation is 13 to 19 inches; increasing from west to east for this semiarid area. Rainfall is highest from late spring to midsummer and very low during the rest of the year. Winter precipitation is snow. Average annual temperature is 40 to 45 degrees F. Average freeze-free period is 110 to 135 days. The plant hardiness zone is 4a, with an average annual minimum temperature of -30 to -25 degrees F. Climatic data for 2015 recorded at Dickinson Research Extension Center, Dickinson, North Dakota, is shown in Table DI-1.

Methods and Materials

Assembly: Refer to Table DI-2 for a list of woody species planted from 1978 through 2015.

Planting Plan: Plots are not randomized or replicated but systematically arranged for ease of evaluation and demonstration purposes. The planting site is approximately 500 feet long and 200 feet wide. The area is divided into five blocks. Each block consists of single row, non-replicated plots. Each plot contains a minimum of 5 plants. Row length is 100 feet and spacing between rows is 20 feet. Block 1A contains mainly tall tree accessions. Block 1B contains conifers. Block 2 contains shrubs and small trees. Block 3 contains medium sized trees. Block 4 contains tall trees. Refer to the plot map in Figure DI-1 and the aerial map in Figure DI-3. All trees are spaced ten feet within row and shrubs are spaced five feet within row. All rows run from west to east. Like species and standards of comparison are established in adjacent plots whenever possible. A new study area (west planting) of 1.1 acres was added west of the original block (east planting) in 2012 (see Figure DI-2).

Plot Preparation: In 2011, DREC staff chemically and mechanically fallowed a 5-acre plot immediately west of the current study area. Part of this area is an expanded tree research area for the PMC. PMC staff seeded the entire new study area (west planting) to blue grama. In early summer 2012, PMC staff stapled four 150-foot strips of weed barrier (6-foot wide) to the ground in preparation for future planting. Using blue grama and weed barrier reduces the risk of mechanical damage to planted stock. It should also reduce DREC maintenance time. New accessions are now planted each year into the fabric. Removal is planned for 14 accessions in the original block for which data is no longer needed or the accessions have mostly died. Once removed, that area of the east planting will be leveled and seeded to ease weed control for DREC staff.

In 2015, an additional 150-foot strip of fabric was stapled down in Row 3.

Planting Method: All trees and shrubs are hand planted using approved forestry methods.

Planting Date: Refer to Table DI-2 for planting dates of woody species planted from 1978 through 2015. If available, replacement stock is planted after establishment year.

Fertilization: No fertilizer has been applied to planting area.

Weed Control: Initially, no herbicide was applied to any plot during year of establishment or in succeeding years. Weeds were controlled by clean cultivating between rows, within row, and in fallow areas. Four to six tillage operations were performed each year in the months of May through August. A minimum of hand hoeing was done to control weeds in rows. In recent years, DREC staff have been spot-spraying glyphosate where invasive weeds are an issue. A near-term goal has been to seed blue grama grass between the tree rows once the weeds are under control, the trees are pruned back, and the soil has been smoothed out enough to allow seeding. That will alleviate the need for cultivation in the East Block, and will allow mowing as the main weed control option.

Pest Control: No animal repellents or insecticides were applied in 2015. Glyphosate was used for spot control of invasive weeds.

Crop Residue Management: Regular tillage for the past several decades has kept overall weed pressure reduced, but tillage operations have damaged the test plantings by tilling out material, breaking or bruising limbs and trunks, or removing identification stakes. Ongoing tillage has also created an environment for extensive water erosion of uphill plantings northwest of the east planting, and those eroded soils are being deposited in this block. In the newer west planting, blue grama was seeded over the entire site one year prior to tree establishment. In-row fabric is applied prior to transplanting the new additions to this block. This site is now maintained by regular mowing, when needed.

Silvicultural Practices: There is ongoing pruning and removal maintenance of the east plantings.

2015 Added Species: On May 8, 2015 the following species were planted:

- Douglas fir, *Pseudotsuga menziesii*, accession 9094434 (Mandan ARS source). The trees from which the cones were harvested have grown for nearly 80 years on loamy sand soils. The average height is about 50 feet. That much time in that location indicates adaptability to the local climate. In addition to the off-center plantings, seedlings of this seed source have been provided to farmers in three states for field planting trials. If the species proves adaptable to multiple soils, it can then be considered for Field Office Technical Guide inclusion. This plant has the potential to greatly improve the resilience of conservation plantings by increasing species diversity as it is not just a different species but an entirely different genus.
- Prairie Expedition elm, *Ulmus americana* 'Prairie Expedition', accession 9094446. This was planted in a continuing attempt to find a Dutch elm disease (DED) resistant American elm. It is vegetatively propagated from a single tree so the genetics will not be very diverse. It was developed by Dale Herman at NDSU from a single survivor in a stand of DED killed trees in eastern North Dakota. At the very least, it should be climatically adapted.

Evaluations and Measurements

Previous years: Records of planting date, survival, vigor, canopy width, height, cold hardiness, animal damage, insect damage, disease symptoms, and unusual or outstanding features have been maintained since 1978 and are listed in Table DI-2. Plant performance data is recorded during the growing season for the first three years. After the third year, data is gathered according to a specific schedule. Select data appears in this report. Annual summary reports have been prepared since 2006 and can be requested from the PMC.

2015 Notes and Observations:

- Bur oak are very stunted (browse) with poor survival.
- Lodgepole pine are all alive but stunted by the white poplar roots.
- Amazingly the Kentucky coffeetree is still alive after 3 seasons in tree shelters.
- Meyer spruce still alive but severely stunted by nearby large tree root systems.
- The two varieties of haskaps are very healthy and growing well, but slowly. They are beginning to look promising.
- American hazel has done well after 3 years.
- In just 3 years the Manchurian ash has grown out the top of 5-foot tree shelters.
- Sycamore are all dead.
- Wisconsin source gray birch are ok after 2 years.
- Swamp white oak is near the top of the 5-foot shelters after 2 years.
- 'Prairie Expedition' have grown out the top of the tree shelters, some to 8 feet, in one year. Note: they were 5-6 feet tall when planted.
- Douglas fir seedlings were all browsed leaving just a 2-inch stick and a few needles. They need to be replaced and protected with cages.
- 'Catskill' sandcherry has grown well but been browsed to a 6-inch tall x 3-foot wide plant.
- Throughout the past year, DREC has done a good job of removing selected species, smoothing the site and controlling the wormwood.
- Future plans are to remove the white poplar, prune amur maple and hawthorn, coppice the plum, cut and stump treat contaminants and prepare the site for seeding in the spring to a double rate of blue grama.

The following accessions exhibit potential for further evaluation and use:

Accession Number	Genus/Species Origin/Source	Plot Location
ND-1765 9005980	Siberian larch <i>Larix sibirica</i> USDA, FS, Shelterbelt Lab., Bottineau, ND	1B/03/1-10
ND-1873 9005648	Amur maple <i>Acer ginnala</i> Lincoln-Oakes Nursery, Bismarck, ND	3/09/1-5
SD-156 9005890	green ash <i>Fraxinus pennsylvanica</i> Deuel Co., Clear Lake, SD	4/01/1-5
ND-1879 9011850 PI-503531	honeylocust <i>Gleditsia triacanthos</i> ARS Field Station, Woodward, OK	4/04/1-5
SD-75 9005713	hackberry <i>Celtis occidentalis</i> Potter Co., SD	4/9/1-10
9069090	quaking aspen <i>Populus tremuloides</i> Lee Nursery, Fertile, MN	1A/5/6-10
9069168	Siberian larch <i>Larix sibirica</i> Altai Region, Russia	1A/09/6-10
9057413	Ponderosa pine <i>Pinus ponderosa</i> Glendive, MT NDFS	1B/05/1-5
9063148	corktree <i>Phellodendron sachalinense</i> Clay Co., MN	1B/09/1-5
9076737	black cherry <i>Prunus serotina</i> Apple Valley OCEP, ND Lincoln-Oakes Nursery, Bismarck, ND	II/07/1-5
9092231 14070 ARS	lodgepole pine <i>Pinus contorta</i> var. <i>latifolia</i> Routt National Forest, Salida, CO	1B/06/6-10
9069081	littleleaf linden <i>Tilia cordata</i> Lee Nursery, Fertile, MN	1B/10/1-5
9082638	western blue elderberry <i>Sambucus nigra</i> ssp. <i>caerulea</i> Lincoln Oakes Nursery, Bismarck, ND	II/06/11-15

Figure DI-1. Off Center Evaluation Planting (east planting) Map at Dickinson Research Extension Center, Dickinson, North Dakota
The plot location of those species/varieties scheduled for removal is indicated by an X.

	Block 1A		Block 1B		Block 2		Block 3			Block 4	
Row 1			ND-1729 Siberian larch							SD-156 green ash	ND-1734 green ash
Row 2	9082885 aspen	9082619 green ash	SL-383-T Siberian larch		9082684 smooth sumac	9008183 Sheridan source chokecherry		'McDermant' Ussurian pear		'Cardan' green ash	ND-1759 green ash
Row 3	14392 Walker poplar	Canam Walker poplar	ND-1765 Siberian larch							ND-647 black ash	ND-1432 Ohio buckeye
Row 4	ND-3796 white poplar	Raverdeau poplar	ND-1763 Ponderosa pine	ND-1565 bristlecone pine			'Konza' aromatic sumac		'Legacy' late lilac	ND-1879 honeylocust	'Carmine Jewel' dwarf cherry
Row 5	9082640 Gambel oak	9069090 quaking aspen	9057413 ponderosa pine	9069169 Siberian pine	ND-11 amur honeysuckle		'Sakakawea' silver buffaloberry		'Magenta' crabapple	9063116 black ash	9091968 Kentucky coffeetree
Row 6	9087732 bur oak	Assiniboine poplar	9069172 Scots pine	9092231 lodgepole pine	9057406 rugosa rose	9082638 western blue elderberry	9076726 tatarian maple		9091969 Russian peashrub	9063115 green ash	9076724 Russian olive
Row 7	9063141 eastern cottonwood		9094406 Princeton elm	ND-3803 white poplar 	9076737 black cherry	'McKenzie' chokeberry	9082891 common ninebark		9082653 skunkbush sumac	Prairie Harvest hackberry	
Row 8	Hunter ponderosa pine	Bridger- Select juniper	9091967 pin cherry	Riverview Germplasm black currant	9063142 Japanese cherry	9082713 Siberian peach	'Prairie Red' plum		ND-629 amur maple	9005725 'Oahe' hackberry	
Row 9	9069164 Scots pine	9069168 Siberian larch	9063148 corktree	ND-21 nannyberry	'Homestead' Arnold hawthorn		ND-1873 amur maple	ND-686 Pekin lilac		9005713 SD-75 hackberry	
Row 10		9082889 mugo pine	9069081 littleleaf linden	9063126 Japanese elm	/common juniper	salt tree/ bittersweet	9069129 amur chokecherry		9094355 roughleaf dogwood	9094356 Meyer's spruce	
	Block 1A		Block 1B		Block 2		Block 3			Block 4	

Figure DI-2. Off Center Evaluation Planting (west planting) Map at Dickinson Research Extension Center, Dickinson, North Dakota

Block 1						
Row 1	'Berry Blue' honeyberry	'Cinderella' honeyberry	9094418 American hazel			
Row 2	9094417 Manchurian ash	9094416 sycamore	9094442 gray birch			
Row 3	909441 swamp white oak	'Prairie Expedition' Amer. elm				
Row 4						
Row 5						
Row 6						
Row 7						
Row 8						
Row 9						
Row 10						
Row 11						
Row 12	9094434 Douglas fir	9094435 Douglas fir				
Row 13	'Catskill' sand cherry					
Block 1						

*Between row spacing is 25 feet.

Figure DI-3. Aerial Map of Off-Center Evaluation Planting at Dickinson Research Extension Center, Dickinson, North Dakota



Table No. DI-1: 2015 Weather Summary - Official Station - Dickinson, North Dakota					
Month	Mean Temperature		Precipitation (inches)		
	(degrees Fahrenheit)		Actual		Deviation from Normal
	2015	Normal*	2015	Normal*	2015
January	21.7	16.8	0.12	0.29	-0.17
February	17.3	21.0	0.15	0.33	-0.18
March	38.0	30.6	0.47	0.69	-0.22
April	43.5	42.9	1.03	1.47	-0.44
May	50.6	53.7	1.66	2.32	-0.66
June	64.4	62.7	2.93	3.20	-0.27
July	69.9	69.8	2.37	2.44	-0.07
August	68.6	68.9	0.76	1.53	-0.77
September	63.0	57.7	0.30	1.47	-1.17
October	48.4	44.4	1.36	1.23	0.13
November	32.1	30.0	0.03	0.54	-0.51
December	23.4	18.4	0.26	0.24	0.02
Annual	45.1	43.1	11.44	15.73	-4.31
*National Climate Data Center 1981-2010 Monthly Normals					
		<u>2015</u>			
	Last Frost (28 degrees)	20-May			
	First Frost (28 degrees)	15-Oct			
	Frost Free Period	146 days			

Key to Table DI-2. 38I316K Field Evaluation of Woody Plant Materials – Dickinson, North Dakota

PLOT LOCATION = plot location of the plant material within the evaluation

ACCESSION NUMBER = any accession number, PI number or cultivar name assigned to the plant material

PLANT SYMBOL = plant symbol of the genus and species (asterisk indicates the symbol is not official)

GENUS/SPECIES = common name and scientific name of the plant material

ORIGIN/SOURCE = origin and/or source of the plant material

TRANS DATE = month and day the plant material was transplanted at the evaluation site

YR PLT = year the plant materials were transplanted at the evaluation site

YR REC = year of record

MATL PLTD = type of material planted, PLBR = bareroot, CONT = containerized

NO PLTS = number of plants planted in the plot

NO SRV = number of plants surviving

PCT SRV = percent of plants surviving

VI = plant vigor (1=excellent, 3=good, 5=fair, 7=poor, 9=very poor)

CAN COV (ft) = canopy cover measured in feet

PLT HT (ft) = plant height measured in feet

Table DI-2.

Project No.: 38I316K Field Evaluation of Woody Plant Materials, Dickinson, North Dakota

Year of Record: 2015

PLOT	ACCESSION	PLANT	GENUS/SPECIES	TRANS YR	YR	MATL	NO	NO	PCT	CAN	PLT			
<u>LOCATION</u>	<u>NUMBER</u>	<u>SYMBOL</u>	<u>ORIGIN/SOURCE</u>	<u>DATE</u>	<u>PLT</u>	<u>REC</u>	<u>PLTD</u>	<u>PLTS</u>	<u>SRV</u>	<u>SRV</u>	<u>VI</u>	<u>(ft)</u>	<u>(ft)</u>	<u>REMARKS</u>
IA/02/1-5	9082885	POTR5	aspen	11-May	04			5	5	100	4	0.8	1.9	browsed off, regrowing
			<i>Populus tremuloides</i>		05				3	60	3	2.1	3.5	
			NDFS Nursery, Towner, ND		06				5	100	4	2.0	2.7	
					08				3	60	4	2.0	2.5	
					10				3	60	4	3.3	3.9	
						13		3	60	3	8.3	10.3		
1A/02/6-10	9082619	FRPE	green ash	16-May	02	CONT		5	5	100	5	0.5	0.8	3,5 browsed by rabbit
			<i>Fraxinus pennsylvanica</i>		03				3	60	4	0.5	1.3	
			Jordan, MT		04				5	100	3	0.9	2.4	
			Valley Nursery, Helena, MT		06				5	100	3	2.1	4.3	
					08				5	100	4	2.7	5.6	
						12		5	100	2	7.8	12.9		
IA/03/1-5	'Manitou' 9058874 14392	POPUL	poplar	9-May	90	PLBR		5	5	100	2	1.7	3.0	anthracnose on leaves, leaves dropping on all trees mostly all dead
			<i>Populus</i>		91				5	100	4	2.5	4.1	
			USDA, ARS, Mandan, ND		92				5	100	4	1.6	3.2	
			Lincoln-Oakes Nursery, Bismarck, ND		94				5	100	2	9.5	16.2	
					96				5	100	3	11.7	24.6	
					99				5	100	3	12.2	35.2	
					04				5	100	5	11.8	24.6	
					09									
		10					2	40	3	15.5	27.4			
		14					2	40	8	16.0	28.0			
IA/04/1-5	9030611 ND-3796	POAL7	white poplar	15-May	92	CONT(P)		5	4	80	4	1.6	1.6	dieback on all trees dieback from freezing on all
			<i>Populus alba</i>		93				5	100	2	3.8	3.7	
			Turner Co., SD		94				4	80	3	6.3	5.9	
			USDA, NRCS, PMC, Bismarck, ND		96				4	80	6	8.7	7.7	
					98				4	80	3	14.4	13.3	
					02				4	80	7	17.0	13.5	
					06				4	80		16.0	15.2	
		12				4	80	3	16.1	21.6				

Project No.: 381316K Field Evaluation of Woody Plant Materials, Dickinson, North Dakota
Year of Record: 2015

PLOT	ACCESSION	PLANT	GENUS/SPECIES	TRANS	YR	YR	MATL	NO	NO	PCT	CAN	PLT		
<u>LOCATION</u>	<u>NUMBER</u>	<u>SYMBOL</u>	<u>ORIGIN/SOURCE</u>	<u>DATE</u>	<u>PLT</u>	<u>REC</u>	<u>PLTD</u>	<u>PLTS</u>	<u>SRV</u>	<u>SRV</u>	<u>VI</u>	<u>(ft)</u>	<u>(ft)</u>	<u>REMARKS</u>
IA/05/1-5	9082640	QUGA	Gambel oak	13-May	99	99	CONT	5	5	100	3	0.8	1.6	
			<i>Quercus gambelii</i>			00			3	60	4	0.9	1.2	
			Lincoln-Oakes Nursery, Bismarck, ND			01			3	60	3	2.1	2.3	
						03			3	60	3	0.9	1.9	browsed
						05			3	60	5	1.2	2.0	
						08			2	40	4	1.8	3.4	
						13			2	40	4	3.3	4.9	
IA/05/6-10	9069090	POTR5	quaking aspen	15-May	93	93	PLBR	5	4	80	5	0.8	1.7	
			<i>Populus tremuloides</i>			94			5	100	3	1.7	4.1	
			Lee Nursery, Fertile, MN			95			5	100	3	3.4	6.2	
						97			5	100	2	5.8	9.9	
						99			5	100	3	8.8	17.3	very colorful fall foliage
						02			5	100	1	12.5	22.6	almost white bark on 5
						07			5	100	2	15.5	25.8	slight dieback 2,5
						12			3	60	4	12.5	24.4	
IA/6/1-5	9087732	QUMA2	bur oak	6-May	09	09	PLBR	5	5	100	4	1.6	2.5	
			<i>Quercus macrocarpa</i>			10			4	80	5	1.3	2.1	
			USDA, NRCS, PMC, Bridger, MT			12			3	60	6	1.1	1.1	tops dead, basal resprouts
						13			3	60	3	1.5	2.2	dieback 3
						15			3	60	5	1.5	2.3	lots of dense brome
IA/06/6-10	'Assiniboine' 9063147	POPUL	hybrid poplar	10-May	93	93	PLBR	5	5	100	4	0.5	1.8	
			<i>Populus</i>			94			5	100	3	3.7	6.1	
			PFRA, Indianhead, Saskatchewan, Canada			95			5	100	3	7.9	11.4	
						97			5	100	4	11.7	17.1	
						99			5	100	3	11.5	27.8	
						02			5	100	3	14.0	31.4	leaf disease on all
						07			5	100	5	11.3	25.2	dead branches on 1
						12			3	60	4	16.8	31.8	dead branches 2,5

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Year of Record: 2015

PLOT	ACCESSION	PLANT	GENUS/SPECIES	TRANS YR	YR	MATL	NO	NO	PCT	CAN	PLT			
LOCATION	NUMBER	SYMBOL	ORIGIN/SOURCE	DATE	PLT	REC	PLTD	PLTS	SRV	SRV	VI	(ft)	(ft)	REMARKS
IA/07/1-5	9063141	PODE3	eastern cottonwood <i>Populus deltoides</i> Lincoln-Oakes Nursery, Bismarck, ND	10-May	93	PLBR		5	5	100	3	1.6	3.4	
					94				5	100	2	5.6	9.0	
					95				5	100	3	8.1	13.7	severe leaf rust
					97				5	100	2	15.7	22.4	
					99				5	100	2	13.5	31.8	
					02				5	100	2	18.0	37.4	2,3,4,5 have some leaf disease
					07				5	100	4	17.5	39.0	
				12			5	100	4	21.9	38.8	all multi-stemmed; dead tops 3,4		
IA/08/1-5	'Hunter Germplasm' 9081843	PIPOS	ponderosa pine <i>Pinus ponderosa</i> var. <i>scopulorum</i> USDA, NRCS, PMC, Bridger, MT	17-May	05			5	5	100	4	0.9	1.3	
					06				5	100	3	1.1	1.8	
					07				5	100	4	1.1	1.8	
					09				4	80	3	2.1	2.7	
					12				4	80	2	3.7	5.9	deer rub 4
					14				4	80	4	5.9	9.0	
1A/08/6-10	'Bridger- Select' 9078631	JUSC2	Rocky Mountain juniper <i>Juniperus scopulorum</i> USDA, NRCS, PMC, Bridger, MT	17-May	05			5	5	100	5	0.7	1.0	one mowed off
					06				5	100	4	1.0	1.6	
					07				4	80	3	1.1	1.9	
					09				4	80		2.1	2.8	
					12				4	80	2	4.4	5.5	
					14				4	80	4	5.1	7.5	
IA/09/1-5	9069164	PISY	Scots pine <i>Pinus sylvestris</i> var. <i>mongolica</i> Heilongjiang Province, China USDA, NRCS, PMC, Bismarck, ND	4-May	98	CONT		5	4	80	4	0.8	1.2	
					99				4	80	4	1.0	1.5	
					00				4	80	3	1.6	2.0	
					02				4	80	3	3.0	4.0	
					04				5	100	3	4.2	5.7	
					07				5	100	3	7.5	10.4	
					12				5	100	1	12.3	18.7	

Project No.: 381316K Field Evaluation of Woody Plant Materials, Dickinson, North Dakota

Year of Record: 2015

PLOT <u>LOCATION</u>	ACCESSION <u>NUMBER</u>	PLANT <u>SYMBOL</u>	GENUS/SPECIES <u>ORIGIN/SOURCE</u>	TRANS <u>DATE</u>	YR <u>PLT</u>	YR <u>REC</u>	MATL <u>PLTD</u>	NO <u>PLTS</u>	NO <u>SRV</u>	PCT <u>SRV</u>	CAN		<u>REMARKS</u>	
											COV <u>VI</u>	PLT <u>(ft)</u>		
IA/09/6-10	9069168	LASI3	Siberian larch <i>Larix sibirica</i> Altai region, Russia USDA, NRCS, PMC, Bismarck, ND	4-May	98	98	CONT	5	4	80	4	0.6	1.3	
											3	1.0	1.8	
											2	1.4	2.8	
											1	3.0	6.5	
											1	4.5	9.0	
											2	8.0	10.2	
											1	14.0	20.0	
IA/10/6-10	9082889	PIMU80	Mugo pine <i>Pinus mugo</i> Big Sioux Nursery, Watertown SD	11-May	04	04		5	1	20	3	0.8	1.3	
											6	0.8	0.7	
											4	1.2	1.0	
											4	1.9	1.5	
											4	3.1	2.2	
											2	5.0	5.0	
IB/01/1-10	ND-1729 9005979	LASI3	Siberian larch <i>Larix sibirica</i> NDFS State Nursery, Towner, ND	16-May	78	PLBR		10	9	90	3	0.7	2.0	
												0.7	1.4	
											4	1.1	1.8	
											8	1.0	1.5	
											7	1.1	2.4	
											4	1.3	3.0	
											6	3.0	6.5	
											4	7.7	11.4	
											2	13.1	17.9	
											2	17.5	25.8	
											4	16.0	26.2	
											3	20.1	28.7	

1 mowed off, moderate rodent damage

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Year of Record: 2015

PLOT	ACCESSION	PLANT	GENUS/SPECIES	TRANS	YR	YR	MATL	NO	NO	PCT	CAN	PLT		
<u>LOCATION</u>	<u>NUMBER</u>	<u>SYMBOL</u>	<u>ORIGIN/SOURCE</u>	<u>DATE</u>	<u>PLT</u>	<u>REC</u>	<u>PLTD</u>	<u>PLTS</u>	<u>SRV</u>	<u>SRV</u>	<u>VI</u>	<u>(ft)</u>	<u>(ft)</u>	<u>REMARKS</u>
IB/02/1-10	SL-383-T	LASI3	Siberian larch	17-May	78	78	PLBR	10	10	100	3	0.6	2.2	
	Pallet No.		<i>Larix sibirica</i>			79			10	100		0.8	1.6	
	2392		Denbigh Exp. Forest			80			10	100	4	1.4	2.0	
	9005976		USDA, FS, Shelterbelt Lab., Bottineau, ND			82			9	90	6	1.5	2.3	
						83			9	90	6	2.0	3.9	1 mowed off, moderate rodent damage
						84			8	80	2	2.6	5.6	
						87			8	80	2	5.9	10.0	
						92			8	80	8	9.9	16.4	
						97			8	80	1	16.2	23.3	
						02			8	80	2	19.0	32.0	
						07			8	80	3	17.0	31.3	
						12			8	80	8	22.1	32.4	
IB/03/1-10	ND-1765	LASI3	Siberian larch	17-May	78	78	PLBR	10	10	100	3	0.6	1.4	
	9005980		<i>Larix sibirica</i>			79			10	100		1.1	1.6	
			USDA, FS, Shelterbelt Lab., Bottineau, ND			80			10	100	4	1.8	2.7	
						82			10	100	5	2.1	4.0	
						83			10	100	5	2.6	4.9	moderate rodent damage, best accession of larch
						84			10	100	4	3.6	6.1	
						87			9	90	2	7.0	11.0	
						92			9	90	2	10.4	17.5	
						97			9	90	2	15.6	24.2	
						02			9	90	2	22.0	32.0	
						07			9	90	3	21.0	30.2	dense canopy
						12			6	60		21.0	32.0	top dead 6

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Year of Record: 2015

PLOT LOCATION	ACCESSION NUMBER	PLANT SYMBOL	GENUS/SPECIES ORIGIN/SOURCE	TRANS DATE	YR PLT	YR REC	MATL PLTD	NO PLTS	NO SRV	PCT SRV	CAN		PLT HT	REMARKS	
											COV VI	(ft)			
IB/04/1-5	ND-1763 9006043	PIPO	ponderosa pine <i>Pinus ponderosa</i> 757-5 Todd Co., SD USDA, FS, Shelterbelt Lab., Bottineau, ND	16-May	78	78	CONT	5	5	100	1	0.5	1.7		
												0.5	1.1		
											4	1.5	2.0		
											7	2.4	4.4		
											5	2.9	3.6		animal damage
											3	3.8	4.9		
											3	5.2	7.5		
											3	9.1	14.0		
											1	15.4	21.7		
											3	21.0	33.0		
											3	21.0	34.2		
											1	25.9	36.4		
IB/04/6-10	ND-1565 9006036	PIAR	bristle cone pine <i>Pinus aristata</i> USDA, FS, Shelterbelt Lab., Bottineau, ND	16-May	78	CONT	5	5	100	3	0.5	0.6			
											0.7	0.6			
										5	1.0	0.8			
										5	2.1	3.0			
										8	1.0	0.8		mower damage on plt 3	
										3	1.9	1.8			
										6	2.3	2.0			
										5	5.4	3.9			
										1	8.2	7.7			
										3	16.5	10.5			
										3	11.0	13.5			
										2	15.0	16.3			
IB/05/1-5	9057413	PIPO	ponderosa pine <i>Pinus ponderosa</i> Glendive, MT NDFS	11-May	88	CONT	5	2	40	4	0.3	1.1			
											0.7	1.4			
										4	0.8	1.5			
										4	1.2	2.2			
										4	3.0	4.2			
										2	7.2	9.3			
										2	12.5	20.9			
										2	14.3	26.9			
										1	21.4	32.0			

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Year of Record: 2015

PLOT LOCATION	ACCESSION NUMBER	PLANT SYMBOL	GENUS/SPECIES ORIGIN/SOURCE	TRANS DATE	YR PLT	YR REC	MATL PLTD	NO PLTS	NO SRV	PCT SRV	CAN		PLT HT	REMARKS
											COV VI	(ft)		
IB/05/6-10	9069169	PISI3	Siberian pine <i>Pinus sibirica</i> Altai USDA, NRCS, PMC, Bismarck, ND	14-May	03	03		5	5	100				
IB/06/1-5	9069172	PISY	Scots pine <i>Pinus sylvestris</i> Altai region, Russia USDA, NRCS, PMC, Bismarck, ND	6-May	97	97	CONT	5	5	100				
IB/06/6-10	9092231 14070 (ARS)	PICOL	lodgepole pine <i>Pinus contorta</i> var. <i>latifolia</i> Routt National Forest, Salida, CO Towner State Nursery, Towner, ND	6-May	09	09		5	5	100				
IB/7/1-5	9094406 'Princeton'	ULAM	American elm <i>Ulmus americana</i> Schumacher's Nursery, Heron Lake, MN	10-May	12	12		5	5	100				
IB/07/6-10	ND-3803 9030612	POAL7	white poplar <i>Populus alba</i> USDA, PMC, Bismarck, ND	24-May	94	94	CONT	5	5	100				

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Year of Record: 2015

PLOT	ACCESSION	PLANT	GENUS/SPECIES	TRANS	YR	YR	MATL	NO	NO	PCT	CAN	PLT		
LOCATION	NUMBER	SYMBOL	ORIGIN/SOURCE	DATE	PLT	REC	PLTD	PLTS	SRV	SRV	COV	HT	REMARKS	
IB/08/1-5	9091967	PRPE2	pin cherry	6-May	09	09		5	5	100	3	0.6	1.9	
			<i>Prunus pensylvanica</i>			10			4	80	5	0.9	1.5	
			Upper Red Lake, MN			12			5	60	5	0.5	1.5	wh poplar competition 3-5
			Big Sioux Nursery, Watertown, SD			13			5	60	5	1.0	2.3	wh poplar competition 1
						15			1	20	2	3.5	6.5	wh poplar competition all over
IB/08/6-10	Riverview Germplasm 9082687	RIAM2	American black currant	9-May	07	07		5	0	0				
			<i>Ribes americanum</i>			08			2	40	6	0.4	1.8	
			northeastern South Dakota			09			4	80	3	2.0	2.1	
			Big Sioux Nursery, Watertown, SD			12			5	100	4	2.7	3.0	20% leaves dead along mid ribs
						13			5	100	4	2.4	2.1	wh poplar competition 1,2,4
IB/09/1-5	9063148	PHSA80	corktree	4-May	95	95	CONT	5	5	100	4	0.7	1.3	
			<i>Phellodendron sachalinense</i>			96			4	80	3	1.7	2.2	
			Clay Co., MN			97			4	80	3	2.6	2.9	
						99			3	60	2	5.2	5.7	some hail damage
						01			3	60	3	10.8	8.3	
						05			3	60	2	14.8	11.3	
						09			3	60	3	14.2	13.3	
						14			3	60	3	19.6	16.9	
IB/09/6-10	ND-21 9034900	VILE	nannyberry	7-May	86	86	PLBR	5	5	100	3	0.5	1.5	
			<i>Viburnum lentago</i>			87			5	100	3	0.7	1.9	
			USDA, ARS, Mandan, ND			88			5	100	3	1.5	2.7	
			USDA, NRCS, PMC, Bismarck, ND			90			5	100	3	2.7	3.8	
						92			5	100	3	4.2	4.7	
						95			5	100	2	6.5	7.4	fruit on 1,2,4,5
						00			5	100	5	9.7	10.3	
						05			5	100	4	12.0	11.2	leaves quite dry on 1
						10			5	100	2	11.0	11.2	
						15			5	100	3	12.1	12.6	

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Year of Record: 2015

PLOT	ACCESSION	PLANT	GENUS/SPECIES	TRANS	YR	YR	MATL	NO	NO	PCT	CAN	PLT			
LOCATION	NUMBER	SYMBOL	ORIGIN/SOURCE	DATE	PLT	REC	PLTD	PLTS	SRV	SRV	VI	(ft)	(ft)	REMARKS	
IB/10/1-5	9069081	TICO2	littleleaf linden	10-May	93	93	CONT(P)	5	5	100	5	0.7	1.3	weedy	
			<i>Tilia cordata</i>			94				5	100	4	0.6	1.2	
			Lee Nursery, Fertile, MN			95				5	100	4	2.1	2.8	
						97				5	100	4	4.0	4.0	
						99				5	100	3	6.9	7.4	
						02				5	100	3	10.5	11.6	
						07				5	100	4	13.0	16.0	
						12				5	100	3	19.4	20.4	
IB/10/6-10	9063126	ULDAJ	Japanese elm	15-May	92	92	CONT(P)	5	3	60	4	1.7	1.7		
			<i>Ulmus davidiana</i> var. <i>japonica</i>			94				3	60	3	4.2	4.5	
			Manchuria			96				5	100	4	5.9	6.3	5 is sucker
			PFRA, Indianhead, Saskatchewan, Canada			98				4	80	5	12.0	10.7	dieback on 2,3,4
						01				4	80	4	14.8	11.7	all have dead branches
						06				4	80	4	16.0	12.9	dieback on 3,4; severe on 3
						12				3	60	3	20.1	19.9	
II/01/1-10	ND-313 9005996 PI-477999	LOTA	red tatarian honeysuckle	17-May	78	78	PLBR	10	9	90	1	1.5	1.6		
			<i>Lonicera tatarica sibirica</i>			79				9	90		2.0	2.4	
			USDA, ARS, Cheyenne, WY			80				10	100	3	3.2	2.4	
			USDA, NRCS, PMC, Bismarck, ND			82				10	100	4	5.3	4.5	
						83				10	100	3	5.9	5.4	good fruit
						84				10	100	4	7.4	5.5	moderate-severe insect
						87				10	100	3	5.6	6.7	defoliation, honeysuckle aphid
						92				10	100	5	6.8	7.3	
						97				10	100	5	15.3	9.0	
						02				10	100	3	15.5	11.6	
						07				10	100	7	14.0	10.5	
			12				8	80	6	5.3	10.0				

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PLOT	ACCESSION	PLANT	GENUS/SPECIES	TRANS	YR	YR	MATL	NO	NO	PCT	CAN	PLT		
LOCATION	NUMBER	SYMBOL	ORIGIN/SOURCE	DATE	PLT	REC	PLTD	PLTS	SRV	SRV	VI	(ft)	(ft)	REMARKS
II/01/11-20	ND-1730 9005994	LOTA	red tatarian honeysuckle <i>Lonicera tatarica sibirica</i> Lincoln-Oakes Nursery, Bismarck, ND	17-May	78	78	PLBR	10	10	100	1	1.6	1.7	
									10	100		2.2	2.8	
									10	100	1	3.4	3.0	
									10	100	4	5.9	5.2	
									10	100	3	6.7	6.5	good vigor
									10	100	5	7.7	6.6	slight insect defoliation
									10	100	3	6.5	7.2	good fruit production,
									9	90	6	6.4	7.1	snow damage, aphid damage
									9	90	5	15.3	8.2	
									10	100	3	15.5	11.5	
									10	100	8	11.5	9.5	
									9	90	4	11.5	10.0	
II/02/1-5	9082684	RHGL	smooth sumac <i>Rhus glabra</i> Lincoln-Oakes Nursery, Bismarck, ND	14-May	03	03		5						weedy, poor survival
									5	100	3	3.0	2.6	
									5	100	4	4.8	3.6	
									5	100	2	6.0	6.0	
									5	100	2	7.0	6.8	
									5	100	2	8.8	8.0	
II/02/6-10	9008183	PRVI	chokecherry <i>Prunus virginiana</i> Sheridan County, ND Lincoln-Oakes Nursery, Bismarck, ND	17-May	05	05		5	4	100	4	1.0	2.3	
									4	100	4	2.2	3.2	
									4	100	3	2.4	3.4	
									4	80	3	3.6	5.0	
									5	100	3	5.6	7.6	Schubert 5
									5	100	3	7.1	9.3	

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PLOT	ACCESSION	PLANT	GENUS/SPECIES	TRANS	YR	YR	MATL	NO	NO	PCT	CAN	PLT				
LOCATION	NUMBER	SYMBOL	ORIGIN/SOURCE	DATE	PLT	REC	PLTD	PLTS	SRV	SRV	VI	(ft)	(ft)	REMARKS		
II/03/1-10	ND-26 9011852	LONIC	honeysuckle	2-May	79	79	PLBR	10	10	100		1.1	1.4			
			<i>Lonicera</i>								5	2.0	1.7			
			USDA, ARS, Mandan, ND									2.6	2.9			
											4	4.5	4.8	leaf spot		
											4	4.9	5.4	witches broom on plts 3,5,8		
											4	7.5	7.0	moderate insect defoliation,		
											5	10.5	9.0	grasshoppers, aphid damage		
											4	15.4	10.5	aphid damage on 3		
											4	21.0	11.8			
											5	18.0	11.0			
II/03/11-15	ND-452 9019978	LOXY	honeysuckle	2-May	79	PLBR		5	5	100		1.2	1.3			
			<i>Lonicera xylosteum mollis</i>									3	2.3	1.5		
			USDA, ARS, Cheyenne, WY									3.2	2.9			
			USDA, NRCS, PMC, Bismarck, ND								4	5.5	5.5	witches broom on 1,2,3		
											3	6.5	5.5	slight leaf spot, leaf		
											5	7.5	6.7	blight, aphid damage		
											6	9.3	7.6			
											5	100	6	11.5	8.4	severe aphid damage on 1,2
											3	60	5	11.5	9.0	
II/03/16-20	ND-170 9005728	COIN16	cotoneaster	9-May	90	CONT		5								
			<i>Cotoneaster integerrimus</i>								4	80	6	0.8	1.5	
			USDA, NRCS, PMC, Bismarck, ND								4	80	6	1.5	1.4	
											4	80	4	4.1	3.0	
											4	80	4	5.5	3.5	
											4	80	4	5.1	3.5	
											4	80	5	6.5	4.5	fireblight on 2, 3
											4	80	3	5.5	4.5	
											5	100	4	5.9	4.6	

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PLOT	ACCESSION	PLANT	GENUS/SPECIES	TRANS	YR	YR	MATL	NO	NO	PCT	CAN	PLT		
LOCATION	NUMBER	SYMBOL	ORIGIN/SOURCE	DATE	PLT	REC	PLTD	PLTS	SRV	SRV	VI	(ft)	(ft)	REMARKS
II/04/1-5	9082711	EUBU6	winterberry euonymus	16-May	02	02	PLBR	5	4	80	4	1.0	1.7	
			<i>Euonymus bungeanus</i>			03			4	80	5	0.9	2.0	
			Lincoln-Oakes Nursery, Bismarck, ND			04			4	80	5	0.4	0.9	cut off #4
						06			4	80	5	0.3	1.4	2 chewed off, 3 heavily browsed
						08			3	60	3	1.8	2.4	
						12			1	20	4	1.5	4.8	chewed off; resprout
II/04/11-20	'Regal'	PRTE5	Russian almond	8-May	80	80	PLBR	10	10	100	5	0.8	2.2	
	ND-283		<i>Prunus tenella</i>			81			7	70		0.9	1.4	
	9006079		ND Game & Fish Dept.			82			10	100	4	1.8	2.3	
	PI-540442		USDA, NRCS, PMC, Bismarck, ND			83			8	80	4	3.9	3.5	few pests
						84			10	100	4	3.8	3.7	
						86			9	90	4	5.2	4.5	
						88			9	90	3	6.0	4.7	
						89			9	90	4	4.2	4.8	
						94			9	90	4	6.6	4.3	
						99			5		3	13.1	6.6	
						04			10	100	3	13.0	7.0	
						09			10	100	3	16.0	5.5	good seed crop
						14			10	100	5	14.0	6.0	contaminants
II/05/1-10	ND-11	LOMA6	amur honeysuckle	7-May	81	81	CONT	10	10	100		0.7	0.6	
	9005993		<i>Lonicera maackii</i>			82			10	100	4	1.4	1.4	
	PI-477998		Res. Sta., Morden, MB, Canada			83			6	60	6	1.6	1.8	slight insect
						84			10	100	4	2.1	1.8	defoliation (grasshoppers)
						86			10	100	4	4.2	4.6	
						87			10	100	3	8.5	5.6	
						88			10	100	4	7.4	5.6	
						90			10	100	4	5.7	5.7	
						95			10	100	4	7.1	8.5	
						00			10	100	4	8.4	10.0	
						05			10	100	2	16.1	12.2	
						10			10	100	3	16.0	13.0	
						15			0	0				removed

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PLOT	ACCESSION	PLANT	GENUS/SPECIES	TRANS	YR	YR	MATL	NO	NO	PCT	CAN	PLT		
<u>LOCATION</u>	<u>NUMBER</u>	<u>SYMBOL</u>	<u>ORIGIN/SOURCE</u>	<u>DATE</u>	<u>PLT</u>	<u>REC</u>	<u>PLTD</u>	<u>PLTS</u>	<u>SRV</u>	<u>SRV</u>	<u>VI</u>	<u>(ft)</u>	<u>(ft)</u>	<u>REMARKS</u>
II/05/11-20	'Centennial'	COIN16	cotoneaster	8-May	85	85	PLBR	10						no data
	ND-177		<i>Cotoneaster integerrimus</i>			86			8	80	4	2.3	2.2	
	9005729		Lincoln-Oakes Nursery, Bismarck, ND			87			7	70	3	4.0	3.3	
	PI-113095					88			10	100	4	3.2	3.0	
						89			8	80	4	4.5	3.5	
						91			7	70	5	5.3	4.3	
						94			7	70	4	7.5	7.6	
						99			7	70	4	12.5	10.2	
						04			7	70	5	12.0	10.5	fireblight on all
						09			7	70	3	12.0	10.5	
						14			7	70	7	15.0	14.0	fireblight on all
II/06/1-5	9057406	RORU	rugosa rose	16-May	02	02	CONT	5	5	100	5	1.0	1.4	
			<i>Rosa rugosa</i>			03			3	60	3	0.8	1.0	
			Lincoln-Oakes Nursery, Bismarck, ND			04			5	100	3	1.8	1.6	
						06			5	100	4	3.2	2.4	
						08			5	100	5	2.1	1.6	
						12			5	100	4	3.7	3.0	50% brown leaves & dead cones
II/06/11-15	9082638	SANIC5	western blue elderberry	13-May	99	99	CONT	5						
			<i>Sambucus nigra</i> ssp. <i>caerulea</i>			00			5	100	4	1.5	2.9	
			Lincoln-Oakes Nursery, Bismarck, ND			01			5	100	3	4.9	5.5	
						03			5	100	2	7.0	6.0	
						05			5	100	4	12.7	9.0	
						08			5	100	5	9.0	9.2	
						13			5	100	5	8.4	10.0	
II/07/1-5	9076737	PRSE2	black cherry	6-May	97	97	PLBR	5	4	80	3	1.1	1.7	
			<i>Prunus serotina</i>			98			5	100	4	2.8	3.0	
			Apple Valley FEP, ND			00			5	100	3	6.6	7.9	
			Lincoln-Oakes Nursery, Bismarck, ND			03			5	100	2	12.4	12.5	
						06			5	100	2	16.0	15.0	
						12			5	100	2	14.8	18.7	

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PLOT <u>LOCATION</u>	ACCESSION <u>NUMBER</u>	PLANT <u>SYMBOL</u>	GENUS/SPECIES <u>ORIGIN/SOURCE</u>	TRANS <u>DATE</u>	YR <u>PLT</u>	YR <u>REC</u>	MATL <u>PLTD</u>	NO <u>PLTS</u>	NO <u>SRV</u>	PCT <u>SRV</u>	CAN		<u>REMARKS</u>		
											COV <u>VI</u>	HT <u>(ft)</u>			
II/07/6-10	'McKenzie' 323957	PHME13	black chokeberry <i>Photinia melanocarpa</i> Lincoln-Oakes Nursery, Bismarck, ND	23-May	00	00	PLBR	5	5	100	3	0.9	1.7		
											4	1.8	1.7		
											3	0.9	1.7		
											3	4.3	3.6		
											2	5.4	4.6		
											3	4.8	5.5		
											4	6.3	6.9		
II/08/1-5	9063142	PRUNU	Japanese cherry <i>Prunus</i> Bottineau FEP, ND Lincoln-Oakes Nursery, Bismarck, ND	10-May	93	93	PLBR	5	5	100	4	1.2	2.0		
											4	1.7	2.6		
											4	2.6	3.0		
											6	1.6	2.3		
											4	3.0	3.3		
											5	5.1	3.0		1,4 have some dieback
											4	4.8	4.9		
3	5.5	4.5													
II/08/6-10	9082713	PRPEP2	Siberian peach <i>Prunus persica</i> var. <i>persica</i> Lincoln-Oakes Nursery, Bismarck, ND	16-May	02	02	PLBR	5	5	100	2	1.6	2.7		
											4	4.1	4.0		
											2	6.1	5.8		
											4	7.8	6.8		
											4	6.9	7.7		
											6	6.6	6.4		some dead limbs/basal resprout
II/09/1-10	'Homestead' ND-20 9005731 PI-503530	CRAN6	Arnold hawthorn <i>Crataegus X anomala</i> USDA, NRCS, PMC, Bismarck, ND	9-May	84	84	CONT	10	10	100	4	0.7	0.3		
											4	1.7	2.7		
											3	3.8	4.8		
											4	4.0	6.0		
											3	6.2	8.9		
											2	13.1	13.0		
											2	18.0	15.4		
											4	18.0	16.2		leaves dried up due to drought
											2	25.4	17.2		

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PLOT LOCATION	ACCESSION NUMBER	PLANT SYMBOL	GENUS/SPECIES ORIGIN/SOURCE	TRANS DATE	YR PLT	YR REC	MATL PLTD	NO PLTS	NO SRV	PCT SRV	CAN		PLT HT	REMARKS			
											COV VI	(ft)					
II/10/2-6	ND-3742 9019593	JUCO6	common juniper <i>Juniperus communis</i>	4-May	06	06	CONT	5	5	100	4	1.6	1.0				
											5	0.8	0.7				
											3	1.1	0.9				
											4	2.5	1.3				
											1	4.2	1.8				
											2	4.5	1.9		HD wood contaminants		
II/10/6-10	9057438	HAHA8	Siberian salt tree <i>Halimodendron halidendron</i> PFRA, Indianhead, Saskatchewan, Canada	11-May	94	94	CONT	5	1	20	3	0.3	1.1				
											4	0.6	1.3				
											4	0.8	1.6		soil shallow to bedrock		
											5	0.9	2.0				
											1	1.8	3.5		many pods left from 2002		
											6	3.0	1.8				
II/10/11-15	9082712	CESC	bittersweet <i>Celastrus scandens</i> Lincoln-Oakes Nursery, Bismarck, ND	16-May	02	02	PLBR	5	4	80	4	0.4	1.1				
											5	0.7	1.7				
											3	0.7	1.4				
											3	2.0	2.1				
											5	1.5	1.5				
											5	100	1		5.5	3.4	
III/01/1-5	'Midwest' 9006003 PI-478000	MAMA37	Manchurian crabapple <i>Malus mandshurica</i> Echo Manchuria/Res. Sta. Morden, MB, Canada USDA, NRCS, PMC, Bismarck, ND	17-May	78	78	PLBR	5	3	60	2	0.5	2.0				
												0.9	2.1				
											3	1.9	2.8				
											3	4.7	5.5				
											5	100	2		6.0	6.9	fall webworm on 1, few
											5	100	4		7.7	8.5	pests, good vigor,
											5	100	3		9.4	11.4	snow damage on 1,2,3
											2	40	8		6.0	7.3	
											2	40	3		13.8	13.9	
											2	40	4		15.5	14.6	
											2	40	8		12.0	12.9	many dead branches
											2	40	5		8.8	11.7	

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PLOT	ACCESSION	PLANT	GENUS/SPECIES	TRANS	YR	YR	MATL	NO	NO	PCT	CAN	PLT		
LOCATION	NUMBER	SYMBOL	ORIGIN/SOURCE	DATE	PLT	REC	PLTD	PLTS	SRV	SRV	VI	(ft)	(ft)	REMARKS
III/01/6-10	Red Splendor' 9006004	MABA	flowering crabapple <i>Malus X</i> Lee Nursery, Fertile, MN	17-May	78	78	PLBR	5	5	100	2	1.6	2.2	
										100		2.5	3.8	
										100	2	3.5	4.7	
										100	3	5.9	8.4	
										100	3	7.0	9.1	good fruit production, few pests
										100	3	8.6	10.9	snow damage 1,2; webworm 3,5
										100	2	10.3	12.2	
										100	6	9.3	11.2	
										100	4	13.8	14.0	
										100	4	14.5	15.6	
										100	6	13.0	14.1	
III/02/1-5	ND-1731 9006001	MABA	Siberian crabapple <i>Malus baccata</i> Lincoln-Oakes Nursery, Bismarck, ND	17-May	78	78	PLBR	5	4	80	2	1.9	2.2	
									5	100		2.8	3.1	
									5	100	3	4.1	4.1	
									5	100	3	5.8	8.2	
									5	100	2	7.5	10.5	good growth & vigor,
									5	100	2	10.1	10.8	few pests, fall webworm
									5	100	3	10.6	13.9	on 1,4,5
									5	100	6	9.2	13.7	
									5	100	6	13.7	14.4	
									5	100	5	15.5	16.8	
									80	6	12.5	16.5		

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<u>LOCATION</u>	<u>NUMBER</u>	<u>SYMBOL</u>	<u>ORIGIN/SOURCE</u>	<u>DATE</u>	<u>PLT</u>	<u>REC</u>	<u>PLTD</u>	<u>PLTS</u>	<u>SRV</u>	<u>SRV</u>	<u>VI</u>	<u>(ft)</u>	<u>(ft)</u>	<u>REMARKS</u>
III/02/6-10	'McDermant'	PYUS2	Ussurian pear	17-May	78	78	PLBR	5	5	100	6	0.9	2.5	
	ND-14		<i>Pyrus ussuriensis</i>			79			5	100		1.8	3.6	
	9006095		Harbin, Manchuria/Res. Sta.			80			5	100	1	3.0	4.6	
	PI-478004		Morden, MB, Canada			82			5	100	3	6.4	8.9	
			USDA, NRCS, PMC, Bismarck, ND			83			5	100	1	8.0	11.0	good growth & vigor
						84			5	100	2	9.3	12.4	
						87			5	100		12.4	15.8	snow damage on 4
						92			5	100	6	10.9	13.2	
						97			5	100	2	18.7	17.2	
						02			5	100	2	25.0	22.0	
						07			4	80	7	21.0	21.6	
						12			5	100	4	25.1	20.7	only 1 live limb on 4
III/03/1-5	'Freedom'	LOKO2	honeysuckle	9-May	90	90	PLBR	5	5	100	5	1.0	1.1	
	9057424		<i>Lonicera korolkowii</i>			91			5	100	4	1.4	1.6	
			Univ. of MN			92			5	100	3	3.3	3.1	
						94			5	100	3	6.6	6.1	
						96			5	100	3	8.5	7.8	minor dieback
						99			5	100	2	14.1	11.2	
						04			5	100	2	17.0	12.3	
						09			5	100	2	18.5	14.0	
						14			5	100	2	17.0	12.3	removed late 2014
III/03/6-10	9063143	LOTA	tatarian honeysuckle	10-May	93	93	PLBR	5	5	100	4	1.1	1.4	
			<i>Lonicera tatarica</i>			94			5	100	3	1.1	1.8	
			Iowa			95			5	100	4	2.2	2.8	
			Lincoln-Oakes Nursery, Bismarck, ND			97			5	100	3	3.5	4.2	
						99			5	100	4	4.3	6.1	
						02			5	100	3	6.5	6.5	
						07			5	100	5	6.0	9.3	
						12			5	100	5	9.5	9.5	

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<u>LOCATION</u>	<u>NUMBER</u>	<u>SYMBOL</u>	<u>ORIGIN/SOURCE</u>	<u>DATE</u>	<u>PLT</u>	<u>REC</u>	<u>PLTD</u>	<u>PLTS</u>	<u>SRV</u>	<u>SRV</u>	<u>VI</u>	<u>(ft)</u>	<u>(ft)</u>	<u>REMARKS</u>
III/03/11-15	Survivor	AMFR	false indigo	6-May	87	87	PLBR	5	4	80		1.3	1.7	
	Germplasm		<i>Amorpha fruticosa</i>			88			5	100	5	2.8	2.1	
	9008041		USDA, NRCS, PMC, Aberdeen, ID			89			5	100	5	3.1	2.7	
						91			5	100	4	5.3	3.3	
						93			5	100	3	7.0	4.3	
						96			5	100	4	6.6	5.0	
						01			5	100	3	11.0	5.0	
						06								mostly dead, overgrown with other volunteers
						12			3	60	3	1.7	2.5	measured suckers
III/03/16-20	'Arnolds Red'	LOTA	red tatarian honeysuckle	10-May	93	93	PLBR	5	5	100	4	0.9	1.1	
	9069080		<i>Lonicera tatarica</i>			94			5	100	4	1.3	1.9	
			Lee Nursery, Fertile, MN			95			5	100	3	2.3	3.1	
						97			5	100	3	3.6	4.7	
						99			5	100	3	4.5	6.5	
						02			5	100	4	6.5	7.0	
						07			5	100	3	6.0	8.3	
						12			5	100	4	8.7	9.7	
III/04/1-5	'Konza'	RHAR4	aromatic sumac	6-May	87	87	PLBR	5	4	80		1.7	2.5	
	PI-477981		<i>Rhus aromatica</i>			88			4	80	3	3.4	3.1	
			USDA, NRCS, PMC, Manhattan, KS			89			4	80	4	3.8	3.7	
						91			4	80	3	5.7	4.4	
						93			4	80	2	9.6	6.3	
						96			4	80	4	9.2	6.7	
						01			4	80	1	16.0	8.0	solid thicket
						06			5	100	3	17.0	8.0	
						12			5	100	3	16.0	8.5	

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PLOT	ACCESSION	PLANT	GENUS/SPECIES	TRANS	YR	YR	MATL	NO	NO	PCT	CAN	PLT		
<u>LOCATION</u>	<u>NUMBER</u>	<u>SYMBOL</u>	<u>ORIGIN/SOURCE</u>	<u>DATE</u>	<u>PLT</u>	<u>REC</u>	<u>PLTD</u>	<u>PLTS</u>	<u>SRV</u>	<u>SRV</u>	<u>VI</u>	<u>(ft)</u>	<u>(ft)</u>	<u>REMARKS</u>
III/04/16-20	'Legacy'	SYVI3	late lilac	11-May	88		PLBR	5	2	40	6	1.0	1.7	
	ND-83		<i>Syringa villosa</i>		89				2	40	6	0.4	1.1	
	9006228		USDA, NRCS, PMC, Bismarck, ND		90				5	100	5	0.7	1.1	
	PI-540443		Lincoln-Oakes Nursery, Bismarck, ND		92				3	60	4	1.9	1.9	
					94				3	60	3	4.2	4.4	
					97				3	60	3	8.1	6.9	
					02				3	60	2	11.0	10.0	
					07				3	60		11.0	9.8	
					12				3	60		9.0	11.7	
III/05/1-10	'Sakakawea'	SHAR	silver buffaloberry	9-May	90		PLBR	10	3	30	3	0.7	2.2	
	ND-10		<i>Shepherdia argentea</i>		91				4	40	4	0.5	1.9	
	PI-478005		USDA, NRCS, PMC, Bismarck, ND		92				8	80	4	0.9	1.7	
					94				8	80	3	3.0	3.7	
					96				8	80	2	5.9	7.0	
					99				8	80	3	8.4	11.3	
					04				8	80	3	13.0	11.8	
					14				8	80	6		12.6	severe honeysuckle infestation
III/05/11-15	'Magenta'	MALUS	crabapple	15-May	92		PLBR	5	5	100	5	0.5	1.1	
	PI-514275		<i>Malus</i> sp.		93				4	80	3	1.6	3.0	
			USDA, NRCS, PMC, E. Lansing, MI		94				5	100	3	2.2	3.6	
					96				5	100	5	3.9	5.2	fireblight on 2,3,5; dieback on 1
					98				5	100	3	4.4	6.9	webworms on 4
					01				5	100	4	9.0	10.0	
					07				4	80	2	16.0	15.2	
					12				4	80	4	18.9	16.0	

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<u>LOCATION</u>	<u>NUMBER</u>	<u>SYMBOL</u>	<u>ORIGIN/SOURCE</u>	<u>DATE</u>	<u>PLT</u>	<u>REC</u>	<u>PLTD</u>	<u>PLTS</u>	<u>SRV</u>	<u>SRV</u>	<u>VI</u>	<u>(ft)</u>	<u>(ft)</u>	<u>REMARKS</u>
III/06/1-5	9076726	ACGI	tatarian maple	13-May	96	96	PLBR	5	5	100	3	1.0	0.9	
			<i>Acer ginnala</i>			97			5	100	5	2.2	1.7	
			USDA, ARS, Mandan, ND			98			5	100	4	2.8	2.0	
						00			5	100	3	3.5	2.3	
						02			5	100	4	5.5	4.0	Canada thistle 1
						05			4	80		8.2	6.5	
						10			4	80	4	13.5	11.1	
						15			4	80	2	19.3	15.0	
III/06/6-10	9091969	CAFR80	Russian peashrub	17-May	05	05		5	5	100	4	0.8	3.4	
			<i>Caragana frutex</i>			06			5	100	6	0.6	2.6	
			Big Sioux Nursery, Watertown, SD			07			5	100	5	0.9	2.6	
						09			5	100	4	0.9	2.9	
						12			5	100	6	1.4	3.8	some suckers 1,5
						14			4	80	7	2.3	4.1	all doing poorly
III/7/1-5	9082891	PHOP	common ninebark	12-May	10	10		5	5	100	5	0.6	1.6	
			<i>Physocarpus opulifolius</i>			12			5	100		2.8	3.2	lots of suckers
			Big Sioux Nursery, Watertown, SD			14			3	60	8	1.6	2.9	invaded by contaminants
III/07/6-10	9082653	RHTR	skunkbush sumac	14-May	03	03		5	5	100				
			<i>Rhus trilobata</i>			04			5	100	3	1.4	1.4	
			Harding Co., SD			05			4	80	4	2.0	1.5	
			USDA, NRCS, PMC, Bismarck, ND			06			5	100	3	3.4	2.0	
						07			5	100	3	3.6	2.4	
						09			4	80		7.0	3.3	
						12			5	100	3	8.8	3.5	hard to tell original from suckers

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<u>LOCATION</u>	<u>NUMBER</u>	<u>SYMBOL</u>	<u>ORIGIN/SOURCE</u>	<u>DATE</u>	<u>PLT</u>	<u>REC</u>	<u>PLTD</u>	<u>PLTS</u>	<u>SRV</u>	<u>SRV</u>	<u>VI</u>	<u>(ft)</u>	<u>(ft)</u>	<u>REMARKS</u>
III/08/1-5	'Prairie Red'	PRUNU	plum	8-May	85	85	PLBR	5						no data
	ND-1134		<i>Prunus</i>			86			5	100	8	0.5	1.3	
	9047203		Miller, SD			87			3	60	4	1.9	3.0	
			USDA, NRCS, PMC, Bismarck, ND			89			3	60	5	3.5	4.1	
						91			2	40	4	6.6	5.7	
						94			2	40	4	8.5	7.9	
						99			2	40	3	11.5	10.0	
						04			1	10	2	17.0	11.0	
						09			2	40	3	13.0	12.0	
						14			2	40	3	16.0	14.5	abundant fruit
III/08/6-10	ND-629	ACGI	amur maple	2-May	79	79	PLBR	5	5	100		1.0	1.5	
	9005645		<i>Acer ginnala</i>			80			0					
	PI-477992		Res. Sta., Morden, MB, Canada			81			4	80		1.3	1.9	
						83			4	80	3	6.0	6.0	
						84			4	80	4	9.9	7.5	
						88			4	80	4	13.0	10.8	
						93			3	60	5	13.1	12.0	
						98			3	60	3	18.4	17.4	
						03			3	60	3	24.5	16.4	
						08			3	60	5	32.0	16.2	
						13			3	60	2	26.0	19.0	
III/09/1-5	ND-1873	ACGI	amur maple	2-May	79	79	PLBR	5	5	100		1.6	2.2	
	9005648		<i>Acer ginnala</i>			80			5	100	3	2.8	3.0	
			Lincoln-Oakes Nursery, Bismarck, ND			81			5	100		4.2	4.3	
						83			5	100	2	7.2	7.4	good seed production
						84			5	100	3	10.0	8.8	
						88			5	100	4	13.2	11.7	
						93			5	100	4	10.0	9.9	
						98			5	100	3	16.1	13.4	
						03			5	100	3	19.9	14.6	
						08			5	100	4	18.0	14.5	
						13			5	100	3	20.3	15.6	

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PLOT	ACCESSION	PLANT	GENUS/SPECIES	TRANS	YR	YR	MATL	NO	NO	PCT	CAN	PLT	REMARKS	
<u>LOCATION</u>	<u>NUMBER</u>	<u>SYMBOL</u>	<u>ORIGIN/SOURCE</u>	<u>DATE</u>	<u>PLT</u>	<u>REC</u>	<u>PLTD</u>	<u>PLTS</u>	<u>SRV</u>	<u>SRV</u>	<u>COV</u>	<u>HT</u>		
III/09/6-10	ND-686 9006225 PI-478008	SYPE4	pekin lilac <i>Syringa pekinensis</i> ND Game & Fish Dept.	2-May	79	79	PLBR	5	5	100		0.7	2.3	
									2	40	7	1.5	2.7	
									2	40		1.5	2.8	
									3	60	5	3.3	3.8	
									5	100	5	3.1	2.9	
									3	60	4	8.3	8.3	
									3	60	4	10.1	9.9	
									3	60	3	15.5	14.2	
									3	60	3	18.5	16.5	
									3	60	3	21.0	16.5	
	3	60	1	22.3	20.8									
III/10/1-5	9069129	PRMA9	Amur chokecherry <i>Prunus maackii</i> Big Sioux Nursery, Watertown, SD	11-May	94	PLBR	5	5	5	100	4	0.7	2.2	
									5	100	2	4.1	6.4	
									5	100	3	7.7	10.7	
									5	100	4	9.1	12.7	
									5	100	4	11.2	12.5	
									5	100	5	10.0	12.8	
									5	100	5	14.3	15.5	
III/10/16-20	9094355	CODR	roughleaf dogwood <i>Cornus drummondii</i> Big Sioux Nursery, Watertown, SD	4-May	11			5	5	100	7	0.4	0.9	
									5	100	3	0.8	1.3	
									4	80	4	0.8	1.2	

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<u>LOCATION</u>	<u>NUMBER</u>	<u>SYMBOL</u>	<u>ORIGIN/SOURCE</u>	<u>DATE</u>	<u>PLT</u>	<u>REC</u>	<u>PLTD</u>	<u>PLTS</u>	<u>SRV</u>	<u>SRV</u>	<u>VI</u>	<u>(ft)</u>	<u>(ft)</u>	<u>REMARKS</u>
IV/01/1-5	SD-156	FRPE	green ash	17-May	78	78	PLBR	5	5	100	1	0.5	2.6	
	9005890		<i>Fraxinus pennsylvanica</i>			79			5	100		1.3	3.6	
			Deuel Co., SD			80			5	100	2	2.2	4.4	
						82			5	100	3	5.6	7.6	
						83			5	100	3	7.3	9.7	slight leaf scorch
						84			5	100	3	8.0	10.8	
						87			5	100	3	8.6	14.2	snow damage on 1
						92			5	100	4	8.9	15.8	
						97			5	100	4	13.5	18.3	
						02			5	100	6	17.0	25.5	
						07			5	100	5	18.8	25.8	
						12			5	100	3	12.2	27.7	
IV/01/6-10	ND-1734	FRPE	green ash	17-May	78	78	PLBR	5	5	100	2	0.4	2.1	
	9005891		<i>Fraxinus pennsylvanica</i>			79			5	100		1.0	3.1	
			Lincoln-Oakes Nursery, Bismarck, ND			80			5	100	4	1.9	3.7	
						82			5	100	4	4.7	7.3	
						83			5	100	4	5.7	8.8	competition from
						84			5	100	4	6.4	10.3	shelterbelt at east end
						87			5	100	4	7.1	13.8	
						92			5	100	5	8.3	14.0	
						97			5	100	4	12.8	20.3	
						07			5	100	5	15.0	24.8	
						12			5	100	4	15.0	25.5	

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PLOT	ACCESSION	PLANT	GENUS/SPECIES	TRANS	YR	YR	MATL	NO	NO	PCT	CAN	PLT		
LOCATION	NUMBER	SYMBOL	ORIGIN/SOURCE	DATE	PLT	REC	PLTD	PLTS	SRV	SRV	COV	HT	REMARKS	
IV/02/1-5	'Cardan'	FRPE	green ash	17-May	78	78	PLBR	5	5	100	2	0.3	2.3	
	MDN-12002		<i>Fraxinus pennsylvanica</i>			79			5	100		1.7	3.4	
	9005895		Wibaux Co., MT			80			5	100	3	3.0	5.1	
	PI-469226		USDA, ARS, Mandan, ND			82			5	100	3	7.5	10.1	
						83			5	100	2	8.4	11.4	good vigor
						84			5	100	3	9.7	13.8	
						87			5	100	3	9.5	18.1	
						92			5	100	3	10.9	22.5	
						97			5	100	3	15.1	25.1	
						07			5	100	3	20.0	33.3	
						12			5	100	5	16.7	32.5	20-50% dead limbs; native ash borer; lots of contaminants
IV/02/6-10	ND-1759	FRPE	green ash	17-May	78	78	PLBR	5	5	100	1	0.4	2.5	
	9005893		<i>Fraxinus pennsylvanica</i>			79			5	100		1.6	4.1	
			SD-156 X MDN-12002			80			5	100	3	3.1	5.2	
			USDA, NRCS, PMC, Bismarck, ND			82			5	100	4	5.8	8.1	
						83			5	100	3	7.9	10.7	competition from
						84			5	100	3	8.9	13.4	shelterbelt at north end
						87			5	100	3	9.0	15.8	
						92			5	100	3	10.2	19.0	
						97			5	100	2	15.6	25.1	
						02			5	100	3	17.0	29.4	
						07			5	100		20.0	30.2	
						12			5	100	4	18.1	30.2	

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<u>LOCATION</u>	<u>NUMBER</u>	<u>SYMBOL</u>	<u>ORIGIN/SOURCE</u>	<u>DATE</u>	<u>PLT</u>	<u>REC</u>	<u>PLTD</u>	<u>PLTS</u>	<u>SRV</u>	<u>SRV</u>	<u>VI</u>	<u>(ft)</u>	<u>(ft)</u>	<u>REMARKS</u>
IV/03/1-5	ND-647	FRNI	black ash	17-May	78	78	PLBR	5	5	100	1	0.1	0.9	
	9005887		<i>Fraxinus nigra</i>						5	100		0.4	1.9	
			Res. Sta., Morden, MB, Canada						5	100	6	1.2	2.7	
									5	100	4	4.1	8.0	
									5	100	4	4.8	10.5	heat stress
									5	100	4	4.2	11.4	leaf scorch
									5	100	3	5.6	18.4	sun scald
									5	100	7	5.6	15.2	
									5	100	5	12.3	19.3	
									5	100	3	14.0	26.8	
									5	100	5	14.5	29.1	
									2	40	6	9.0	25.5	
IV/03/6	ND-1432	AEGL	Ohio buckeye	17-May	78	78	PLBR	5	3	60	8	0.0	0.2	
	9005658		<i>Aesculus glabra</i>						3	60		0.1	0.5	
			Res. Sta., Morden, MB, Canada						3	60	9	0.5	0.4	
									1	20	6	1.5	2.1	
									1	20	6	1.6	2.3	
									1	20	6	3.3	3.3	
									1	20	6	6.2	5.4	
									1	20	5	7.9	7.2	
									1	20		12.8	10.5	
									1	20	4	12.5	15.5	
									1	20		14.5	15.5	
									1	20		17.0	23.8	

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PLOT <u>LOCATION</u>	ACCESSION <u>NUMBER</u>	PLANT <u>SYMBOL</u>	GENUS/SPECIES <u>ORIGIN/SOURCE</u>	TRANS <u>DATE</u>	YR <u>PLT</u>	YR <u>REC</u>	MATL <u>PLTD</u>	NO <u>PLTS</u>	NO <u>SRV</u>	PCT <u>SRV</u>	CAN		<u>REMARKS</u>		
											COV <u>VI</u>	PLT <u>(ft)</u>			
IV/04/1-5	ND-1879 9011850 PI-503531	GLTR	honeylocust <i>Gleditsia triacanthos</i> Woodward, OK USDA, ARS, Mandan, ND	8-May	80		PLBR- CONT	5	1	20	9	0.3	0.5		
									2	40		0.1	0.8		
									5	100	4	1.4	2.2		
									5	100	2	2.5	3.9		good vigor
									5	100	3	3.2	5.7		
									5	100	3	7.5	9.1		
									4	80	4	8.1	12.8		
									5	100	4	16.4	17.4		
									5	100	3	19.2	26.5		
									5	100	3	22.0	25.8		
IV/04/6-10	909440 'Carmine Jewel'	PRCE	dwarf cherry <i>Prunus cerasus</i> Big Sioux Nursery, Watertown, SD	10-May	12	PLBR	5	3	60	6		1.8	shelters & water on all		
								5	100	3	1.6	2.0	tubes removed, pine comp on eas		
								5	100	6	1.0	1.7	stressed, few leaves remaining		
IV/05/1-5	9063116	FRNI	black ash <i>Fraxinus nigra</i> Itasca State Park, MN	11-May	94	CONT	5	5	100	4	0.3	1.2			
								5	100	4	0.9	1.4			
								4	80	4	1.1	1.7		broken leader on 4	
								4	80	3	2.0	3.6			
								4	80	4	3.2	6.5			
								3	60	4	5.3	10.2			
								3	60	4	4.8	12.6			
IV/05/6-10	9091968	GYDI	Kentucky coffeetree <i>Gymnocladus dioicus</i> Big Sioux Nursery, Watertown, SD	4-May	11	PLBR	5	5	100	2	1.0	1.5	tip dieback, good limb growth		
								5	100	2		1.8			
								5	100	2		2.4			

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											VI	(ft)	(ft)	
IV/06/1-5	9063115	FRPE	green ash <i>Fraxinus pennsylvanica</i> Itasca State Park, MN	11-May	94	94	CONT	5	5	100	3	0.7	1.7	
						95			5	100	3	1.5	3.3	
						96			5	100	2	2.5	4.5	
						98			5	100	2	7.1	9.7	
						00			5	100	3	8.9	13.4	
						03			5	100		13.6	19.4	
						08			5	100	3	14.5	24.4	
						13			5	100	2	16.3	33.8	
IV/06/6-10	9076724	ELAN	Russian olive <i>Elaeagnus angustifolia</i> USDA, ARS, Mandan, ND	13-May	96	96	PLBR	5	4	80	3	2.2	2.3	
						97			4	80	3	3.3	3.4	
						98			4	80	3	5.4	5.5	
						00			4	80	4	7.9	8.4	
						02			4	80	5	11.0	9.5	needs a new stake
						05			4	80	4	11.7	12.5	
						10			4	80	3	15.5	14.8	
						15			4	80	3	18.4	20.3	
IV/07/1-5	Prairie Harvest CEOC Germplasm 9034956		hackberry <i>Celtis occidentalis</i> Polk County, MN	3-May	10	10	CONT	5	5	100	6	0.3	1.0	all heavily browsed
						12			5	100	6	0.3	0.4	nearly tilled out, need shelters
						14			5	100	8	0.6	0.8	
IV/07/6-10	9069166	ELAN	Russian olive <i>Elaeagnus angustifolia</i> USDA, ARS, Mandan, ND	13-May	96	96	CONT(S)	5	1	20	5	0.5	0.7	1-4 destroyed by cultivation
						97			4	80	3	1.0	1.3	
						98			2	40	6	1.4	3.0	
						00			2	40	5	2.3	4.1	
						02			2	40	6	4.8	7.5	
						05			2	40	5	6.6	8.2	
						10			2	40	3	6.1	12.1	
						15			0	0				removed in 2014?

Project No.: 381316K Field Evaluation of Woody Plant Materials, Dickinson, North Dakota

Year of Record: 2015

PLOT	ACCESSION	PLANT	GENUS/SPECIES	TRANS	YR	YR	MATL	NO	NO	PCT	CAN	PLT	REMARKS							
LOCATION	NUMBER	SYMBOL	ORIGIN/SOURCE	DATE	PLT	REC	PLTD	PLTS	SRV	SRV	COV	HT								
IV/08/1-10	'Oahe'	CEOC	hackberry <i>Celtis occidentalis</i> USDA, ARS, Mandan, ND	8-May	80	80	PLBR	10	10	100		0.5	2.0							
IV/09/1-10	SD-75 9005713	CEOC	hackberry <i>Celtis occidentalis</i> Potter Co., SD	7-May	81	81	PLBR	10	10	100		0.1	1.2							
IV/10/1-5	9094356	PIME	Meyer's spruce <i>Picea meyeri</i> Big Sioux Nursery, Watertown, SD	4-May	11	12	CONT	5	5	100	4	1.1	1.2	yellow needles on old growth						
W1/1/1-5	9094419 'Berry Blue'	LOED	honeyberry (haskaps) <i>Lonicera edulis</i> Jeffries Nursery, Portage LaPrairie, MB	30-May	13	13	POTD	5	5	100	3	1.4	1.8	bindweed in holes						

Project No.: 381316K Field Evaluation of Woody Plant Materials, Dickinson, North Dakota
Year of Record: 2015

PLOT <u>LOCATION</u>	ACCESSION <u>NUMBER</u>	PLANT <u>SYMBOL</u>	GENUS/SPECIES <u>ORIGIN/SOURCE</u>	TRANS <u>DATE</u>	YR <u>PLT</u>	YR <u>REC</u>	MATL <u>PLTD</u>	NO <u>PLTS</u>	NO <u>SRV</u>	PCT <u>SRV</u>	CAN		PLT <u>HT</u>	<u>REMARKS</u>					
											<u>COV</u>	<u>VI</u>							
W1/1/6-10	9094420	LOED	honeyberry (haskaps)	30-May	13	13	POTD	5	5	100	4	1.1	1.1	bindweed in holes					
			<i>Lonicera edulis</i>				14								5	100	2	1.4	1.2
			Jeffries Nursery, Portage LaPrairie, MB				15								5	100	3	2.0	1.8
W1/1/11-15	9094418	COAM	American hazel	30-May	13	13	POTD	5	5	100	3	0.8	1.4						
			<i>Corylus americana</i>				14								5	100	2	1.5	2.2
			northern MN source				15								4	80	2	3.0	3.5
W1/2/1-5	9094417	FRMA	Manchurian ash	30-May	13	13	POTD	5	5	100	2		3.3	in tubes					
			<i>Fraxinus mandshurica</i>				14								5	100	1	5.4	
			China				15								5	100	2	6.7	
W1/2/6-10	9094416	PLOC	sycamore	30-May	13	13	POTD	5	5	100	2		2.9	in tubes					
			<i>Platanus occidentalis</i>				14								2	40	5	2.3	
			Lincoln-Oakes Nursery, Bismarck, ND				15								0	0			all dead
W1/2/11-15	9094442	BEPO	gray birch	May	14	14	PLBR	5	5	100	1		6.4	tube is causing top breakage					
			<i>Betula populifolia</i>				15								5	100	3	6.4	3 ft dead top on 5
			Wisconsin																
W1/3/1-5	9094441	QUBI	swamp white oak	May	14	14	PLBR	5	5	100			2.6						
			<i>Quercus bicolor</i>				15								5	100	2	4.6	
			Illinois																
W1/3/6-10	9094446	ULAM	American elm	26-May	15	15	PLBR	5	5	100	3		8.0						
			<i>Ulmus americana</i>																
			NDSU, Fargo, ND																
			Big Sioux Nursery, Watertown, SD																

Project No.: 381316K Field Evaluation of Woody Plant Materials, Dickinson, North Dakota

Year of Record: 2015

PLOT	ACCESSION	PLANT	GENUS/SPECIES	TRANS	YR	YR	MATL	NO	NO	PCT	CAN	PLT		
<u>LOCATION</u>	<u>NUMBER</u>	<u>SYMBOL</u>	<u>ORIGIN/SOURCE</u>	<u>DATE</u>	<u>PLT</u>	<u>REC</u>	<u>PLTD</u>	<u>PLTS</u>	<u>SRV</u>	<u>SRV</u>	<u>VI</u>	<u>(ft)</u>	<u>(ft)</u>	<u>REMARKS</u>
W1/12/1-5	9094434	PSMEG	Douglas fir <i>Pseudotsuga menziesii</i> var. <i>glauca</i> USDA, ARS, Mandan, ND NDFS, Towner, ND	26-May	15	15	CONT	5	4	80	9		0.3	all damage due to deer browse
W1/13/1-5	'Catskill' 9051508	PRPUD	sand cherry <i>Prunus pumila</i> var. <i>depressa</i> Big Flats Plant Materials Center, Corning, NY	May	14	14	PLBR	5	5	100	1	4.0	1.0	
						15			5	100	3	4.4	0.3	deer niped off all tops

OFF-CENTER EVALUATION PLANTINGS: TECHNICAL REPORT – 2015

Study 38I347K University of Minnesota, Sand Plain Experimental Research Farm, Becker, Minnesota.

Study Title: Field Evaluation of Woody Plant Materials.

Introduction: There is a need to evaluate the performance of shrub and tree species/cultivars for windbreaks, wildlife, and recreational plantings under diverse soil and climatic conditions. To meet this need, field evaluation planting sites representative of the major land resource areas are located in the three States served by the PMC. These sites provide planting locations under long-term land tenure for assemblies of trees and shrubs to be evaluated under uniform culture and management. New material can be added on an annual basis. Comparisons are made with previously released cultivars and area of adaptation determined.

Objective: The objective is to assemble and evaluate woody plant materials for conservation use. Superior cultivars will be selected and released for increase by commercial nurseries.

Cooperators: The USDA Natural Resources Conservation Service, Plant Materials Center, Bismarck, North Dakota, in cooperation with the University of Minnesota, Sand Plain Experimental Research Farm, Becker, Minnesota. The cooperative agreement expired August 9, 2010, and is in the review and renewal process.

Location: University of Minnesota, Sand Plain Experimental Research Farm, Becker, Minnesota. Legal Description: NW 1/4 SW 1/4 sec. 31, T. 34 N., R. 28 W.

Major Land Resource Area: This site is located in Major Land Resource Area 91, Wisconsin and Minnesota Sandy Outwash. About 90 percent of this area is in farms. The area is nearly level, with elevations averaging around 980 feet above sea level.

Soils: The soils at this site are a Hubbard-Mosford complex. Hubbard is formed from leached coarse and medium sand outwash. Drought and wind erosion are major management problems. Hubbard and Mosford soils are in Conservation Tree/Shrub Suitability Group 7.

Climate: The average annual precipitation for Sherburne County is 26 to 30 inches. The average annual temperature is 40 to 45 degrees F, with an average freeze-free period of 135 days. The plant hardiness zone for this site is 4a, with an average annual minimum temperature of -30 to -25 degrees F. Climatic data for 2015 at the nearest official weather station, Elk River, Minnesota, is shown in Table BE-1.

Methods and Materials

Assembly: Refer to Table BE-2 for a list of woody species planted from 1998 to 2015.

Planting Plan: The plots are not randomized or replicated but organized systematically for evaluation and demonstration purposes (Figure BE-1). The site is divided into four blocks (refer to Figure BE-2). Block 1 is planted to shrubs, Block 2 to medium trees, Block 3 to tall trees, and Block 4 to conifers. Each block is arranged into single row, non-replicated plots. Each plot contains 1 to 10 plants. Spacing is 20 feet between rows and 5 feet within row for shrubs and 10 feet within row for trees. Row length is 100 feet. Like species and standards of comparison are planted in adjacent plots whenever possible.

Site Preparation: A clean, firm planting site was prepared by roto-tilling.

Planting Method: All trees and shrubs were hand planted using approved forestry methods.

Planting Date: Refer to Table BE-2 for planting dates of woody species planted from 1998 to 2015.

Fertilization: No fertilizer has been applied to the planting area.

Weed Control: Mechanical weed control, rotary mowing between rows, and roto-tilling and hand hoeing within row.

Biological Control: None.

Irrigation: Trees are often hand watered at time of planting.

Crop Residue Management: On May 20, 2003, Block I (shrubs) was seeded between rows to a cover of 50 percent Bad River blue grama and 50 percent Pierre sideoats grama. In 2008, fescue was seeded between rows in Blocks III and IV. Blue grama and sideoats grama seeded between rows in Blocks I and II was is mowed and doing well.

Silvicultural Practices: Minor pruning has been done each year to remove dead or damaged branches.

Evaluations and Measurements: Plant performance data is recorded during the growing season for the first three years. After the third year, data is gathered according to a specific schedule. The trees and shrubs were evaluated for survival, canopy width, plant height, vigor, insect and disease, and animal damage. Select data appears in this report. Annual summary reports have been prepared since 2006 and can be requested from the PMC.

New entries:

On May 5, 2015, two new accessions were planted:

- 1) 9094434, Douglas fir (*Pseudotsuga menziesii*) from USDA, ARS, Mandan, ND, and Towner Nursery, Towner, ND. Block III, Row 13, 6-10:
- 2) 9094446, Prairie Expedition elm (*Ulmus americana*) 'Lewis & Clark' from Big Sioux Nursery, Watertown, SD; Block III, Row 14, 6-10:

Evaluation:

Information was collected on 59 selected entries on August 5, 2015. Crown spread and plant height were recorded along with observational notes relative to vigor, disease and insect damage, drought and cold tolerance, fruit production, survival, and predator damage. The inventory was completed and the planting plan was updated. Grass between the tree rows was mowed during the growing season. Plots looked very good from a maintenance standpoint.

Plant Performance: One hundred-twenty accessions of 97 species have been or are being evaluated. Maintenance on this site is excellent and most species are doing very well. Refer to BE-2 for detailed performance information.

The following accessions exhibit potential for further evaluation and use.

9019586 green ash	9082711 winterberry euonymus
9094417 Manchurian ash	9076729 gray dogwood
9069164 Mongolian Scots pine	9082632 Mongolian pea shrub
9082891 common ninebark	9082712 bittersweet
Schubert chokecherry	'Arnold's Red' honeysuckle
9069162 Dahurian larch	9092051 northern catalpa
9069168 Siberian larch	9082667 gray birch
9082610 Siberian larch	9069162 Dahurian larch
9030971 amur maple	9076737 black cherry
9063148 corktree	9057406 rugosa rose
9092053 staghorn sumac	9094419 'Cinderella' honeyberry (haskap)
9082888 American hazelnut	9094420 'Berry Blue' honeyberry (haskap)
9082719 'Nero' chokeberry	

Seeds from 9069164 Mongolian Scots pine were collected, grown out and provided for field plantings in 2013 and 2014. 'McKenzie' black chokeberry is currently in big demand by growers from across the globe. It is particularly prized by wineries. There are many requests to grow birch in conservation plantings. Continuing evaluations of 9082667 gray birch will determine adaptability to conservation growing conditions. Further study of gray birch on a less droughty site would have merit (CTSG-1, 2, 3, and 4). Seed was collected from 9069164 Mongolian Scots pine on September 30, 2015 and seed from 9082667 was collected in late October.

Figure BE-1. Sand Plain Experimental Farm layout

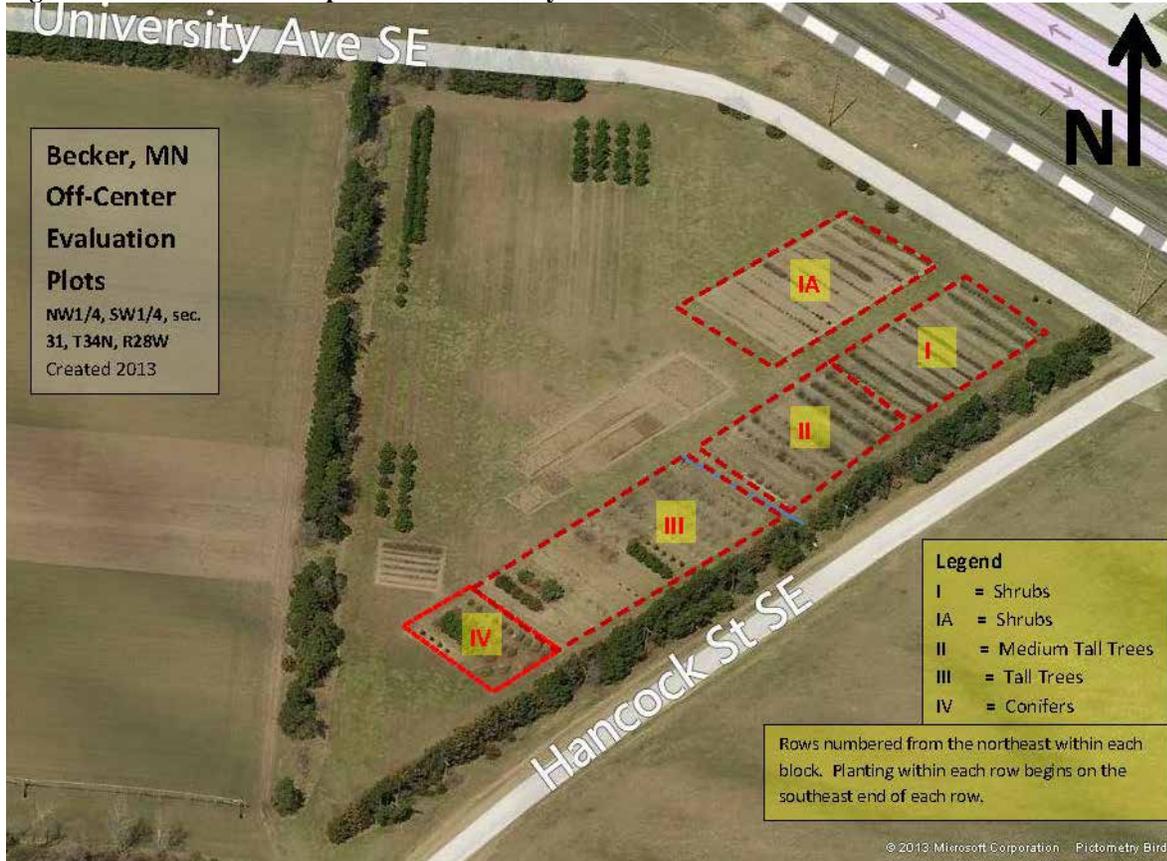


Figure BE-2. Becker Woody Off-Center Evaluation Planting – Plot Layout

BLOCK IV CONIFERS			
	Canaan fir		
9069163 Dahurian larch	9069164 Scots pine		
9069168 Siberian larch	9069162 Dahurian larch		
9082610 Siberian larch	9082611 Siberian larch		
BLOCK III TALL TREES			
9082739 ironwood	9092231 lodgepole pine		
9082639 northern pin oak	cedar		
9094334 American linden	9094417 Manchurian ash		
ND-686 Pekin lilac	9094434 Douglas fir		
9082885 aspen (Towner)	9094446 American elm		
9082609 Meyer's spruce	9094416 sycamore		
9076735 Ohio buckeye	9076737 black cherry		
9069178 red pine	9076731 bur oak		
Hunter ponderosa pine	9063148 amur corktree		
9063127 white ash	9076730 silver maple		
9063115 green ash	9063116 black ash		
Cardan green ash	9019586 green ash		
Oahe hackberry	9019578 hackberry		
9076739 oak hybrid	9069177 bur oak		
BLOCK II MEDIUM TALL TREES			
9082667 gray birch	9092051 northern catalpa		
9092052 swamp white oak	9082675 Manchurian ash		
9094406 Princeton elm	Carmine Jewel dwarf cherry		
9091968 Kentucky coffeetree	9069121 mayday		
McDermand Ussurian pear	9076733 nannyberry		
Prairie Harvest hackberry	Oahe hackberry		
9047209 chokecherry	ND-1733 plum		
9030971 amur maple	Schubert chokecherry		
Roselow sarg. crabapple	Midwest Manch. crabapple		
BLOCK I SHRUBS		BLOCK 1A SHRUBS	
Legacy late lilac	9019621 lilac	Cinderella haskaps Berry blue haskaps 9094418 hazel	
Scarlet Mongolian cherry	9019579 Sib. pea shrub	apricot Caragana frutex skunkbush sumac pin cherry	
Konza aromatic sumac		Catskill sandcherry nannyberry MO hazelnut MO plum	
9019576 juneberry	Shadblow svcbry arrowwood	com. ninebark Am. hazelnut PrairieRed plum staghorn sumac	
9019581 Pekin cotoneaster	9019605 sand cherry	mugo pine seaberry wayfaring bush roundleaf hawthorn	
Centennial E. cotoneaster	ND-170 Euro. cotoneaster	pr. rose M. gooseberry pin cherry b.l. honeysuckle	
	roughleaf dogwd A Amber sk.sumac Am.h.cranb.	leadplant chokeberry chokecherry Red River pr.cordgr.	
9076729 gray dogwood (open)	9094333 elderberry	Nero chokbry Viking chokbry winterberry E. bittersweet	
9019580 redosier dogwood	Indigo silky dogwood	rugosa rose black currant cupplant	
Arnolds Red honeysuckle	9063143 r.t. honeysuckle	chokeberry Sib.dogwood slough sedge sweetgrass	
		Survivor false indigo 9082632 Mong. pea shrub	
		9019611 golden currant Silver Sands sandbar willow	
revised 6/15			



Table No. BE-1: 2015 Weather Summary - Official Station - Elk River, Minnesota					
Month	Mean Temperature		Precipitation (inches)		
	(degrees Fahrenheit)		Actual		Deviation from Normal
	2015	Normal*	2015**	Normal*	2015
January	17.7	9.1	M	0.73	n/a
February	9.5	15.6	M	0.71	n/a
March	31.3	31.4	M	1.65	n/a
April	46.1	46.6	1.42	2.99	-1.57
May	56.6	58.2	5.52	3.46	2.06
June	67.9	68.0	4.94	4.64	0.30
July	71.2	72.5	7.22	4.21	3.01
August	67.3	70.3	4.96	3.88	1.08
September	65.7	61.6	2.60	3.96	-1.36
October	49.7	47.9	4.47	2.60	1.87
November	40.3	35.6	2.59	1.67	0.92
December	27.3	14.4	M	0.93	n/a
Annual	45.9	44.3	n/a**	31.42	n/a**
* National Climate Data Center 1981-2010 Monthly Normals					
** Missing data					
		<u>2015</u>			
	Last Frost (28 degrees)	23-Apr			
	First Frost (28 degrees)	17-Oct			
	Frost Free Period	175 days			

Key to Table BE-2. 38I347K Field Evaluation of Woody Plant Materials – Becker, Minnesota

PLOT LOCATION = plot location of the plant material within the evaluation

ACCESSION NUMBER = any accession number, PI number or cultivar name assigned to the plant material

PLANT SYMBOL = plant symbol of the genus and species (asterisk indicates the symbol is not official)

GENUS/SPECIES = common name and scientific name of the plant material

ORIGIN/SOURCE = origin and/or source of the plant material

TRANS DATE = month and day the plant material was transplanted at the evaluation site

YR PLT = year the plant materials were transplanted at the evaluation site

YR REC = year of record

MATL PLTD = type of material planted, PLBR = bareroot, CONT = containerized

NO PLTS = number of plants planted in the plot

NO SRV = number of plants surviving

PCT SRV = percent of plants surviving

VI = plant vigor (1=excellent, 3=good, 5=fair, 7=poor, 9=very poor)

CAN COV (ft) = canopy cover measured in feet

PLT HT (ft) = plant height measured in feet

Table BE-2.

Project No.: 381347K Field Evaluation of Woody Plant Materials, Becker, Minnesota

Year of Record: 2015

PLOT <u>LOCATION</u>	ACCESSION <u>NUMBER</u>	PLANT <u>SYMBOL</u>	GENUS/SPECIES <u>ORIGIN/SOURCE</u>	TRANS <u>DATE</u>	YR <u>PLT</u>	YR <u>REC</u>	MATL <u>PLTD</u>	NO <u>PLTS</u>	NO <u>SRV</u>	PCT <u>SRV</u>	CAN		<u>REMARKS</u>	
											COV	HT		
											<u>VI</u>	<u>(ft)</u>	<u>(ft)</u>	
I/1/1-10	'Arnolds Red' 9069080	LOTA	red tatarian honeysuckle	1-May 96	96		CONT(P)	10	10	100	4	2.0	2.1	
			<i>Lonicera tatarica</i>		97				10	100	5	1.8	2.1	
			Lee Nursery, Fertile, MN		98				10	100	2	2.6	4.1	
			USDA, NRCS, PMC, Bismarck, ND		00				10	100	4	4.4	5.3	
					02				10	100	3	4.8	6.1	All fair fruit; yellow leaf tips
					05				10	100	4	5.0	7.3	
					10				10	100	4	6.8	8.2	
		15				10	100	6	4.6	7.0	10 cut off			
I/1/11-20	'Hawkeye' 9063143	LOTA	red tatarian honeysuckle	1-May 96	96		CONT(P)	10	10	100	3	1.7	1.9	
			<i>Lonicera tatarica</i>		97				10	100	4	1.5	2.4	
			Iowa		98				10	100	2	2.2	3.0	
			Lincoln-Oakes Nursery, Bismarck, ND		00				10	100	2	5.1	5.2	
			USDA, NRCS, PMC, Bismarck, ND		02				10	100	2	5.8	6.5	
					05				10	100	3	6.7	7.7	good vigor
					10				10	100	6	3.2	7.1	
		15				10	1000	4	8.2	8.8				
I/2/11-20	'Indigo' 468117	COAM2	silky dogwood	1-May 96	96		PLBR	10	10	100	4	1.7	2.1	
			<i>Cornus amomum</i>		97				9	90	2	3.2	2.9	
			USDA, NRCS, PMC, E. Lansing, MI		98				9	90	1	7.2	4.8	
					00				9	90	2	9.6	6.4	
					02				9	90	3	9.8	7.3	
					05				10	100	5	10.5	7.3	dieback on 1,2; resprout on 4
					10				10	100	6	5.0	6.2	50% dieback, mostly resprouts
		15				10	100	5	7.1	5.5	leaf spot on all, many suckers			

Project No.: 381347K Field Evaluation of Woody Plant Materials, Becker, Minnesota

Year of Record: 2015

PLOT	ACCESSION	PLANT	GENUS/SPECIES	TRANS	YR	YR	MATL	NO	NO	PCT	CAN	PLT		
<u>LOCATION</u>	<u>NUMBER</u>	<u>SYMBOL</u>	<u>ORIGIN/SOURCE</u>	<u>DATE</u>	<u>PLT</u>	<u>REC</u>	<u>PLTD</u>	<u>PLTS</u>	<u>SRV</u>	<u>SRV</u>	<u>VI</u>	<u>COV</u>	<u>HT</u>	<u>REMARKS</u>
I/3/1-10	9076729	CORA6	gray dogwood <i>Cornus racemosa</i> Lincoln-Oakes Nursery, Bismarck, ND	1-May	96	96	PLBR	10	10	100	3	1.4	1.9	browse on 2,3
						97			10	100	3	2.2	2.8	
						98			10	100	2	5.4	4.9	
						00			10	100	2	7.8	6.5	
						02			10	100	2	8.0	7.4	
						05			10	100	4	7.0	7.5	
						10			10	100	5	5.6	6.2	
						15			10	100	6	6.9	6.7	
I/3/6-10	9094333	SANIC4	common elderberry <i>Sambucus nigra</i> ssp. <i>canadensis</i> Big Sioux Nursery, Watertown, SD	4-May	10	10	PLBR	5	3	60	6	0.5	0.5	
						11			4	80	6	0.7	0.9	
						12			5	100	5	0.8	1.0	deer browse heavy, need tubes
						14			5	100	7	0.9	1.1	deer browse, need tubes, winter dieback
1/4/6-10	9094355	CODR	roughleaf dogwood <i>Cornus drummondii</i> Big Sioux Nursery, Watertown, SD	4-May	11	11	PLBR	5	4	80	5	0.6	1.8	
						12			5	100	2	1.1	1.7	5 replant
						13			5	100	4	4.8	1.0	drought-affected
						15			5	100	4	1.5	2.0	
1/4/11-15	'Autumn Amber'	RHTR	skunkbush sumac <i>Rhus trilobata</i> USDA, NRCS, PMC, Los Lunas, NM	7-May	09	09		5	5	100	3	1.1	0.7	
						10			5	100	3	1.1	1.0	
						11			5	100	2	2.0	0.9	no leaf spot
						13			5	100	3	3.6	1.0	
						15			5	100	3	4.5	1.0	
1/4/16-20	9094281	VIOPA2	American highbush cranberry <i>Viburnum opulus</i> var. <i>americanum</i> Big Sioux Nursery, Watertown, SD	7-May	09	09		5	5	100	3	1.4	1.6	
						10			5	100	4	1.8	1.6	
						11			5	100	3	n/a	n/a	
						13			5	100	6	2.3	2.1	leave burnt as fireblight, no stem lesions
						15			5	100	4	3.0	2.5	

Project No.: 381347K Field Evaluation of Woody Plant Materials, Becker, Minnesota

Year of Record: 2015

PLOT	ACCESSION	PLANT	GENUS/SPECIES	TRANS	YR	YR	MATL	NO	NO	PCT	CAN	PLT		
LOCATION	NUMBER	SYMBOL	ORIGIN/SOURCE	DATE	PLT	REC	PLTD	PLTS	SRV	SRV	VI	COV	HT	REMARKS
I/5/1-10	'Centennial'	COIN16	European cotoneaster	1-May	96	96	PLBR	10	10	100	5	1.6	1.6	browse on 7
	113095		<i>Cotoneaster integerrimus</i>			97			9	90	4	1.6	1.6	some dieback on 2,7
	9005729		USDA, NRCS, PMC, Bismarck, ND			98			9	90	4	4.0	3.9	
			Lincoln-Oakes Nursery, Bismarck, ND			00			9	90	3	8.5	5.2	
						02			9	90	3	8.6	6.0	
						05			10	100	2	9.5	5.5	excellent fruit
						10			10	100	7	7.0	6.0	
						15			9	90	6	5.7	5.1	
I/5/11-20	ND-170	COIN16	European cotoneaster	1-May	96	96	PLBR	10	10	100	3	1.8	2.0	
	9005728		<i>Cotoneaster integerrimus</i>			97			10	100	5	2.1	2.0	leaf spots
			USDA, NRCS, PMC, Bismarck, ND			98			10	100	4	3.7	2.9	
			Lincoln-Oakes Nursery, Bismarck, ND			00			10	100	2	7.3	4.1	
						02			10	100	2	7.2	4.5	
						05			10	100	3	6.3	4.5	
						10			10	100	7	6.0	4.0	80% leaves gone 8/18
						15			10	100	9			need to be removed
I/6/1-10	9019581	COAC	Pekin cotoneaster	1-May	96	96	PLBR	10	10	100	5	1.0	1.6	
			<i>Cotoneaster acutifolia</i>			97			10	100	3	1.7	2.2	dieback
			Lincoln-Oakes Nursery, Bismarck, ND			98			10	100	3	3.9	3.6	
						00			10	100	3	6.3	4.9	
						02			10	100	3	6.9	5.6	
						05			10	100	5	6.5	5.5	fireblight on 6,7
						10			10	100	7	6.0	4.0	mostly resprouts
						15			10	100	5	4.4	3.8	
I/7/1-10	9019576	AMAL2	juneberry	1-May	96	96	PLBR	10	10	100	5	1.0	1.0	
			<i>Amelanchier alnifolia</i>			97			10	100	5	1.4	1.3	
			Lincoln-Oakes Nursery, Bismarck, ND			98			10	100	4	1.7	1.7	
						00			10	100	3	5.2	2.4	
						02			10	100	3	6.1	2.8	
						05			10	100	4	5.5	3.3	all are grown together
						10			10	100	5	6.0	4.3	
						15			9	90	3	6.0	2.0	all resprouts, suckers; some rust

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											COV <u>VI</u>	PLT <u>(ft)</u>		
1/7/6-10	9091975	AMLA9	serviceberry <i>Amelanchier lamarckii</i> Lincoln-Oakes Nursery, Bismarck ND	12-May	05	05		5	5	100	6	0.6	1.2	1,4 browsed
					06		4	80	7	0.4	1.0			
					07		4	80	4	0.6	1.4			
					09		4	80	5	0.8	1.0			
					11		4	80	4	1.5	1.6			
					14		4	80	7	3.3	3.1	no browse		
1/7/11-15	9091976	VIDE	arrowwood viburnum <i>Viburnum dentatum</i> Lincoln-Oakes Nursery, Bismarck, ND	12-May	05	05		5	5	100	6	0.6	1.7	dead leaves on 1,4
					06		2	40	5	0.8	1.4			
					07		4	80	4	1.3	2.1			
					09		4	80	4	1.3	2.1			
					11		4	80	3	1.8	2.3			
					14		4	80	4	2.2	2.3			
I/8/1-10	'Konza' 477981	RHAR4	aromatic sumac <i>Rhus aromatica</i> NRCS, PMC, Manhattan, KS Lincoln-Oakes Nursery, Bismarck, ND	1-May	96	96	PLBR	10	7	70	6	0.7	1.1	
					97		7	70	4	1.9	1.9	top dieback - winter injury		
					98		7	70	3	5.2	3.5	leaf fungus on 5,6,7,9		
					00		7	70		8.3	4.2			
					02		7	70	4	9.2	4.8			
					05		9	90	4	9.5	5.1			
					10		10	100	3	9.0	5.0			
					15		9	90	4	11.7	6.4	4,6,7,8 splayed out		
I/9/1-10	'Scarlet' 478003	PRFR2	Mongolian cherry <i>Prunus fruticosa</i> NRCS, PMC, Bismarck, ND Lincoln-Oakes Nursery, Bismarck, ND	1-May	96	96	PLBR	10	10	100	3	1.1	1.3	
					97		10	100	4	1.6	1.8	severe rabbit damage on 1		
					98		10	100	3	2.9	2.7	all suckering		
					00		10	100	3	6.8	3.2			
					02		10	100	2	6.8	3.8			
					05		10	100	4	7.3	4.4	variable heights		
					10		10	100	3	4-8	3-5	variable, good vigor, grown together		
					15		10	100	4	6.5	3.5			

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I/9/11-20	9019579	CAAR18	Siberian pea shrub	1-May	96	96	PLBR	10	10	100	5	0.8	2.0	browse on all
			<i>Caragana arborescens</i>			97			10	100	6	1.1	2.5	
			Lincoln-Oakes Nursery, Bismarck, ND			98			10	100	5	2.0	3.7	insect damage 4,5
						00			10	100	4	4.2	5.0	
						02			10	100	3	6.1	6.2	
						05			10	100	5	6.5	6.9	leaf defoliation
						10			10	100	5	4-6	4-8	lots of variation
						15			10	100	2	8.2	8.2	
I/10/1-10	'Legacy' ND-83 540443 9006228	SYVI3	late (villosa) lilac	1-May	96	96	PLBR	10	10	100	6	0.6	1.1	resprout on 7,9
			<i>Syringa villosa</i>			97			10	100	10	0.7	1.3	
			NRCS, PMC, Bismarck, ND			98			10	100	4	1.3	1.9	
			Lincoln-Oakes Nursery, Bismarck, ND			00			10	100	4	3.5	3.2	
						02			10	100	4	4.6	4.1	
						05			10	100	5	4.5	4.2	variable heights
						10			10	100	5	3-5	2-5	variable heights
						15			10	100	6	4.2	3.9	
I/10/11-20	9019621	SYVU	common lilac	1-May	96	96	PLBR	10	10	100	5	1.0	1.6	better than late lilac
			<i>Syringa vulgaris</i>			97			10	100	5	1.1	2.2	mildew on 1,8
			Lincoln-Oakes Nursery, Bismarck, ND			98			10	100	3	1.9	2.9	
						00			10	100	4	4.1	4.0	
						02			10	100	3	5.2	5.2	
						05			10	100	4	5.3	6.3	variable heights
						10			10	100	5	4.7	5.5	
						15			10	100	6	4.9	6.0	
IA/1/1-10	9019611	RIAU	golden currant	1-May	96	96	PLBR	10	10	100	4	1.2	2.1	
			<i>Ribes aureum</i>			97			10	100	6	2.0	2.4	
			Lincoln-Oakes Nursery, Bismarck, ND			98			10	100	7	3.0	3.7	
						00			10	100	3	5.2	4.2	
						02			10	100	4	5.6	4.4	
						05			10	100	5	4.7	4.5	leaves mostly gone-leaf spot
						10			10	100	5	4-6	3-6	leaves 95% gone 8/18
						15			10	100	7	3.6	4.8	

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IA/1/11-20	Silver Sands	SAIN	sandbar willow	1-May	96	96	CONT(S)	10	0	0				
	Germplasm		<i>Salix interior</i>			97			3	30	5	1.1	2.0	
	ND-3902		USDA, NRCS, PMC, Bismarck, ND			98			8	80	6	0.8	1.3	rabbit browse on all
	9035212					00			10	100	2	8.4	5.2	
						02			10	100	2	9.1	6.4	
						05			10	100	2	9.0	7.5	
						10			10	100	3	10.0	7.0	
						15			10	100	2	11.0	8.5	looks good
IA/2/1-10	Survivor	AMFR	false indigo	1-May	96	96	PLBR	10	10	100	3	2.3	2.7	browse on all
	Germplasm		<i>Amorpha fruticosa</i>			97			10	100	4	3.0	2.2	
	9008041		NRCS, PMC, Bismarck, ND			98			10	100	3	6.3	3.6	
			Lincoln-Oakes Nursery, Bismarck, ND			00			10	100	3	8.2	4.4	
						02			10	100	3	9.6	5.0	
						05			10	100	2	10.0	5.5	
						10			10	100	5	8.4	4.2	
						15			10	100	3			remove, many contaminants
1A/2/11-20	9082632	CAIN	Mongolian peashrub	29-Apr	99	99	PLBR	10	10	100	3	0.8	1.0	
			<i>Caragana intermedia</i>			00			10	100	3	2.1	1.7	
			Lawyer Nursery, Plains, MT			01			9	90	4	3.6	2.6	
						03			9	90	4	4.8	3.4	
						05			9	90	3	6.0	3.9	
						08			9	90	4	7.3	4.4	dieback on 8, good seed on 10
						13			10	100	5	11.4	5.6	
1A/3/1-5	'McKenzie'	PHME13	black chokeberry	3-May	00	00	PLBR	5	5	100	2	1.6	1.7	
	323957		<i>Photinia melanocarpa</i>			01			5	100	3	2.3	2.4	
			Lincoln-Oakes Nursery, Bismarck, ND			02			5	100	2	3.6	2.9	
						04			5	100	2	4.1	3.2	
						06			5	100	2	6.4	4.2	
						09			5	100	2	6.8	4.9	
						14			5	100	2	7.6	6.4	all have fruit

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											<u>COV</u>	<u>HT</u>		
											<u>VI</u>	<u>(ft)</u>	<u>(ft)</u>	
1A/3/6-10	9082664	COALS2	Siberian dogwood <i>Cornus alba</i> var. <i>sibirica</i> Lawyer Nursery, Plains, MT	5-May	00	00	PLBR	5	5	100	2	1.5	2.7	
											3	3.9	3.1	
											2	5.8	4.4	
											3	5.6	5.3	
											4	6.8	5.3	
											5	6.7	5.4	
								5	100	6	3.8	4.6	dieback on all	
1A/4/6-10	9057406	RORU	rugosa rose <i>Rosa rugosa</i> Lincoln-Oakes Nursery, Bismarck, ND	16-May	01	01	PLBR	5	5	100	4	1.2	1.2	
											3	2.7	2.0	
											3	3.6	2.2	
											3	5.3	3.0	good vigor
											2	7.6	3.5	
											2	10.0	4.0	
								5	100	3	11.0	3.0	width based on mower trimming	
1A/4/11-15	Riverview Germplasm 9082687	RIAM2	American black currant <i>Ribes americanum</i> Big Sioux Nursery, Watertown, SD	16-May	01	01	PLBR	5	5	100		1.5	1.9	
											3	4.0	2.6	
											3	3.6	3.2	
											3	5.5	3.5	
											3	5.9	3.9	
											3	5.5	3.5	
								5	100	3	6.5	4.8	all grown together, width by mower	
1A/4/16-20	9082714	SIPEP	cupplant <i>Silphium perfoliatum</i> USDA, NRCS, PMC, Bismarck, ND		02	02	CONT	5	5	100	3	0.6	0.3	
											3	1.1	3.5	
														all five okay, height varies
														all five okay, flowering
														good growth, some drought stress

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											COV <u>Vl</u>	PLT <u>(ft)</u>													
1A/5/1-5	'Nero' 9082719	PHME13	chokeberry <i>Photinia melanocarpa</i> Northwoods Nursery, Molalla, OR	02	02	02	PLBR	5	5	100	3	1.0	1.5												
											4	1.4	1.9												
											4	1.7	2.0												
											3	3.2	3.0												
											3	3.7	3.4												
								5	5	100	3	4.0	3.9	good fruit											
1A/5/6-10	'Viking' 9082720	PHME13	chokeberry <i>Photinia melanocarpa</i> Northwoods Nursery, Molalla, OR	02	02	02	PLBR	5	5	100	3	1.1	1.4												
											3	1.8	2.0												
											3	2.3	2.1												
											2	4.0	3.2												
											2	4.4	3.2												
								5	5	100	3	5.1	4.0	good fruit											
1A/5/11-15	9082711	EUBU6	winterberry euonymus <i>Euonymus bungeanus</i> Lincoln-Oakes Nursery, Bismarck, ND	02	02	02	PLBR	5	5	100	3	0.5	2.6												
											3	1.4	3.0												
											4	2.6	3.2	3 has seed											
											4	4.1	4.1	dark pink fruit on 3											
											3	4.5	4.6	upright form on 2											
								5	5	100	3	4.6	5.6												
1A/5/16/20	9082712	CESC	bittersweet <i>Celastrus scandens</i> Lincoln-Oakes Nursery, Bismarck, ND	02	02	02	PLBR	5	5	100	3	0.5	1.0												
											3	1.2	2.4												
											4	1.2	3.2	berries on 4											
											3	2.6	3.4												
											3	3.1	2.8	all female											
								5	5	100	3	2.8	3.1												
1A/6/1-5	9082678	AMCA6	leadplant <i>Amorpha canescens</i> Lincoln-Oakes Nursery, Bismarck, ND	02	02	02	PLBR	5	5	100	2	0.6	1.0												
																			5	5	100		1.4	1.3	
																			5	5	100	4	1.5	1.3	
																			5	5	100	3	1.9	2.2	
																			5	5	100	3	3.0	2.2	
								5	5	100	4	3.3	2.4												

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1A/6/6-10	9091971	PHME13	black chokeberry <i>Photinia melanocarpa</i> Bailey Nurseries, Inc.	12-May	05	05		5	5	100	3	1.5	2.1	
						06			5	100	2	2.1	2.4	
						07			5	100	3	3.2	2.7	
						09			5	100	3	4.3	3.6	sprouts from layering
						13			5	100	2	5.8	4.2	
						14			5	100	3	4.8	4.4	some fruit
1A/6/11-15	9008183	PRVI	common chokecherry <i>Prunus virginiana</i> Lincoln-Oakes Nursery, Bismarck, ND Sheridan County, ND	12-May	05	05		5	5	100	3	0.8	1.8	
						06			5	100	5	1.5	2.6	
						07			5	100	3	2.2	3.8	1,5 yellow leaves; 3 powdery mildew
						09			5	100	4	4.5	5.5	tent caterpillars on 1
						11			5	100	3	5.6	4.2	
						14			5	100	3	6.2	8.8	
1A/7/1-5	9082706	ROAR3	prairie rose <i>Rosa arkansana</i> Bismarck, ND Lincoln-Oakes Nursery, Bismarck, ND		03	03		5	5	100	4	1.2	1.2	
						04			5	100	6	0.7	0.6	
						05			3	60	5	2.3	1.3	
						07			3	60	3	2.3	1.3	
						09			3	60	5	2.6	1.4	
						11			3	60	2	4.1	1.2	
1A/7/6-10	9082746	RIMI	Missouri gooseberry <i>Ribes missouriense</i> Big Sioux River, Watertown, SD Big Sioux Nursery, Watertown, SD		03	03	PLBR	5	5	100	6	1.4	1.4	
						04			5	100	5	1.4	1.6	
						05			5	100		2.5	2.0	
						07			5	100	7	1.9	1.7	severe leaf spot on all
						09								needs removal
1A/7/11-15	9091967	PRPE2	pin cherry <i>Prunus pensylvanica</i> Big Sioux Nursery, Watertown, SD	12-May	05	05		5	5	100	3	1.5	2.2	
						06			5	100	4	2.5	3.1	
						07			5	100	3	4.2	3.8	
						09			5	100	5	6.9	6.3	
						11			5	100	3	7.9	9.3	
						14			5	100	3	9.5	10.0	

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											COV <u>VI</u>	PLT <u>(ft)</u>		HT <u>(ft)</u>			
1A/7/16-20	'Freedom'	LOKO2	blueleaf honeysuckle <i>Lonicera korolkowii</i> Lincoln-Oakes Nursery, Bismarck, ND	03	03	PLBR		5	5	100	4	2.2	2.2	clean leaves, no disease			
											3	4.7	4.0				
											2	5.5	4.9				
											2	9.3	8.1				
											1	12.0	10.0				
1A/8/1-5	9082889	PIMU80	Mugo pine <i>Pinus mugo</i> Big Sioux Nursery, Watertown, SD	12-May	04	04	PLBR	5	5					no measurements taken			
															5	0.4	0.4
															4	0.9	0.7
															4	1.8	1.4
															3	2.9	2.8
1A/8/6-10	9082887	HIRH80	seaberry <i>Hippophae rhamnoides</i> Lincoln-Oakes Nursery, Bismarck, ND	20-May	04	04	PLBR	5	5	100	4	0.6	1.6				
											4	1.1	1.6				
											4	1.5	1.9				
											3	3.1	3.1				
											3	4.5	3.8				
1A/8/11-15	9082642	VILA	wayfaring bush <i>Viburnum lantana</i> Lincoln-Oakes Nursery, Bismarck, ND	20-May	04	04	PLBR	5	5	100	5	0.9	1.3	winter injury on 4,5 sun scald, chlorosis on all stressed, yellow leaf margins			
											5	0.8	1.2				
											4	0.8	1.2				
											5	1.3	1.4				
											6	1.9	2.4				
1A/8/16-20	9076686	CRCH	roundleaf hawthorn <i>Crataegus chrysocarpa</i> Lincoln-Oakes Nursery, Bismarck, ND	20-May	04	04	PLBR	5	4	80	4	0.6	0.7	cedar apple rust on all, wooly aphids 3 powdery mildew heavy rust heavy deer browse			
											4	0.8	0.9				
											5	1.0	1.4				
											5	1.7	2.2				
											5	2.6	2.9				

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											COV <u>VI</u>	HT <u>(ft)</u>		
1A/9/1-5	9082891	PHOP	common ninebark <i>Physocarpus opulifolius</i> Big Sioux Nursery, Watertown, SD	20-May	04	04	PLBR	5	5	100	3	1.3	1.6	
											4	2.5	1.9	
											3	4.6	3.2	
											2	5.9	6.0	
											2	7.0	7.0	
						13		5	100	3	8.1	6.7	some apical tip dieback on all (5% foliage)	
1A/9/6-10	9082888	COAM3	American hazelnut <i>Corylus americana</i> Lincoln-Oakes Nursery, Bismarck, ND	20-May	04	04	PLBR	5	4	80	4	0.7	1.1	
											4	1.0	1.5	
											3	1.6	1.7	
												3.3	2.9	all browsed
											2	3.0	4.0	
						13		5	100	2	4.8	5.4		
IA/9/11-15	'Prairie Red' 9047203	PRUNU	hybrid plum <i>Prunus</i> sp. Big Sioux Nursery, Watertown, SD	4-May	06	06	PLBR	5	5	100	3	0.8	1.6	
											3	1.0	1.8	
											3	1.4	1.9	all browsed
											5	2.2	3.0	
											4	4.3	4.5	
IA/9/16-20	9092053	RHTY	staghorn sumac <i>Rhus typhina</i> Lincoln-Oakes Nursery, Bismarck, ND	4-May	06	06	PLBR	5	5	100	2	3.9	3.9	
											4	4.5	5.1	
											4	5.3	4.4	deer rub on 2
											4	6.0	6.2	
											3	7.3	6.6	
1A/10/1-5	'Catskill'	PRPUD	sand cherry <i>Prunus pumila</i> var. <i>depressa</i> Big Flats PMC, Corning, NY	12-May	14	14	PLBR	5	5	100	3	2.9	0.5	
											3	2.3	0.6	

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<u>LOCATION</u>	<u>NUMBER</u>	<u>SYMBOL</u>	<u>ORIGIN/SOURCE</u>	<u>DATE</u>	<u>PLT</u>	<u>REC</u>	<u>PLTD</u>	<u>PLTS</u>	<u>SRV</u>	<u>SRV</u>	<u>VI</u>	<u>(ft)</u>	<u>(ft)</u>	<u>REMARKS</u>
1A/10/6-10	9092141	VILE	nannyberry	May	07	07		5	5	100	3	0.5	1.6	2,3,5 powdery mildew
			<i>Viburnum lentago</i>			08			5	100	3	1.2	1.7	
			Schumacher's Nursery, Heron Lake, MN			09			5	100	4	0.8	1.8	powdery mildew on all
						11			5	100		1.9	2.8	powdery mildew on all
						13			5	100	3	2.7	3.2	
						15								
IA/10/11-15	Sun Harvest Germplasm 9083247	COAM3	American hazelnut	May	07	07		5	3	60	4	0.4	1.8	
			<i>Corylus americana</i>			08			5	100	4	0.7	1.6	all browsed
			USDA, NRCS, PMC, Elsberry, MO			09			5	100	5	2.1	1.7	
						11			5	100	3	4.2	3.4	
						13			5	100	4	4.2	3.8	
IA/10/16-20	Midwest Premium Germplasm 9083241	PRAM	American plum	May	07	07		5	3	60	4	0.4	1.3	
			<i>Prunus americana</i>			08			3	60	6	0.3	1.0	
			USDA, NRCS, PMC, Elsberry, MO			09			4	80	5	0.8	1.1	deer browse on all
						11			4	80	5	2.4	2.4	
						13			4	80	4	2.0	2.2	narrow leaves, sparse foliage
IA/11/1-5	9082895	PRAR3	apricot	May	07	07		5	3	60	4	0.9	1.0	
			<i>Prunus armeniaca</i>			08			3	60	4	1.8	2.6	
			Rod O'Clair, Jamestown, ND			09			3	60	5	3.8	4.5	
			USDA, NRCS, PMC, Bismarck, ND			11			3	60		7.3	10.0	
						13			3	60	1	9.8	10.8	
IA/11/6-10	9091969	CAFR80	Russian peashrub	May	07	07		5	5	100	4	0.3	1.4	
			<i>Caragana frutex</i>			08			5	100	5	0.4	1.4	
			Big Sioux Nursery, Watertown, SD			09			5	100	4	0.6	1.5	
						11			4	80	6	0.7	1.6	
						13			4	80	7	0.6	1.2	

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IA/11/11-15	9091964	RHTR	skunkbush sumac	May	07	07		5	5	100	2	0.9	1.8	
			<i>Rhus trilobata</i>			08			5	100	4	2.7	2.0	chlorosis
			Cave Hills, SD			09			5	100	4	3.8	2.4	
			USDA, NRCS, PMC, Bismarck, ND			11			5	100	3	3.8	2.6	
						13			5	100	4	4.1	2.5	50-75% leaves dropped
IA/11/16-20	9091967	PRPE2	pin cherry	8-May	08	08		5	5	100	4	0.4	1.7	all browsed
			<i>Prunus pensylvanica</i>			09			4	80	4	0.8	1.6	
			Big Sioux Nursery, Watertown, SD			10			4	80	5	1.6	2.1	
						12			4	80	5	1.4	1.3	
						14			1	20	8	0.4	0.8	most appear dead
1A/12/1-5	'Cinderella' 9094420	LOED	honeyberry (haskaps)	16-May	13	13	POTD	5	5	100	7	1.0	1.0	50% dead leaves, need water
			<i>Lonicera edulis</i>			14			5	100	5	1.5	1.5	
			Jeffries Nursery, Portage LaPrairie, MB			15			5	100	3	1.4	1.4	
1A/12/6-10	'Berry Blue' 9094419	LOED	honeyberry (haskaps)	16-May	13	13	POTD	5	5	100	7	1.2	1.6	30% dead leaves, need water
			<i>Lonicera edulis</i>			14			5	100	5	1.5	1.5	some deer browse on all
			Jeffries Nursery, Portage LaPrairie, MB			15			5	100	3	1.4	1.7	
1A/12/11-15	9094418	PLBR	American hazel	16-May	13	13	PLBR	5	5	100	6	0.4	0.9	
			<i>Corylus americana</i>			14			5	100	7	0.8	0.8	all browsed
			Big Sioux Nursery, Watertown, SD			15			5	100	1	1.0	1.2	some browse on all
II/1/1-5	'Roselow' PI-477986	MASA9	Sargent crabapple	1-May	96	96	PLBR	5	4	80	4	1.4	2.0	browse on 4
			<i>Malus sargentii</i>			97			4	80	2	2.0	2.3	
			USDA, NRCS, PMC, East Lansing, MI			98			4	80	3	3.5	3.4	
			Lincoln-Oakes Nursery, Bismarck, ND			00			4	80	3	6.7	5.5	
						02			4	80	3	7.1	6.9	no leaf diseases
						05			4	80	3	6.0	8.1	
						10			4	80	4	14.3	7.9	
						15			4	80	4	13.0	9.2	

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II/1/6-10	'Midwest' 478000	MAMA37	Manchurian crabapple <i>Malus mandshurica</i> USDA, NRCS, PMC, Bismarck, ND Lincoln-Oakes Nursery, Bismarck, ND	1-May	96	96	PLBR	5	5	100	3	1.6	2.5	browse on 1,3
						97			5	100	2	3.4	3.6	
						98			5	100	1	5.0	6.4	
						00			5	100	3	7.8	9.1	
						02			5	100	2	9.0	10.2	
						05			5	100	3	9.8	13.3	
						10			5	100	5	12.8	11.5	
						15			5	100	4	14.8	12.5	
II/2/1-5	9030971	ACGI	amur maple <i>Acer ginnala</i> Lincoln-Oakes Nursery, Bismarck, ND	1-May	96	96	PLBR	5	5	100	3	1.1	1.8	
						97			5	100	2	1.6	1.9	
						98			5	100	2	3.1	4.1	
						00			5	100	4	7.9	7.0	
						02			5	100	3	9.2	8.1	
						05			5	100	3	10.0	13.9	
						10			5	100	4	13.4	9.9	
						15			5	100	4	14.6	12.6	
II/1/6-10	'Schubert' 9012608	PRVI	chokecherry <i>Prunus virginiana</i> Lincoln-Oakes Nursery, Bismarck, ND	1-May	96	96	PLBR	5	5	100	4	0.7	2.1	
						97			5	100	1	1.5	2.6	
						98			5	100	1	2.4	3.5	
						00			5	100	2	5.8	6.5	
						02			5	100	2	8.1	9.0	
						05			5	100	2	10.0	11.8	
						10			5	100	3	10.4	13.0	
						15			5	100	5	9.5	9.2	pruned back, basal regrowth
II/3/1-5	9047209	PRVI	chokecherry <i>Prunus virginiana</i> Lincoln-Oakes Nursery, Bismarck, ND	1-May	96	96	PLBR	5	5	100	3	0.7	2.0	
						97			5	100	3	1.5	3.5	insect damage on 4
						98			5	100	1	2.5	5.3	some suckers on 3,4
						00			5	100	4	6.8	8.1	
						02			5	100	3	9.1	10.8	
						05			5	100	3	12.0	13.2	yellow fruit on 1
						10			5	100	4	13.8	14.1	fungus on 3
						15			5	100	4	12.5	10.1	basal regrowth on 4

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											COV <u>VI</u>	HT <u>(ft)</u>					
II/3/6-10	ND-1733 9006060	PRAM	plum	1-May	96	96	PLBR	5	5	100	3	1.3	2.4	insect, disease damage			
			<i>Prunus americana</i>								97	5	100		3	2.8	3.4
			Lincoln-Oakes Nursery, Bismarck, ND								98	5	100		3	4.0	6.3
											00	5	100		3	10.7	9.0
											02	5	100		2	11.4	10.5
											05	5	100		4	9.9	11.9
											10	5	100		5	10.8	9.9
	15	5	100	5	7.2	9.5											
II/4/1-5	Prairie Harvest Germplasm 9034956	CEOC	hackberry	7-May	09	09		5	5	100	3	0.4	1.1				
			<i>Celtis occidentalis</i>								10	5	100		5	0.5	0.7
			Polk County, MN								11	5	100		6	0.5	0.6
			USDA, NRCS, PMC, Bismarck, ND								13	5	100		8	0.3	0.4
											15	5	100		7	0.6	0.7
II/4/6-10	'Oahe'	CEOC	hackberry	7-May	09	09		5	5	100	3	0.5	1.7				
			<i>Celtis occidentalis</i>								10	5	100		5	0.4	1.1
			Big Sioux Nursery, Watertown, SD								11	5	100		7	0.5	0.6
											13	5	100		8	0.6	1.6
											15	4	80		6	0.8	1.0
II/5/1-5	'McDermand' 478004	PYUS	Ussurian pear	1-May	96	96	PLBR	5	5	100	3	1.0	2.5	browse on 1 leaf damage			
			<i>Pyrus ussuriensis</i>								97	5	100		3	2.4	3.3
			NRCS, PMC, Bismarck, ND								98	5	100		2	2.9	5.2
			Lincoln-Oakes Nursery, Bismarck, ND								00	5	100		3	7.3	9.4
											02	5	100		3	10.0	11.8
											05	5	100		4	12.0	13.6
											10	5	100		3	16.8	16.0
											15	5	100		4	22.4	17.0

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II/5/6-10	9076733	VILE	nannyberry	1-May	96	96	PLBR	5	5	100	5	0.3	0.7	
			<i>Viburnum lentago</i>			97			5	100	5	0.8	1.3	
			Turtle Mountains, ND			98			5	100	3	1.3	2.9	mildew on leaves
			Lincoln-Oakes Nursery, Bismarck, ND			00			5	100	4	3.9	4.7	
						02			5	100	5	4.4	5.4	
						05			5	100	4	3.8	5.8	red color on 3-5
						10			5	100	7	3.2	4.9	
						15			5	100	5	3.2	4.8	
II/6/1-5	9091968	GYDI	Kentucky coffeetree	4-May	11	11	PLBR	5	5	100	4	0.9	1.6	
			<i>Gymnocladus dioicus</i>			12			5	100	3		1.7	
			Big Sioux Nursery, Watertown, SD			13			4	80	6		1.3	very yellow leaves
						15			1	20	3		1.0	
II/6/6-10	9069121	PRPA5	mayday	1-May	96	96	PLBR	5	5	100	5	0.4	0.6	browse on 4,5
			<i>Prunus padus</i>			97			5	100	4	1.1	1.7	
			Norway			98			5	100	3	1.6	3.2	insect damage on 3,4
			USDA, NRCS, PMC, Bismarck, ND			00			5	100	3	3.7	6.1	
						02			5	100	3	5.4	9.2	
						05			5	100	4	5.7	10.3	
						10			4	80	6	5.8	7.6	
						15			5	100	5	4.0	4.0	
II/7/1-5	9094406	ULAM	American elm	8-May	12	12	PLBR	5	5	100	6	0.3	1.4	3' shelters and watered all 5/9/12
	'Princeton'		<i>Ulmus americana</i>			13			5	100	4		0.9	
			Schumacher's Nursery, Heron Lake, MN											
II/7/6-10	9094400	PRCE	dwarf cherry	8-May	12	12	PLBR	5	5	100	2	0.3	3.2	3' shelter and watered all 5/9/12
	'Carmine Jewel'		<i>Prunus cerasus</i>			13			5	100	2		3.3	deer eating leaves at tube tops
			Big Sioux Nursery, Watertown, SD			14			5	100	2		3.5	deer browsing above tube tops

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II/8/1-5	9092052	QUBI	swamp white oak <i>Quercus bicolor</i> Lincoln-Oakes Nursery, Bismarck, ND	4-May	06	06	PLBR	5	4	80	3	0.6	1.2	5 chewed off
						07			4	80	3	0.8	1.3	
						08			4	80	4	1.1	1.3	
						11			4	80		2.7	2.1	
						12			4	80	3	2.7	2.3	all hedged by deer
II/8/6-10	9082675	FRMA5	Manchurian ash <i>Fraxinus mandshurica</i> Lincoln-Oakes Nursery, Bismarck, ND	3-May	00	00	PLBR	5	5	100	2	0.8	2.2	
						01			5	100	4	1.2	2.3	
						02			5	100	4	2.0	4.0	
						04			5	100	5	1.9	5.7	
						06			5	100	5	2.6	6.4	
						09			5	100	6	2.2	6.3	
						14			5	100	6	1.9	5.2	
II/9/1-5	9082667	BEPO	gray birch <i>Betula populifera</i> Lawyer Nursery, Plains, MT	3-May	00	00	PLBR	5	5	100	2	1.3	3.6	
						01			5	100		3.7	6.4	
						02			5	100	2	5.4	9.8	
						04			5	100	3	8.1	14.5	
						06			5	100	3	9.6	16.4	drought stress
						09			5	100	3	10.6	19.0	
						14			5	100	2	15.0	24.3	
II/9/6-10	9092051	CASP8	northern catalpa <i>Catalpa speciosa</i> Big Sioux Nursery, Watertown, SD	4-May	06	06	PLBR	5	5	100	3	0.6	0.8	
						07			4	80	3	0.8	1.0	
						08			4	80	4	4.0	1.6	
						10			4	80	3	2.0	2.8	
						12			4	80	3	2.6	3.4	yellow leaves
						15			5	100	6	1.4	2.6	1 birch comp; 4 maple close by

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											COV <u>VI</u>	PLT <u>(ft)</u>		
III/1/1-5	9076739	QUERC	oak hybrid <i>Quercus</i> E.T. Jacobson, MN USDA, NRCS, PMC, Bismarck, ND	30-Apr	98	98	CONT(P)	5	5	100	4	0.6	1.7	
											6	1.2	2.4	browse on 4
											3	2.4	3.9	
											5	3.9	6.2	
											6	4.5	7.3	acorns on 3
											4	6.6	8.3	
3	8.8	10.5	2,4,5 basal sprouts, 5 hvy browse											
III/1/6-10	9069177	QUMA2	bur oak <i>Quercus macrocarpa</i> E.T. Jacobson, MN USDA, NRCS, PMC, Bismarck, ND	30-Apr	98	98	CONT(P)	5	5	100	6	0.5	1.0	browse on 3
											6	0.8	1.2	browse on 1,4
											5	1.4	1.7	
											5	3.9	4.8	
											5	3.2	5.4	stem gall on 5
											5	4.7	6.6	deer browse 1; anthracnose 5
5	8.0	10.4												
III/2/1-5	'Oahe' 476982	CEOC	hackberry <i>Celtis occidentalis</i> NRCS, PMC, Bismarck, ND Lincoln-Oakes Nursery, Bismarck, ND	1-May	96	96	PLBR	5	5	100	5	1.0	2.7	
											5	1.7	2.7	4 browsed
											5	2.1	3.7	
											4	6.6	8.1	
											4	7.9	11.7	
											4	7.6	13.4	
5	9.1	15.1												
III/2/6-10	9019578	CEOC	hackberry <i>Celtis occidentalis</i> Lincoln-Oakes Nursery, Bismarck, ND	1-May	96	96	PLBR	5	5	100	6	0.5	1.7	browse on 2,3,5
											6	1.7	2.8	browse on 3,4,5
											4	2.5	3.9	
											4	6.2	7.1	
											4	10.3	13.2	leaf gall
											4	10.4	14.7	
4	11.5	21.0												
5	13.5	18.9												

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PLOT <u>LOCATION</u>	ACCESSION <u>NUMBER</u>	PLANT <u>SYMBOL</u>	GENUS/SPECIES <u>ORIGIN/SOURCE</u>	TRANS <u>DATE</u>	YR <u>PLT</u>	YR <u>REC</u>	MATL <u>PLTD</u>	NO <u>PLTS</u>	NO <u>SRV</u>	PCT <u>SRV</u>	CAN PLT		<u>REMARKS</u>		
											<u>VI</u>	<u>COV</u>		<u>HT</u>	
III/3/1-5	'Cardan' 469226	FRPE	green ash <i>Fraxinus pennsylvanica</i> NRCS, PMC, Bismarck, ND Lincoln-Oakes Nursery, Bismarck, ND	1-May	96	96	PLBR	5	4	80	5	0.4	1.6		
												3	1.4		2.2
												4	3.0		4.1
												4	7.6		8.1
												4	9.4		12.4
												4	10.2		14.9
												3	9.8		22.6
3	13.5	20.4													
III/3/6-10	9019586	FRPE	green ash <i>Fraxinus pennsylvanica</i> Lincoln-Oakes Nursery, Bismarck, ND	1-May	96	PLBR	5	5	100	3	1.0	2.6	2 browsed		
											3	2.8		3.7	
											3	5.3		6.7	
											3	9.3		11.2	
											3	11.5		14.9	
											3	10.4		17.1	
											3	12.4		18.3	
											3	7.6		27.2	
3	17.2	25.0													
III/4/1-5	9063115	FRPE	green ash <i>Fraxinus pennsylvanica</i> Itasca State Park, MN USDA, NRCS, PMC, Bismarck, ND	1-May	96	CONT(P)	5	5	100	5	0.2	0.9	browse on 1,2,3,5 leaf damage on 2		
											3	1.0		2.0	
											4	2.3		3.9	
											3	6.3		7.5	
											4	9.2		13.8	
											4	9.1		17.1	
											3	14.2		27.0	
											3	12.0		24.4	

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Year of Record: 2015

PLOT	ACCESSION	PLANT	GENUS/SPECIES	TRANS	YR	YR	MATL	NO	NO	PCT	CAN	PLT		
<u>LOCATION</u>	<u>NUMBER</u>	<u>SYMBOL</u>	<u>ORIGIN/SOURCE</u>	<u>DATE</u>	<u>PLT</u>	<u>REC</u>	<u>PLTD</u>	<u>PLTS</u>	<u>SRV</u>	<u>SRV</u>	<u>VI</u>	<u>(ft)</u>	<u>(ft)</u>	<u>REMARKS</u>
III/4/6-10	9063116	FRNI	black ash	1-May	96	96	CONT(P)	5	5	100	5	0.3	1.3	browse on 2
			<i>Fraxinus nigra</i>			97			2	40	7	0.7	1.0	browse on 1
			Itasca State Park, MN			98			2	40	6	1.5	2.3	
			USDA, NRCS, PMC, Bismarck, ND			00			2	40	4	2.4	5.4	
						02			2	40	5	4.2	8.6	
						05			2	40	6	4.1	9.9	leaves yellowing-stress
						10			2	40	6	5.0	9.0	
						15			1	20	8	6.0	10.0	
III/5/1-5	9063127	FRAM2	white ash	1-May	96	96	PLBR	5	5	100	5	0.2	1.4	
			<i>Fraxinus americana</i>			97			5	100	4	1.6	2.3	slight insect damage on 2
			Wisconsin			98			5	100	4	2.1	3.8	
			Lincoln-Oakes Nursery, Bismarck, ND			00			5	100	5	4.5	8.9	
						02			5	100	4	7.6	12.9	
						05			5	100	4	7.3	14.9	
						10			5	100	3	7.2	20.8	
						15			5	100	5	11.5	21.6	
III/5/6-10	9076730	ACSA2	silver maple	1-May	96	96	PLBR	5	5	100	3	1.2	3.1	
			<i>Acer saccharinum</i>			97			5	100	1	3.8	5.2	
			Lincoln-Oakes Nursery, Bismarck, ND			98			5	100	3	8.7	9.5	
						00			5	100	3	14.2	15.7	
						02			5	100	4	13.3	16.9	
						05			5	100	4	12.9	19.0	broke off stump sprout on 2
						10			5	100	4	14.4	19.3	2 very small, few weak leaves
						15			4	80	4	17.1	23.2	
III/6/1-5	Hunter Germplasm 9081843	PIPOS	ponderosa pine	12-May	05	05		5	5	100	2	0.6	1.2	
			<i>Pinus ponderosa</i> var. <i>scopulorum</i>			06			5	100	2	1.2	1.6	
			USDA, ARS, Bridger, MT			07			5	100	2	2.1	2.5	
						09			5	100		4.1	4.6	
						11			5	100	3	6.6	7.3	
						14			3	60	5	10.2	8.8	2,3 dead; 4 very poor

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<u>LOCATION</u>	<u>NUMBER</u>	<u>SYMBOL</u>	<u>ORIGIN/SOURCE</u>	<u>DATE</u>	<u>PLT</u>	<u>REC</u>	<u>PLTD</u>	<u>PLTS</u>	<u>SRV</u>	<u>SRV</u>	<u>VI</u>	<u>(ft)</u>	<u>(ft)</u>	<u>REMARKS</u>
III/6/6-10	9063148	PHAM2	amur corktree	1-May	96	96	CONT(P)	5	5	100	5	0.4	1.2	browse on 5
			<i>Phellodendron amurense</i>			97			5	100	3	2.8	2.6	
			Clay County, MN			98			5	100	3	4.9	4.8	
			USDA, NRCS, PMC, Bismarck, ND			00			5	100	3	8.5	6.8	
						02			5	100	3	10.4	8.7	
						05			5	100	4	10.5	9.9	tractor damage on trunk of 5
						10			5	100	3	11.8	11.1	
						15			5	100	5	13.2	10.8	
III/7/1-5	9069178	PIRE	red pine	29-Apr	99	99		5	5	100	4	1.0	1.3	
			<i>Pinus resinosa</i>			00			5	100	4	1.0	1.3	
			USDA, NRCS, PMC, Bismarck, ND			01			5	100	3	2.9	3.0	
						03			5	100	3	4.7	5.4	
						05			5	100	2	6.2	8.5	
						08			5	100	3	3.0	3.5	
						13			5	100	1	9.0	17.6	
III/7/6-10	9076731	QUMA2	bur oak	1-May	96	96	PLBR	5	5	100	5	0.2	1.3	browse on 1,2
			<i>Quercus macrocarpa</i>			97			4	80	6	0.8	1.3	
			Black Hills, SD			98			4	80	5	1.6	2.1	mod-severe rabbit damage
						00			4	80	4	2.6	4.3	
						02			4	80	5	4.3	6.5	leaf spot
						05			4	80	5	4.8	6.9	acorns, leaf spot on all, dieback 5
						10			4	80	5	6.6	9.1	
						15			4	80	6	6.8	9.2	
III/8/1-5	9076735	AEGL	Ohio buckeye	1-May	96	96	PLBR	5	5	100	4	0.2	0.6	
			<i>Aesculus glabra</i>			97			5	100	8	0.7	0.6	
			Lincoln-Oakes Nursery, Bismarck, ND			98			5	100	6	0.7	1.0	
						00			5	100	4	1.6	1.5	
						02			5	100	6	1.9	1.8	
						05			5	100	6	1.0	1.4	leaf burns/dieback on all
						10			3	60	8	1.5	1.2	
						15			1	20	9	2.5	1.0	

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<u>LOCATION</u>	<u>NUMBER</u>	<u>SYMBOL</u>	<u>ORIGIN/SOURCE</u>	<u>DATE</u>	<u>PLT</u>	<u>REC</u>	<u>PLTD</u>	<u>PLTS</u>	<u>SRV</u>	<u>SRV</u>	<u>VI</u>	<u>COV</u>	<u>HT</u>	<u>REMARKS</u>
III/8/6-10	9076737	PRSE2	black cherry	1-May	96	96	PLBR	5	4	80	3	1.0	1.9	
			<i>Prunus serotina</i>			97			4	80	4	1.9	2.2	
			Apple Valley FEP			98			4	80	3	4.3	5.0	
			Lincoln-Oakes Nursery, Bismarck, ND			00			4	80	3	8.7	10.1	
						02			4	80	3	11.1	12.9	
						05			4	80	4	10.8	15.1	
						10			4	80	3	10.0	17.3	
						15			4	80	4	11.9	17.8	
III/9/1-5	9082609	PICEA	Meyer's spruce	16-May	01	01	CONT	5	3	60	5	0.8	0.7	
			<i>Picea meyeri</i>			02			3	60		1.0	0.9	
			Itasca Greenhouse, Cohasset, MN			03			3	60		1.2	1.1	
						05			3	60	3	1.6	1.4	
						07			3	60	5	2.2	1.6	
						10			3	60	1	3.0	2.0	4,5 replaced 6/15/11
						15			5	100	5	3.3	2.6	
III/9/6-10	9094335	TICO	littleleaf linden	4-May	10	10	PLBR	5	5	100	8	0.5	0.9	
			<i>Tilia cordata</i>			11			5	100	8	0.5	0.8	
			Big Sioux Nursery, Watertown, SD			12			5	100	6	0.4	0.4	all chewed off by deer; basal growth
III/9/6-10	9094416	PLOC	sycamore	16-May	13	13	PLBR	5	5	100	2		2.2	
			<i>Platanus occidentalis</i>			14			5	100	5		2.2	
			Lincoln-Oakes Nursery, Bismarck, ND			15			5	100	6		2.0	
III/10/1-5	9082885	POTR5	aspen	20-May	04	04	PLBR	5	3	60	4	0.7	2.1	
			<i>Populus tremuloides</i>			05			4	80	5	1.1	1.9	
			NDFS Nursery, Towner, ND			06			5	100		1.4	2.2	
						08			5	100	4	1.8	2.2	
						10			5	100	4	2.4	1.6	
						13			2	40	6	1.7	1.2	

Project No.: 38I347K Field Evaluation of Woody Plant Materials, Becker, Minnesota
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<u>LOCATION</u>	<u>NUMBER</u>	<u>SYMBOL</u>	<u>ORIGIN/SOURCE</u>	<u>DATE</u>	<u>PLT</u>	<u>REC</u>	<u>PLTD</u>	<u>PLTS</u>	<u>SRV</u>	<u>SRV</u>	<u>VI</u>	<u>(ft)</u>	<u>(ft)</u>	<u>REMARKS</u>
III/10/6-10	9082633	FRNI	black ash <i>Fraxinus nigra</i> Lawyer Nursery, Plains, MT	29-Apr	99	99		5	5	100	6	0.3	0.7	browse on 4
						00			4	80	4	0.9	1.0	
						01			4	80	4	1.0	2.1	
						03			4	80	4	1.1	3.2	
						05			4	80	5	1.7	3.5	
						08			4	80	4	1.1	3.2	
						13			4	80	8	0.5	0.9	weak basal resprouts, dead tops gone??, replaced with "Prairie Expedition"
						15								
III/10/6-10	9094446	ULAM	American elm <i>Ulmus americana</i> NDSU, Fargo, ND Big Sioux Nursery, Watertown, SD	13-May	15	15	PLBR	5	5	100	2		6.5	
III/11/1-5	ND-686 478008	SYPE	Pekin lilac <i>Syringa pekinensis</i> Lincoln-Oakes Nursery, Bismarck, ND	1-May	96	96	PLBR	5	5	100	3	2.3	2.9	
						97			4	80	5	2.4	2.3	winter damage
						98			4	80	3	4.6	3.7	
						00			4	80	4	6.9	5.9	
						02			4	80		8.1	6.9	
						05			4	80	6	7.0	6.9	
						10			4	80	4	7.8	6.9	fungus on 3
						15			4	80	5	6.0	5.5	
III/11/6-10	9094336	ACFR	Freeman maple <i>Acer X freemanii</i> Big Sioux Nursery, Watertown, SD	4-May	10	10	PLBR	5	3	60	8	0.5	1.2	
						11			4	80	5	0.3	1.4	2 replants (5/4/11)
						12			3	60	7	0.3	0.3	deer eating leaves to ground
						14			1	20	8	0.5	0.5	
						15								gone??, replaced with Doug fir?
III/11/6-10	9094434	PSMEG	Douglas fir <i>Pseudotsuga menziesii</i> var. <i>glauca</i> USDA, ARS, Mandan, ND ND Forest Service Nursery, Towner, ND	13-May	15	15	CONT	5	5	100	4		0.8	

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											COV <u>VI</u>	HT <u>(ft)</u>					
III/12/1-5	9094334	TIAM	American linden	4-May	10	10	PLBR	5	5	100	5	0.7	1.5				
			<i>Tilia americana</i>								11	5	100	8	0.6	0.7	dieback on all
			Big Sioux Nursery, Watertown, SD								12	5	100	4	0.6	0.5	deer eaten all veg, basal resprout
III/12/6-10	9094417	FRMA	Manchurian ash	16-May	13	13	PLBR	5	5	100	2	3.4	tubes				
			<i>Fraxinus mandshurica</i>								14	5	100	3	5.1		
			China								15	5	100	3	5.8		
III/13/1-5	9082639	QUEL	northern pin oak	29-Apr	99	99	PLBR	5	2	40	8	0.3	0.5				
			<i>Quercus ellipsoidalis</i>								00	2	40	6	1.1	0.9	
			Lincoln-Oakes Nursery, Bismarck, ND								01	2	40	6	1.0	2.5	
											03	2	40	4	2.4	4.1	
											05	2	40	?	2.3	5.6	leaf galls, army worms/galls
											08	2	40	4	4.3	7.9	
III/14/1-5	9082739	OSVI	ironwood	May	07	07		5	2	40	4	0.9	2.1				
			<i>Ostrya virginiana</i>								08	5	100	6	0.4	1.0	deer browse, chlorosis on 1
			Sertoma Park, Bismarck, ND								09	5	100	6	0.7	1.1	
			USDA, NRCS, PMC, Bismarck, ND								11	5	100	6	1.6	1.3	
											13	5	100	2	3.5	3 ft tubes installed in 2012	
III/14/6-10	9092231 14070	PICOL	lodgepole pine	7-May	09	09		5	5	100	4	0.5	1.1	needle burn on 4			
			<i>Pinus contorta</i> var. <i>latifolia</i>								10	5	100	1	0.9	1.5	
			Colorado (Routt National Forest, Salida)								11	5	100	2	1.8	2.3	
											13	5	100	2	2.8	4.3	double leader 5
											15	5	100	4	5.0	6.5	
IV/1/1-5	9082610	LASI	Siberian larch	30-Apr	98	98	CONT(S)	5	5	100	4	0.5	1.0				
			<i>Larix sibirica</i>								99	5	100	6	0.8	1.5	
			NDFS Nursery, Towner, ND								00	5	100	5	1.3	2.1	
											02	5	100	4	3.1	5.0	
											04	5	100	5	3.9	6.9	
											07	5	100	3	6.5	11.2	
	12	5	100	1	10.3	16.9											

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											<u>VI</u>	<u>COV</u>		<u>HT</u>
IV/1/6-10	9082611	LASI	Siberian larch <i>Larix sibirica</i> NDFS Nursery, Towner, ND	30-Apr 98	98	CONT(S)	5	5	100	3	0.5	1.2		
											6	0.7	1.4	
											5	1.0	1.6	
											5	1.8	2.7	
											5	2.4	3.7	
											5	3.9	6.6	
											3	6.4	10.9	
IV/2/1-5	9069168	LASI	Siberian larch <i>Larix sibirica</i> Russia USDA, NRCS, PMC, Bismarck, ND	30-Apr 98	98	CONT(P)	5	1	20	4	0.3	1.3		
											6	0.7	1.4	
											5	1.1	1.9	
											4	2.6	4.0	
											4	3.2	6.6	
											4	8.0	11.9	
											2	11.1	18.4	not as dark green as 9082610
IV/2/6-10	9069162	LARIX	Dahurian larch <i>Larix olgensis</i> China USDA, NRCS, PMC, Bismarck, ND	30-Apr 98	98	CONT(P)	5	3	60	3	0.9	1.7		
											4	2.1	2.2	
											4	2.9	3.6	
											3	5.4	5.9	
											3	7.0	8.1	chlorotic, no leader on 4
											3	9.6	11.0	3 top dieback, deer damage 4
											3	13.8	19.5	thinner foliage than others
IV/3/1-5	9069163	LARIX	Dahurian larch <i>Larix olgensis</i> China USDA, NRCS, PMC, Bismarck, ND	30-Apr 98	98	CONT(P)	5	0	0	5	1.0	2.0		
											5	1.3	2.0	
											5	2.6	3.8	
											6	4.2	6.8	
											3	9.2	13.8	
											3	14.2	25.2	medium dense foliage
											2	14.2	25.2	

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<u>LOCATION</u>	<u>NUMBER</u>	<u>SYMBOL</u>	<u>ORIGIN/SOURCE</u>	<u>DATE</u>	<u>PLT</u>	<u>REC</u>	<u>PLTD</u>	<u>PLTS</u>	<u>SRV</u>	<u>SRV</u>	<u>VI</u>	<u>(ft)</u>	<u>(ft)</u>	<u>REMARKS</u>
IV/3/6-10	9069164	PISYM	Mongolian Scots pine	30-Apr	98		CONT(P)	5	2	40	4	0.6	1.0	
			<i>Pinus sylvestris</i> var. <i>mongolica</i>		99				5	100	4	1.3	1.8	
			China		00				5	100	3	2.4	2.7	
			USDA, NRCS, PMC, Bismarck, ND		02				5	100	3	5.2	6.2	
					04				5	100	3	7.9	10.9	
					07				5	100	3	14.5	16.3	
					12				4	80	1	20.8	23.1	

OFF-CENTER EVALUATION PLANTING: TECHNICAL REPORT 2015

Study NDPMC-T-0201-CP

Study Title: Eastern South Dakota Soil & Water Research Farm, Brookings, South Dakota

Purpose: The purpose of the farm is to find solutions to national and regional concerns related to soil and water conservation and the efficiency and sustainability of agricultural production. Research and technology transfer activities on the farm are conducted by a partnership including: USDA Agricultural Research Service, USDA Natural Resources Conservation Service, South Dakota State University, South Dakota Agricultural Experiment Station, the Brookings County Conservation District, as well as 14 other County Conservation Districts from eastern South Dakota.

History: The Eastern South Dakota Soil and Water Research Farm, Inc. is a non-profit organization consisting of a Board of Directors elected from each of 15 Soil and Water Conservation Districts in eastern South Dakota. Brookings, Codington, Clark, Day, Deuel, Hamlin, Kingsbury, Lake, Lincoln, Marshall, McCook, Minnehaha, Minor, Moody, and Turner Soil and Water Conservation Districts are represented on the Board of Directors. The purpose of the corporation is to promote research of efficient farm production practices that conserve soil and water resources.

The Brookings Research Farm consists of 80 acres located approximately one mile north of the campus of South Dakota State University. The soils on this farm are characteristic of those found in northeastern South Dakota and west central Minnesota and are similar to soils common to the northern Corn Belt. A new building was constructed in 2006. Some trees were removed during the construction. Soils at this site are classified as a Vienna-Brookings Complex silt loam with a 0-2% slope and in conservation tree and shrub groups 1 and 3.

Methods and Materials

Assembly: The first tree planting trials were started in 2000 when 16 species were planted. An additional six species were planted in 2001. These trials were used to showcase different types of tree species and various weed control methods.

In 2004, the PMC staff became involved in planting additional tree and shrub accessions to be evaluated on an annual basis. There are now 51 accessions of 37 different species under evaluation at this site. Refer to Table BR-2 for entries planted from 2004-2015.

For the 2015 weather summary at Brookings, see Table BR-1.

Planting Plan: The layout of the evaluation plots is shown in Figure BR-1 and Figure BR-2. The tree and shrub plots are in the northeastern area of the Research Farm.

Site Preparation: Strips to be planted are chemically killed with glyphosate, and then tree fabric is laid down.

Planting Method: All trees and shrubs are planted by hand, except those moved with a tree spade in 2008.

Weed/Pest/Plot Management: Between-row grass is clipped as needed during the growing season to control weeds and reduce fire danger. In-row fabric controls weeds well. Weeds do grow in the open spaces where the trees are planted. Additional maintenance and pruning is done during the fall evaluation.

Evaluations and Measurement: Plant performance data is recorded during the growing season for the first three years. After the third year, data is gathered according to a specific schedule. Records of planting date, survival, vigor, fruit (seed) amount, canopy width, plant height, winter injury, disease symptoms, and insect damage are recorded. Select data appears in this report. Annual summary reports have been prepared since 2006 and are available on request. Fifty-one accessions of 37 different species are currently under evaluation at this site.

2015 New Accessions Added:

- 9094434, Douglas fir (*Pseudotsuga menziesii*) from USDA/ARS, Mandan, North Dakota, and Towner Nursery, Towner, North Dakota; Row 7/2/1-5.
- 9094446, Prairie Expedition elm (*Ulmus americana*) 'Lewis & Clark' from Big Sioux Nursery, Watertown, South Dakota; Row 7/3/1-5.

Replaced the following:

Row 7/1, plants 1 and 5 with 9094443 composite of lodgepole pine (*Pinus contorta*) from the Bismarck PMC.

Current Evaluation:

On August 4, 2015, PM staff collected information on 27 entries.

- Crown spread and plant height were recorded along with observational notes relative to disease and insect damage, drought and cold tolerance, fruit production, survival, vigor, and predator damage.
- Considerable pruning was done on the white poplar to open the canopy for adjoining tree and shrub entries. Some additional pruning and other maintenance was also done. This species should be removed in the future.
- Most species exhibited good growth and survival. Species recently added in 2012 through 2015 are looking good, with the exception of the lodgepole pine. The pine are barely surviving and may have to be replaced with another species in the future.

Plant Performance: Records of planting date, survival, vigor, canopy width, height, cold hardiness, animal damage, insect damage, disease symptoms, and unusual or outstanding features have been maintained since 1978 and are listed in Table BR-2.

Maintenance is excellent. Table BR-2 provides detailed evaluation information on each tree or shrub in this planting. The following tables indicate individual species and varieties that are best adapted to the environment in this location:

Accessions currently performing well	
9082889 mugo pine	9082892 white poplar
9012606 creeping juniper	9091968 Kentucky coffeetree
9082887 seaberry	9078631 Rocky Mountain juniper
9082888 American hazel	9081843 ponderosa pine
9082891 common ninebark	9091971 black chokeberry
9082687 American black currant	9019593 common juniper
9082738 grey dogwood	9094281 Am. highbush cranberry
9091976 arrowwood viburnum	9047203 'Prairie Red' hybrid plum
9091971 black chokeberry	9092141 nannyberry
9008183 common chokecherry	9094333 common elderberry
323597 'McKenzie' black chokeberry	9094355 roughleaf dogwood
Recently planted accessions currently performing well	
9094356 Meyer spruce	9076737 black cherry
9094400 'Carmine Jewel' dwarf cherry	9094406 'Princeton' American elm
9094336 Freeman maple	9094417 Manchurian ash
9094416 sycamore	9094418 American hazel
9051508 'Catskill' sand cherry	9094442 gray birch

Figure BR-1. 2013 aerial photo at Brookings, South Dakota Off-Center Evaluation Plots



Figure BR-2. USDA-NRCS, Bismarck Plant Materials Center Tree and Shrub Evaluation Plots, Eastern South Dakota Soil and Water Research Farm, Brookings, SD

Brookings OCEP Plot Map											
Row	1	2	3	4	5	6	7	8	9	10	11
S 1	Mugo pine (9082889)	Common ninebark (9082891)	Wayfaring bush (9082642)	Seaberry (9082887)	American hazelnut (9082888)	American currant (9082687)	Missouri gooseberry (9082746)	Gray dogwood (9082890)	Gray dogwood (9082738)	Roundleaf hawthorn (9076686)	Pin cherry (9091967)
S 2	Arrowwood viburnum (9091976)	Winterberry (9082711)	Shadblow serviceberry (9091975)	Chokeberry (9091971)	Chokecherry (9008183)	Russian peashrub (9091969)	Common juniper (9019593)	'Silverscape' olive hybrid (9092054)	Staghorn sumac (9092053)	Ironwood (9082739)	Skunkbush sumac (9091964)
S 3	Roughleaf dogwood (9094355)	horizontal juniper (9012606)	highbush cranberry (9094281)	'McKenzie' black chokeberry			'Prairie Red' plum	Nannyberry (9092141)	Elderberry (9094333)	Korean mountain ash (9092140)	
S 4	Meyer spruce (9094356)	Black cherry (9076737)		'Carmine Jewel' cherry (9094400)		Pie cherry (9092162)		Princeton elm (9094406)		'Berry Blue' haskap (9094419)	
T 5	Freeman maple (9094336)	Littleleaf linden (9094335)		American linden (9094334)		White poplar (9082892)		Kentucky coffeetree (9091968)		'Cinderella' haskap (9094420)	
6	Manchurian Ash (9094417)	Sycamore (90944176)		American Hazel (9094418)		'Catskill' Sand cherry 9051508	Swamp white oak 9094441	Gray birch 9094442			
7	Lodgepole pine (9092231 & 9094433)	Douglas fir (9094434)		'Prairie Expedition' American elm (9094417)							
8											
T 9	Juniper (Bridger-Select)		Ponderosa pine (Hunter)								
SWCD 4	'Prairie Harvest' hackberry	'Oahe' hackberry	hackberry (9094282)								

updated 6/2015

Table No. BR-1: 2015 Weather Summary - Official Station - Brookings, South Dakota					
Month	Mean Temperature		Precipitation (inches)		
	(degrees Fahrenheit)		Actual		Deviation from Normal
	2015	Normal*	2015**	Normal*	2015
January	18.2	12.9	0.45	0.35	0.10
February	10.5	17.9	0.36	0.38	-0.02
March	32.5	29.9	0.32	1.22	-0.90
April	46.6	43.8	0.30	2.18	-1.88
May	55.4	56.0	4.69	2.97	1.72
June	66.8	65.7	2.30	4.30	-2.00
July	70.5	70.3	3.96	3.24	0.72
August	66.8	68.1	6.96	3.06	3.90
September	65.2	58.8	1.72	3.19	-1.47
October	49.8	45.6	1.16	2.05	-0.89
November	38.0	30.6	1.32	0.90	0.42
December	23.7	16.7	M	0.42	n/a
Annual	45.3	43.0	23.54**	24.24	n/a
* National Climate Data Center 1981-2010 Monthly Normals					
** Missing data					
		<u>2015</u>			
	Last Frost (28 degrees)	23-Apr			
	First Frost (28 degrees)	16-Oct			
	Frost Free Period	175 days			

Key to Table BR-2. 38I347K Field Evaluation of Woody Plant Materials – Brookings, South Dakota

PLOT LOCATION = plot location of the plant material within the evaluation

ACCESSION NUMBER = any accession number, PI number or cultivar name assigned to the plant material

PLANT SYMBOL = plant symbol of the genus and species (asterisk indicates the symbol is not official)

GENUS/SPECIES = common name and scientific name of the plant material

ORIGIN/SOURCE = origin and/or source of the plant material

TRANS DATE = month and day the plant material was transplanted at the evaluation site

YR PLT = year the plant materials were transplanted at the evaluation site

YR REC = year of record

MATL PLTD = type of material planted, PLBR = bareroot, CONT = containerized

NO PLTS = number of plants planted in the plot

NO SRV = number of plants surviving

PCT SRV = percent of plants surviving

VI = plant vigor (1=excellent, 3=good, 5=fair, 7=poor, 9=very poor)

CAN COV (ft) = canopy cover measured in feet

PLT HT (ft) = plant height measured in feet

Table BR-2.

Study No.: NDPMC-T-0201-CP, Field Evaluation of Woody Plant Materials, Brookings, SD

Year of Record: 2015

PLOT	ACCESSION	PLANT	GENUS/SPECIES	TRANS	YR	YR	MATL	NO	NO	PCT	CAN		PLT	REMARKS
											COV	HT		
<u>LOCATION</u>	<u>NUMBER</u>	<u>SYMBOL</u>	<u>ORIGIN/SOURCE</u>	<u>DATE</u>	<u>PLT</u>	<u>REC</u>	<u>PLTD</u>	<u>PLTS</u>	<u>SRV</u>	<u>SRV</u>	<u>VI</u>	<u>(ft)</u>	<u>(ft)</u>	
S1-1	9082889	PIMU80	mugo pine <i>Pinus mugo</i> Big Sioux Nursery, Watertown, SD	18-May	04	PLBR	5	4	80	5	0.9	1.1		
									5	4	1.0	0.7	replant 3	
									5	3	1.4	0.8	1 open form	
									5	3	2.5	2.1		
									5	3	4.4	3.5		
S1-2	9082891	PHOP	common ninebank <i>Physocarpus opulifolius</i> Big Sioux Nursery, Watertown, SD	18-May	04	PLBR	5	6	100	2	1.4	1.9		
									100	2	3.7	3.5		
									100	3	5.0	5.0	1 blight on leaves, 4 good seed	
									100	3	7.5	5.9	light mildew, spot	
									100	2	8.8	6.8		
S1-3	9082642	VILA	wayfaring bush <i>Viburnum lantana</i> Lincoln-Oakes Nursery, Bismarck, ND	18-May	04	PLBR	5	5	100	3	0.7	1.2		
									100	3	1.3	1.7	leaf burn on all	
									100	3	2.0	2.6		
									100	4	3.4	4.3	highly variable	
									100	5	4.8	5.2	red leaves 2	
S1-4	9082887	HIRH80	seaberry <i>Hippophae rhamnoides</i> Lincoln-Oakes Nursery, Bismarck, ND	18-May	04	PLBR	5	5	100	3	0.9	2.2		
									100	3	1.9	2.9		
									100	3	3.3	4.1		
									100	3	6.4	6.2	1-2 female, 3-5 male	
									100		8.8	7.8	berries 1,2; 3-5 male	
S1-5	9082888	COAM3	American hazelnut <i>Corylus americana</i> Lincoln-Oakes Nursery, Bismarck, ND	18-May	04	PLBR	5	5	100	7	0.3	0.6	1 browsed off	
									100	5	0.6	0.7	leaf burn on all	
									100	3	1.0	1.4		
									100	4	2.0	2.5	highly variable	
									100	4	3.6	3.6		
								5	100	2	4.7	4.6	6-10" tip dieback 4	

Study No.: NDPMC-T-0201-CP, Field Evaluation of Woody Plant Materials, Brookings, SD

Year of Record: 2015

PLOT LOCATION	ACCESSION NUMBER	PLANT SYMBOL	GENUS/SPECIES ORIGIN/SOURCE	TRANS DATE	YR PLT	YR REC	MATL PLTD	NO PLTS	NO SRV	PCT SRV	CAN		PLT HT	REMARKS
											COV	VI		
S1-6	Riverview Germplasm 9082687	RIAM	American black currant	18-May 04	04		PLBR	5	5	100	2	1.2	1.8	
			<i>Ribes americanum</i>		05		5		100	3	4.0	2.6	mildew spot on all	
			northeastern South Dakota		06		5		100	3	5.0	3.2	1,2 blight, leaf drop	
			Bix Sioux Nursery, Watertown, SD		08		5		100	3	6.2	3.8		
					10		5		100	3	5.4	4.6		
				13	5	100	3	5.0	4.5	fungal disease on leaves				
S1-7	9082746	RIMI	Missouri gooseberry	18-May 04	04		PLBR	5	5	100	3	1.8	1.7	
			<i>Ribes missouriense</i>		05		5		100	3	3.1	2.5	red fall color on all	
			Big Sioux Nursery, Watertown, SD		06		5		100	3	3.8	3.3	3-5 some leaf drop, blight	
					08		5		100	4	4.5	3.7	early leaf drop	
					10		5		100	5	4.1	3.6		
				13	5	100	5	3.5	3.0	leaf disease all				
S1-8	9082890	CORA6	gray dogwood	18-May 04	04		PLBR	5	5	100	4	0.8	1.3	3 browsed
			<i>Cornus racemosa</i>		05		5		100	3	1.4	1.9	leaf spot on 5	
			Big Sioux Nursery, Watertown, SD		06		5		100	3	2.2	2.6	1,2,5 leaf spot	
					08		5		100	4	3.8	3.9	highly variable; 4 very leafy	
					10		5		100	3	4.2	4.6		
				13	5	100	4	4.8	5.3					
S1-9	9082738	CORA6	gray dogwood	18-May 04	04		PLBR	5	5	100	2	1.1	2.4	
			<i>Cornus racemosa</i>		05		5		100	3	1.9	2.8	leaf spot on 1 and 5	
			Lincoln-Oakes Nursery, Bismarck, ND		06		5		100	2	3.4	3.8	1 bad leaf spot	
					08		5		100	2	5.0	5.3		
					10		5		100	3	5.2	6.0	leaf spot on all	
				13	5	100	2	5.9	6.5	lots of leaf spot				
S1-10	9076686	CRCH	roundleaf hawthorn	18-May 04	04		PLBR	5	5	100	4	0.4	0.5	heavily browsed
			<i>Crataegus chrysocarpa</i>		05		4		80	4	0.7	1.3	browsed	
			Lincoln-Oakes Nursery, Bismarck, ND		06		5		100	5	1.0	2.0	1 white aphid	
					08		5		100	4	2.3	3.9		
					10		5		100	4	2.8	5.6		
				13	5	100	3	4.6	6.9	reduced width due to browsing				

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Year of Record: 2015

PLOT LOCATION	ACCESSION NUMBER	PLANT SYMBOL	GENUS/SPECIES ORIGIN/SOURCE	TRANS DATE	YR PLT	YR REC	MATL PLTD	NO PLTS	NO SRV	PCT SRV	CAN		PLT HT	REMARKS
											COV	VI		
S1-11	9091967	PRPE2	pin cherry <i>Prunus pensylvanica</i> Big Sioux Nursery, Watertown, SD	10-May	05	05		5	5	100	3	2.9	2.9	5 close spacing
									5	100	3	4.2	4.1	4,5 leaf spot
									5	100	3	4.3	5.0	
									5	100	5	7.8	7.1	deer rub 1,4; 5 close spacing
									3	60	6	5.8	6.5	
S2-1	9091976	VIDE	arrowwood viburnum <i>Viburnum dentatum</i> Lincoln-Oakes Nursery, Bismarck, ND	10-May	05	05		5	100	3	0.9	2.2	1 and 4 has fruit	
								5	100	3	2.2	2.6	clean leaves, no disease	
								5	100	3	3.1	3.3	no fruit	
								5	100	3	4.9	5.0	1 clean leaves, some fruit	
								5	100	3	5.8	5.7		
S2-2	9082711	EUBU6	winterberry <i>Euonymus bungeanus</i> Lincoln-Oakes Nursery, Bismarck, ND	10-May	05	05		5	100	4	0.7	1.2		
								5	100	4	1.1	1.5		
								5	100	4	2.1	2.7		
								5	100	4	4.7	3.9		
								5	100	5	5.1	3.9		
S2-3	9091975	AMLA9	serviceberry <i>Amelanchier lamarckii</i> Lincoln-Oakes Nursery, Bismarck, ND	10-May	05	05		5	100	4	0.9	1.9	leaves chewed on	
								5	100	3	3.0	2.9		
								5	100	2	3.9	3.8		
								5	100	2	6.6	7.1		
								5	100	3	8.2	8.7		
S2-4	9091971	PHME13	black chokeberry <i>Photinia melanocarpa</i> Bailey Nurseries, Inc.	10-May	05	05		5	100	3	1.5	2.1	fruit on all	
								5	100	3	2.2	2.7		
								5	100	2	2.7	3.3		
								5	100	3	4.7	4.6		
								5	100	3	5.5	5.9		
								5	100	3	6.2	6.9		

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Year of Record: 2015

PLOT LOCATION	ACCESSION NUMBER	PLANT SYMBOL	GENUS/SPECIES ORIGIN/SOURCE	TRANS DATE	YR PLT	YR REC	MATL PLTD	NO PLTS	NO SRV	PCT SRV	CAN		PLT HT	REMARKS
											COV	VI		
S2-5	9008183	PRVI	common chokecherry <i>Prunus virginiana</i> Sheridan County, North Dakota Lincoln-Oakes Nursery, Bismarck, ND	10-May 05	05			5	5	100	3	0.7	2.5	
									5	100	3	2.0	4.0	shot hole on all
									5	100	3	2.6	5.4	shot hole on all
									5	100	4	5.1	8.4	
									5	100	3	6.0	10.5	
									5	100	3	7.7	12.8	
S2-6	9091969	CAFR80	Russian peashrub <i>Caragana frutex</i> Big Sioux Nursery, Watertown, SD	10-May 05	05			5	100	4	0.5	2.2		
								5	100	6	0.4	1.3		
								5	100	6	0.5	1.5	deer browse on all	
								5	100	4	1.2	2.4	1,2,5 browsed	
								5	100	6	1.1	3.2		
								4	80	7	1.4	3.3	1,2 leaf mold	
S2-7	9019593	JUCO6	common juniper <i>Juniperus communis</i> Wilton Mine, ND/McKenzie FEP, ND	2-May 06	06	CONT		5	100	3	2.6	0.8		
								5	100	2	3.9	0.8		
								5	100	2	5.8	1.5		
								5	100	3	8.0	2.3		
								5	100	2	9.0	2.5		
								5	100	2	9.0	2.5		
S2-8	9092054 'Silverscape'	ELAEA	Russian olive/silverberry hybrid <i>Elaeagnus X 'Jefmorg'</i> Lincoln-Oakes Nursery, Bismarck, ND	2-May 06	06	POTD		5	40	2	3.1	4.3	2,3,5 recently dead, canker?	
								4	80	6	1.4	2.6		
								4	80	5	3.9	4.6		
								4	80	4	6.2	6.8		
								4	80	3	7.3	6.8	some (10%) dieback 1	
								3	60	5	8.5	6.6	40% dead tips on 1,2	
S2-9	9092053	RHTY	staghorn sumac <i>Rhus typhina</i> Lincoln-Oakes Nursery, Bismarck, ND	2-May 06	06	PLBR		5	100	3	3.8	5.0	clean leaves, no disease	
								5	100	5	4.8	6.2		
								5	100	3	8.9	8.9		
								5	100	5	8.2	8.8		
								5	100	2	4.3	5.9		
								5	100	3	8.1	6.7	3,4 some dead stems	

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Year of Record: 2015

PLOT LOCATION	ACCESSION NUMBER	PLANT SYMBOL	GENUS/SPECIES ORIGIN/SOURCE	TRANS	YR	YR	MATL	NO	NO	PCT	CAN	PLT	REMARKS			
				DATE	PLT	REC	PLTD	PLTS	SRV	SRV	VI	COV		HT		
S2-10	9082739	OSVI	ironwood <i>Ostrya virginiana</i> Sertoma Park, Bismarck, ND USDA, NRCS, PMC, Bismarck, ND	May	07			5	5	100		0.7	1.4	rabbit damage 1,5		
S2-11	9091964	RHTR	skunkbush sumac <i>Rhus trilobata</i> Cave Hills, SD USDA, NRCS, PMC, Bismarck, ND	May	07			5	5	100	3	0.8	1.3			
S3-1	'Cathedral' 9092142	ULMUS	Siberian/Japanese elm cross <i>Ulmus X 'Cathedral'</i> S & B Nursery, Bismarck, ND (Bailey's)	May	07			5	5	100	4	1.6	8.6	no leaves on 1		
S3-1	9094355	CODR	roughleaf dogwood <i>Cornus drummondii</i> Big Sioux Nursery, Watertown, SD	5-May	11			5	5	100	3	0.9	2.2			
S3-2	9012606	JUHO2	creeping juniper <i>Juniperus horizontalis</i> Golden Valley County, ND		08			5	5	100	3	2.1	0.4			
S3-3	9094281	VIOPA2	American highbush cranberry <i>Viburnum opulus var. americanum</i> Big Sioux Nursery, Watertown, SD	7-May	09			5	5	100	3	1.6	2.0			

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											COV	VI		
S3-4	'McKenzie' 323597	PHME13	black chokeberry			08		5	5	100	2	2.8	2.5	
			<i>Photinia melanocarpa</i>			09			5	100	2	4.2	3.7	all large fruit
			USDA, NRCS, PMC, Bismarck, ND			10			5	100	2	4.8	4.2	
						12			5	100	2	5.2	4.9	no fruit
						14			5	100	2	5.6	6.0	2 much fruit
S3-5	'Prairie Red' 9047203	PRUNU	hybrid plum			08		5	5	100	3	3.6	5.1	highly variable
			<i>Prunus</i> sp.			09			5	100	3	4.3	6.3	
			USDA, NRCS, PMC, Bismarck, ND			10			5	100	4	4.6	6.9	
						12			5	100	3	6.2	7.9	seed all gone, if any
						14			5	100	3	7.6	10.2	
S3-6	9092141	VILE	nannyberry	May 07		07		5	5	100	2	0.5	1.4	
			<i>Viburnum lentago</i>			08			4	80	2	1.0	3.0	
			Schumacher's, Heron Lake, MN			09			5	100	4	2.2	3.7	
						11			5	100	3	3.7	6.0	
						13			5	100	2	5.6	7.2	
S3-7	9094333	SANIC4	common elderberry			10		5	5	100	3	0.7	1.1	
			<i>Sambucus nigra</i> ssp. <i>canadensis</i>			11			5	100	4	2.1	3.5	
			Big Sioux Nursery, Watertown, SD			12			5	100	3	3.0	3.8	3,5 no seed, cupping on new leaves
						14			5	100	5	2.8	4.3	good fruit 2-5
S3-8	9092140	SOAL9	Korean mountain ash	May 07		07		5	5	100	6	0.4	1.2	rabbits 1,5; no leaves 1,4
			<i>Sorbus alnifolia</i>			08			2	40		0.9	1.5	
			Big Sioux Nursery, Watertown, SD			09			2	40	6	1.9	2.3	
						11			2	40	6	2.0	2.8	
						13			2	40	6	1.8	3.1	
4-1	9094356	PICEA	Meyer's spruce	5-May 11		11	CONT	5	5	100	3	1.1	1.3	
			<i>Picea meyeri</i>			12			5	100	2	1.2	1.3	
			Big Sioux Nursery, Watertown, SD			13			5	100	4	1.3	1.3	yellow apical
						15			5	100	2	2.3	2.2	no leader 2,5

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Year of Record: 2015

PLOT LOCATION	ACCESSION NUMBER	PLANT SYMBOL	GENUS/SPECIES ORIGIN/SOURCE	TRANS	YR	YR	MATL	NO	NO	PCT	CAN		PLT	REMARKS		
				DATE	PLT	REC	PLTD	PLTS	SRV	SRV	VI	(ft)	(ft)		HT	
4-2	9076737	PRSE2	black cherry	5-May	11	11	CONT	5	5	100	5	0.9	1.6			
			<i>Prunus serotina</i>													
			Big Sioux Nursery, Watertown, SD													
4-3	9094400 'Carmine Jewel'	PRCE	dwarf cherry	7-May	12	12	PLBR	5	5	100	1	0.3	3.6	3' shelters & watered 5/8/12		
			<i>Prunus cerasus</i>													
			Big Sioux Nursery, Watertown, SD													
4-4	9092162	PRUNU	pie cherry	7-May	12	12	PLBR	5	1	20	2	0.3	2.3	3' shelters & watered 5/8/12		
			<i>Prunus</i> sp.													
			Harding County, SD													
			USDA, NRCS, PMC, Bismarck, ND													
4-5	9094406 'Princeton'	ULAM	American elm	7-May	12	12	PLBR	5	5	100	2	0.6	4.3	3' shelters		
			<i>Ulmus americana</i>													
			Schumacher's Nursery, Heron Lake, MN													
4-6	9094419 'Berry Blue'	LOED	honeyberry (haskaps)	15-May	13	13	POTD	5	5	100	5	1.1	1.4	50% leaves blue/brown color		
			<i>Lonicera edulis</i>													
			Jeffries Nursery, Portage LaPrairie, MB													
5-1	9094336	ACFR	Freeman maple	6-May	10	10	PLBR	5	5	100	3	0.5	1.5			
			<i>Acer x freemanii</i>													
			Big Sioux Nursery, Watertown, SD													
5-2	9094334	TIAM	American linden	6-May	10	10	PLBR	5	5	100	3	1.1	1.8			
			<i>Tilia americana</i>													
			Big Sioux Nursery, Watertown, SD													

Study No.: NDPMC-T-0201-CP, Field Evaluation of Woody Plant Materials, Brookings, SD

Year of Record: 2015

PLOT LOCATION	ACCESSION NUMBER	PLANT SYMBOL	GENUS/SPECIES ORIGIN/SOURCE	TRANS DATE	YR PLT	YR REC	MATL PLTD	NO PLTS	NO SRV	PCT SRV	CAN		PLT HT	REMARKS	
											COV	VI			
5-3	9094335	TICO2	littleleaf linden <i>Tilia cordata</i> Big Sioux Nursery, Watertown, SD	6-May	10		PLBR	5	5	100	5	0.5	1.0	tip dieback on 1	
												5	2.3	2.8	
												4	2.4	3.6	leaf rust 1,2,5; severe rust 4
												4	3.8	4.8	
5-4	9082892	POAL7	white poplar <i>Populus alba</i> Big Sioux Nursery, Watertown, SD	6-May	10		PLBR	5	5	100	3	1.9	3.4		
												7.1	6.9		
												1	9.9	8.3	many basal and root sprouts
												2	18.0	14.6	very invasive, spreading to other plots
5-5	9091968	GYDI	Kentucky coffeetree <i>Gymnocladus dioica</i> Big Sioux Nursery, Watertown, SD	5-May	11		PLBR	5	5	100		0.6	0.7		
												1.1	1.1	weed competition	
												2	2.4	5-ft tubes; leaves all bunched tubes removed 1,5	
												4	0.9	3.6	
												5	100	4	0.9
5-6	'Cinderella' 9094420	LOED	honeyberry (haskaps) <i>Lonicera edulis</i> Jeffries Nursery, Portage La Prairie, MB	15-May	13			5	4	80	7	0.9	0.9	appeared to have no new growth	
												5	1.3	1.2	
												4	1.6	1.6	50% dark gray black on leaves
6-1	9094417	FRMA	Manchurian ash <i>Fraxinus mandshurica</i> China Big Sioux Nursery, Watertown, SD	15-May	13			5	5	100	2	3.6	5-ft tubes		
												2	6.2		
												4	7.0	1,4 misshapen, small, wrinkled leaves	
6-2	9094416	PLOC	sycamore <i>Platanus occidentalis</i> Lincoln-Oakes Nursery, Bismarck, ND	15-May	13			5	5	100	1	4.8	5-ft tubes		
												1	7.9		
												2	4.5	9.8	tubes; nice trees, big, green leaves
6-3	9094418	COAM	American hazel <i>Corylus americana</i> northern Minnesota Big Sioux Nursery, Watertown, SD	15-May	13			5	5	100	2	0.8	1.7		
												3	1.7	2.2	
												2.2	2.6	2.9	all healthy, dark green leaves
												5	100	2.2	2.6

Study No.: NDPMC-T-0201-CP, Field Evaluation of Woody Plant Materials, Brookings, SD

Year of Record: 2015

PLOT LOCATION	ACCESSION NUMBER	PLANT SYMBOL	GENUS/SPECIES ORIGIN/SOURCE	TRANS DATE	YR PLT	YR REC	MATL PLTD	NO PLTS	NO SRV	PCT SRV	CAN		PLT HT	REMARKS
											COV	VI		
6-4	'Catskill' 9051508	PRPUD	sandcherry <i>Prunus pumila</i> var. <i>depressa</i> Big Flats PMC, Corning, NY	12-May 14	14	14	PLBR	5	5	100	2	4.1	1.3	
									5	100	2	3.6	1.5	
6-5	9094441	QUBI	swamp white oak <i>Quercus bicolor</i> Illinois Lawyer Nursery, Plains, MT	12-May 14	14	14	PLBR	5	5	100	3		2.6	tubes are too tall
								5	100	3	4.1	2,4 chlorotic; 5 very chlorotic		
6-6	9094442	BEPO	gray birch <i>Betula populifolia</i> Wisconsin Lawyer Nursery, Plains, MT	12-May 14	14	14	PLBR	5	5	100	1		6.6	
								5	100	4	7.2	all have broken limbs at top of tube		
7-1	9092231	PICO	lodgepole pine <i>Pinus contorta</i> USDA-ARS, Mandan, ND ND Forest Service Nursery, Towner, ND	12-May 14	14	14	PLBR	5	3	60	5		0.5	poor stock; need to be replanted
								15	3	60	7	0.3	0.5	barely alive
7-2	9094446 'Prairie Expedition'	ULAM	American elm <i>Ulmus americana</i> Big Sioux Nursery, Watertown, SD	12-May 15	15	15	PLBR	5	5	100	3		8.2	
7-2	9094434	PSME	Douglas fir <i>Pseudotsuga menziesii</i> USDA, ARS, Mandan, ND ND Forest Service Nursery, Towner, ND	12-May 15	15	15	CONT	5	5	100	3	0.4	0.9	
T2-1	'Bridger-Select' 9078631	JUSC2	Rocky Mountain juniper <i>Juniperus scopulorum</i> USDA, NRCS, Bridger, MT	10-May 05	05	05		5	5	100	2	0.8	1.5	good color
									5	100	2	1.5	2.8	
									4	80	2	1.9	3.2	
									4	80	4	3.1	4.5	
									4	80	3	4.1	5.9	
								4	80	5	5.6	7.8		

Study No.: NDPMC-T-0201-CP, Field Evaluation of Woody Plant Materials, Brookings, SD

Year of Record: 2015

PLOT LOCATION	ACCESSION NUMBER	PLANT SYMBOL	GENUS/SPECIES ORIGIN/SOURCE	TRANS	YR	YR	MATL	NO	NO	PCT	CAN		PLT	REMARKS
				DATE	PLT	REC	PLTD	PLTS	SRV	SRV	VI	(ft)	(ft)	
T2-2	Hunter Germplasm 9081843	PIPO	ponderosa pine <i>Pinus ponderosa</i> USDA, NRCS, Bridger, MT	10-May	05			5	5	100	3	0.6	1.2	
					06				5	100	2	1.3	1.8	
					07				5	100	2	1.6	2.1	
					09				5	100	3	3.1	4.2	
					11				5	100	4	5.0	6.7	
					15				5	100	2	8.2	11.1	4 really dense foliage, close limbs
Row 4	9094282	CEOC	hackberry <i>Celtis occidentalis</i> South Dakota source Big Sioux Nursery, Watertown, SD	8-May	09			4	4	100	4		3.8	in Tubex
					10				4	100	3		5.6	in Tubex
					11				4	100	3	4.1	7.2	
					13				4	100	3	5.3	8.7	some dieback 3
					15				4	100	3	7.0	11.0	4 chlorotic
Row 4	'Oahe'	CEOC	hackberry <i>Celtis occidentalis</i> Big Sioux Nursery, Watertown, SD	8-May	09			5	5	100	3		3.0	in Tubex
					10				5	100	3		5.4	
					11				5	100	4	4.8	7.0	
					13				5	100	4	5.4	8.5	fungal disease on 10% leaves
					15				5	100	3	6.5	10.6	
Row 4	Prairie Harvest Germplasm 9034956 ND-3878	CEOC	hackberry <i>Celtis occidentalis</i> Polk County, MN	8-May	09			5	5	100	3		3.5	in Tubex
					10				4	80	3		4.8	
					11				5	100	4	2.5	5.7	1-replant
					13				5	100	4	3.7	7.0	dieback and resprout on 3
					15				5	100	3	4.7	8.3	

OFF-CENTER EVALUATION PLANTING: TECHNICAL REPORT 2015

Study NDPMC-P-1001-WI Lodgepole Pine Evaluation

Study Title: Field Evaluation of Woody Plant Materials

Objective: Evaluate various selected seed sources of lodgepole pine in both replicated and non-replicated field trials in western North and South Dakota. Data collection will document both species performance in windbreaks and seed source differences.

Introduction: Lodgepole pine (*Pinus contorta* var. *latifolia*) is a native conifer species known for its long, slender trunk and high, thin crown. It grows on a wide variety of soils but does best on medium-textured soils derived from coarse parent materials. Lodgepole pine may have potential as an additional tall tree species for conservation use in the western parts of North and South Dakota.

Cooperators: The USDA Natural Resources Conservation Services, Plant Materials Center (PMC), Bismarck, North Dakota, in cooperation with NRCS field offices located at Dickinson and Hettinger, ND, and Hot Springs, SD; Lake Angostura State Park, SD; NDSU Hettinger Research Extension Center (HREC), ND; and the Flying O Ranch near Hebron, ND.

Location: Flying O Ranch, NW1/4, sec. 3, T140N, R91W, Hebron, ND (non-replicated); Hettinger Research and Extension Center, Sec. 14, T129N, R96W, Hettinger, ND (replicated); and, Angostura State Park, Sec. 28, T8S, R6E, Hot Springs, SD (replicated).

Major Land Resource Area (MLRA): The sites are located in MLRA 54, the Rolling Soft Shale Plain; and MLRA 61, the Black Hills Foot Slopes.

Soils: The Hebron site is a fine sandy loam. The Hettinger site is an Arnegard silt loam, and the Hot Springs planting is on a Savo silt loam.

Climate: The average annual precipitation for MLRA 54 is 12 to 17 inches with an average freeze-free period of 110 to 135 days. The average annual precipitation for MLRA 61 is 15 to 18 inches with an average freeze-free period of 110 to 140 days.

Methods and Materials

Assembly: Cones were collected from superior trees (Table LP-1) in 2012 in a provenance study at the Agricultural Research Service, Northern Great Plains Research Lab at Mandan, North Dakota. Cones were processed at the Bismarck PMC and the seed was separated. Towner State Nursery (TSN) grew out seedlings of each source and provided them for the study.

Table LP-1. Selected Seed Sources

Accession	Origin	Seedlings
14107(107)	British Columbia (Jacobie Creek)	500+
14108(108)	British Columbia (Lac le Jeune)	45
14109(109)	British Columbia (Clearwater)	400
14070 (070)	Colorado (Routt National Forest - Salida)	100
13351-10 (1-10)	Montana (Beaverhead National Forest – Dillon)	125
14105 (105)	Saskatchewan (Cypress Hills Provincial Park)	75
MP-718	Mongolian Scots Pine (PMC)	30
MP-158	Mongolian Scots Pine (PMC)	5
PP	Ponderosa Pine (TSN)	5
MP-157	Mongolian Scots Pine (PMC)	5

Planting Plan:

Replicated (2 sites) – One site each in western North Dakota (Hettinger REC) and South Dakota (Angostura State Park). Total number of trees at each site equals 3-plant plots x 5 randomized replications x 8 seed sources = 120 trees at each site, 15 of each accession. Accession MP-718 (Mongolian pine) was included as part of the replicated study. Ponderosa pine was included as a standard of comparison.

Non-replicated (1 site) – The one non-replicated site in western North Dakota near Hebron had 5-plant plots for each entry. Accession 108 was not included due to stock shortages. Ten entries of accession 109 were included as a substitute for the missing accession 108. Ponderosa pine was used as a standard of comparison. A total of 40 trees were planted.

Plot Preparation: All three sites were cultivated. The Hebron site is near an existing windbreak by a farmstead. The trees were hand planted into weed barrier fabric. The Hettinger site is cropland on the outside of a deteriorating windbreak. The trees were hand planted into weed barrier fabric, and six-foot diameter by five-foot tall wire cages were placed around the trees to protect from deer. The area between the fabric strips was seeded to blue grama. The Angostura site is part of a recreation area. Trees were planted into six-foot wide bands of well tilled soil and 3-foot fabric squares were placed around trees after planting.

Planting Dates: All plots were planted in the spring of 2008. The Hebron site was planted on May 16; the Hettinger site on May 12; and the Angostura site on May 14.

Irrigation: The trees are not irrigated.

Evaluations and Measurements:

2008: Survival, vigor ratings, and height measurements were taken the end of the growing season in 2008. See Tables LP-2 (Hebron), LP-6 (Hettinger), and LP-10 (Angostura) for 2008 evaluation data. Initial survival was greater than 80% at all sites. Vigor ratings were in the average range (3-5), and height averaged approximately .75 to 1 foot for all sites. Trees at Angostura State Park were browsed repeatedly by deer and killed during the fall and winter 2008/2009. Approximately 75% of the lodgepole pines and 50% of the ponderosa pines were damaged at Angostura.

2009: Replacements at Angostura State Park were planted on May 15, 2009, in the first three replications. Most of the trees replanted in replications four and five were ponderosa pine. Animal repellent was sprayed on all the trees after replanting. Cages were later installed on the first three replications (southwest two rows). See Table LP-3 for 2009-2010 data collected at the Hebron site and Table LP-7 for 2009-2010 data collected at the Hettinger site. See Table LP-11 for 2009 data collected at Angostura State Park.

2010: Dead and missing plants in the spring were replanted at all sites to either Mongolian pine or ponderosa pine. Many of the plants at Hettinger had a major flush of annual weed growth in the hole of the fabric and on the edge. The heaviest infestations were removed, and granular Preen (trifluralin) was applied and incorporated by hand. Replacements at Angostura State Park were planted in early June. Rainfall conditions were again good to excellent at the three sites. Dense growth of Russian thistle again provided protection from deer at Hebron. Overall, the plants were not vigorous at Angostura State Park, and the 3-foot fabric squares may not provide adequate weed control in the sod. See Table LP-3 for 2009-2010 data collected at the Hebron site; Table LP-7 for 2009-2010 data collected at the Hettinger site; and Table LP-12 for 2010 data collected at Angostura State Park near Hot Springs, South Dakota.

2011: Evaluations were completed. There was very good survival at Hettinger. The one time application of Preen was quite effective. Some Siberian elms have become established in the fabric openings. Grass that was seeded between fabric strips continues to be sparse, but the research center is controlling weeds effectively with mowing. No evaluations were conducted at Hebron. Tree growth rates and vigor continue to decline at Angostura. Brome has regrown to fabric edges. The dense clay subsoil often found within the Savo map unit may greatly hinder coniferous tree survival and growth, especially if the 3-foot fabric squares are providing limited to no weed control benefits to the trees. Note: After the trees were planted and fabric squares installed, we became aware of several weed control studies indicating that weed control of less than 6-foot square around individual trees was no more effective than the controls in the study with no weed control. Plants where water can apparently pond are not doing well. Deer continue to decimate trees not protected with wire cages. See Table LP-4 for 2012 data collected at the

Hebron site; Table LP-8 for 2011-2012 data collected at the Hettinger site; and Table LP-13 for 2011-2012 data collected at Angostura State Park near Hot Springs, SD.

2012: This was a dry year at all three sites. Angostura was experiencing severe drought. Trees at Angostura continued to die. Dense brome was growing at edges of fabric squares and from many of the fabric openings. Some accessions have died completely. The Angostura location supports other research findings that 3-foot fabric squares do not provide adequate weed control. Russian thistle had diminished at the Hebron site, replaced by dense stands of brome. Brome formed robust contiguous bands along the edges of the fabric and from many of the fabric openings at the Hebron site. It appears the dense brome has hindered tree growth, resulting in the death of some.

The planting at Hettinger is doing well. No additional mortality. Good growth on all. Factors favoring these good results include good weed control with the fabric, good weed control between the rows with the blue grama and mowing, and the fact of being planted on one of the better soils in the region. At evaluation time, the lodgepole pine exhibited a very dark green color. The ponderosa pine showed a green/grey color cast while the Mongolian Scots pine exhibited a yellow/green cast. Similar to what is found in the wild and what was observed at the ARS provenance test, 5-10 of the lodgepole pine at Hettinger showed tip damage from *Petrova luculentana* (pine pitch nodule maker). Unless this insect damages an apical tip it should have minimal impact on the planting.

See Table LP-4 for 2012 data collected at the Hebron site; Table LP-8 for 2011-2012 data collected at the Hettinger site; and Table LP-13 for 2011-2012 data collected at Angostura State Park near Hot Springs, SD. For a graphical summary of the findings after five years, refer to Figures LP-1 through LP-4. For more specific details on overall heights, vigor, and survival, refer to Tables LP-2 through LP-13. Similar to findings in other studies, five years of data show that Scots pine grows the fastest, with survival rates similar to ponderosa pine. Both the lodgepole pine and the ponderosa grow at about the same rate, but lodgepole pine has a bit less survival percentage and is less able to exist with dense sod weed pressure.

2013: No on-site visits were made. Extensive inventory and analysis of findings will be conducted in 2014. Note: The provenance test at ARS, source of the seeds for the three test locations above, is being converted into a seed orchard by ARS and PMC staff. Plans are to thin the stand to about 65 square feet basal area and prune the mostly dead limbs to 8' height above the ground. The thinning scheme calls for every seed tree left to have at least one blank (missing tree) adjacent, to provide more water and nutrients and reduce stress. The thinning and especially the pruning, will make the stand more resistant to stand killing fires. The four lowest-scoring accessions will be removed, leaving 21 accessions to be used as a composite seed orchard. Disposal of pruning and thinning debris is the biggest issue as the debris cannot be stacked onsite due to fire and Ips beetle risk, and the ARS station does not want to burn the debris, so debris will be chipped and/or shipped to the Mandan landfill for burial. Once thinned and pruned the stand will be more accessible for bucket truck maneuvering and mowing or chemical control of sod and weeds.

2014: 545 lodgepole pine seedlings, grown from seeds collected at ARS were provided to 21 field offices for field plantings in Minnesota, South Dakota, and North Dakota.

There was no site visit to the Hebron site, and a brief visit of the Hettinger site indicated that it was doing well. The Angostura site was visited with a representative of the South Dakota Division of Forestry. The entire Angostura study site has been destroyed as part of sewer installation. Only one or two trees of the first three replications were still alive and growing. Wire cages, fabric, and other trees were gone with only bare soil remaining. The study site at the Angostura location is terminated.

2015: Data from 2015 yielded different results than those shown for 2012. See Table LP-5 for 2015 data collected at Hebron and Table LP-9 for 2015 data collected at Hettinger. The Hettinger planting was impacted by a severe hail storm in May 2013. Evidence was still visible in 2015. Interestingly, the Ponderosa pine and the Scots pine which suffered from the same storm had pretty much callused over by the time of the 2015 inventory. However, the lodgepole pine still showed raw wounds. In some cases the xylem was still exposed on 20-30% of the trunk or limb circumference. Based on the amount of exposed xylem and callus tissue, the hail must have stripped bark and cambium from 50% or more of the main stem circumference. This had to cause lots of stress to the plants.

Additionally it was noted that 38% of the Mongolian Scots pine (10 of 26 trees) and 39% of the lodgepole pine (30 of 77 trees) developed double leaders beginning at the time of the hail storm. The Ponderosa pine showed no signs of double leaders (0 of 16 trees). Though we have no definitive reason for the double leader occurrence the following may yield definitive answers with further research, literature review or consultation with experts:

- Was the lodgepole and Mongolian Scots pine more susceptible to apical bud damage because they normally grow in areas not subject to high winds and intense hail or because in the dense stands where naturally found they have the mutual protection from adjacent trees and never developed the genetics to withstand intense hail?
- At the time of the storm in late May, were the lodgepole and Mongolian Scots pine apical buds more tender? Had they just begun to shoot new growth? Did they get damaged from mechanical injury of the hail stone or from the wind?
- Because Ponderosa pine normally grows in a more exposed situation, was it tougher? Did it initiate bud growth later and therefore missed the hail?

Regarding the fact that the Scots pine and Ponderosa pine had just about all callused over by the time of the 2015 inventory:

- Were the trunks of these two species not damaged as much? Why?
- Did these two species have the ability to heal faster? Why?

So far we have learned the following about lodgepole pine.

- It still looks promising as a potential addition to the Field Office Technical Guide, yet more observations on a wider variety of soils are needed.
- Similar to other species that are replacing “traditional tried and true” species, lodgepole pine, though promising, appears to need more care during stock handling, planting and maintenance for the first few years. After that it has shown to be quite similar in growth, care requirements and function to other conifers.
- After eight years Ponderosa pine showed an average height of 6.6 ft. while Mongolian Scots pine had grown 5.7 ft. and lodgepole pine had grown 5.6 ft. Considering the severe damage from the hail storm and the high incidence of double leaders, the latter two species still exhibited respectable growth.

Note: Since one of the reasons for the planting at Hettinger was to strengthen an existing farmstead windbreak, the following recommendations were made to and demonstrated for the farm manager; proper pruning of double leaders from the pines to create a more resilient windbreak and reduce future maintenance. Pruning could be done whenever time allowed. It is better to do it soon before limbs get larger and a larger pruning cut remains open for longer. Such pruning may affect some observations at future inventories. However, when comparing heights of double leader trees to those without double leaders, there was no consistent difference. Some accessions showed a few tenths greater height without double leaders; some accessions showed a few tenths greater height with double leaders. Proper cut stump herbicide treatments were demonstrated to reduce the need for continuous cutting of contaminant Siberian elm. See Figure LP-5 for height summary at the Hettinger location after 8 years growth.

The Hebron site has proven interesting over the years. Established on a sandy loam soil with fabric, this site has experienced high mortality and reduced growth from weed pressure and deer browse. By far the best growing species on this site has been the Mongolian Scots pine at 100% survival with the 4 tallest trees averaging over 8 feet. The other Mongolian has been continuously browsed by deer into a 4-foot diameter globe. Over half of the trees in the remaining accessions have died. Most of those that remain have been severely reduce in height by deer browse or smooth brome sod competition. See Figure LP-6 for survival and height summary at the Hebron location.

Table LP- 2. Pine evaluation study, planted in 2008 near Hebron, North Dakota. Data collected 8/24/2008.

 = dead plant at 2008 evaluation

Accession	Plant No.	Survival	Vigor 1= best 9 =worst	Height (ft)	Remarks
70	1	x	4.00	1.00	
70	2	x	4.00	1.00	
70	3	x	3.00	0.75	
70	4	x	3.00	1.00	
70	5	x	3.00	1.00	
105	1	x	4.00	0.75	
105	2	x	3.00	0.50	
105	3	x	3.00	0.50	
105	4	x	3.00	0.50	
105	5	x	5.00	0.50	
PP	1	x	4.00	1.00	
PP	2	dead	9.00		
PP	3	x	4.00	0.75	
PP	4	x	3.00	0.75	
PP	5	x	3.00	0.75	
107	1	x	3.00	0.75	
107	2	dead	9.00		
107	3	x	4.00	1.00	
107	4	x	4.00	1.00	
107	5	dead	9.00		
MP-158	1	x	3.00	1.00	
MP-158	2	x	3.00	1.00	
MP-158	3	x	4.00	1.25	terminal bud browsed
MP-158	4	x	3.00	1.25	
MP-158	5	x	3.00	1.25	
109	1	x	3.00	0.75	
109	2	x	5.00	0.75	
109	3	x	3.00	0.75	
109	4	x	6.00	0.50	browsed
109	5	x	8.00	0.50	
109	6	x	3.00	0.75	
109	7	x	4.00	0.50	buds gone
109	8	dead	9.00		
109	9	x	3.00	0.50	
109	10	x	3.00	0.50	
1(10)	1	x	3.00	1.00	
1(10)	2	dead	9.00		
1(10)	3	x	3.00	1.00	
1(10)	4	x	2.00	1.00	
1(10)	5	x	3.00	1.00	

**Table LP-3. Pine evaluation study, planted in 2008 near Hebron, North Dakota.
Data was collected on September 23, 2009, and September 26, 2010.**

Accession No.	Plant No.	Survival	Vigor (1=highest, 9=poorest)		Height (ft)		Remarks (2009)
			2009	2010	2009	2010	
70	1	x	3	2	1.00	1.75	
	2	x	3	2	1.50	1.75	
	3	x	3	3	1.00	1.25	
	4	x	3	4	1.50	1.25	
	5	x	3	5	1.00	1.25	
105	1	x	4	2	0.75	1.25	
	2	x	4	2	0.75	1.50	
	3	x	3	2	0.75	1.00	
	4	x	3	2	1.00	1.25	
	5	x	5	5	0.50	0.50	browsed
PP	1	x	3	2	1.75	2.50	
	2	x	3	9	1.00	0.00	
	3	x	3	3	1.00	1.50	
	4	x	4	9	1.00	0.00	
	5	x	3	2	1.25	1.25	
107	1	x	4	2	1.75	2.00	browsed
	2	x	3	9	1.75	1.25	
	3	x	3	3	1.25	1.25	
	4	x	5	3	1.00	1.00	
	5	x	4	1	1.50	2.00	
MP-158	1	x	3	3	1.25	1.50	
	2	x	3	2	1.25	2.00	
	3	x	2	1	1.75	3.25	
	4	x	2	1	1.75	2.25	
	5	x	2	2	1.75	1.75	
109	1	x	3	9	1.50	0.00	
	2	x	2	2	1.50	2.00	
	3	x	4	3	0.75	1.25	
	4	dead	NA	NA	NA	NA	
	5	dead	NA	NA	NA	NA	
	6	x	3	2	1.00	2.00	
	7	x	3	9	0.75	0.00	
	8	x	3	3	1.50	1.25	
	9	x	4	1	1.00	2.25	
	10	x	4	1	1.00	2.00	
1(10)	1	x	4	4	1.75	1.00	
	2	x	4	9	1.75	0.00	
	3	x	2	2	1.75	2.25	browsed
	4	x	3	4	1.50	1.25	
	5	x	4	4	0.75	0.75	

Table LP-4. Pine evaluation study near Hebron, North Dakota. Evaluated 10/16/2012.

█ = replanted to original accession, spring 2009.

Vigor rating: 1-9; 1=best, 9=poorest

Accession	Plant #	Vigor rating	Height (ft)	Width (ft)	Notes
070	1	2	2.5	1	
070	2	1	2.25	1.25	
070	3	1	2.5	2.25	
070	4	9			dead at 2' tall
070	5	6	1	0.5	dense brome and browse
105	1	4	1	0.5	
105	2	2	2	2.25	
105	3	1	2.25	1.5	
105	4	3	1.25	1.25	
105	5	9			dead, small needles still on
PP	1	2	2.75	2	
█ PP	2	9			dead
PP	3	9			dead
PP	4	9			dead
PP	5	2	3	1.75	
107	1	2	3.25	1.5	
█ 107	2	9			dead
107	3	1	3.25	1.75	
107	4	9			dead
█ 107	5	3	2	0.5	
MP 158	1	4	2.5	3	yellow needle tips
MP 158	2	3	4.5	3	
MP 158	3	3	3.25	2.5	double leader
MP 158	4	3	4	3.5	short needles, open canopy
MP 158	5	3	4.25	3.5	
█ 109	1	9			dead
█ 109	2	2	2.25	2.25	
109	3	9			dead
█ 109	4	9			dead
█ 109	5	9			dead
109	6	2	3.25	3	
109	7	9			dead
█ 109	8	2	2	1.75	double leader
109	9	2	4.75	2.25	
109	10	2	4.5	3	
█ 1-10	1	3	1.5	1.25	
█ 1-10	2	9			dead
█ 1-10	3	3	1.75	1.25	
█ 1-10	4	9			dead
1-10	5	3	2	1	

There appears to be a strong correlation between dense weeds in the opening and reduced vigor and height. Dense weeds and sod are found in most all openings and along fabric edges. There is a hard-to penetrate soil layer at 3" depth.

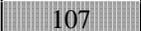
Table LP-5. Pine evaluation study near Hebron, North Dakota. Evaluated 10/6/2015.

Accession	Plant No.	Vigor(1-9) 1=best	Height (feet)	Width (feet)	Remarks
070	1	2	2	1.5	
070	2	2	2.25	1.75	
070	3	2	2.75	3.5	
070	4				DEAD
070	5				DEAD
105	1	2	1.5	1.5	
105	2	3	1.5	3	
105	3	2	2	2.25	
105	4	2	3	2.5	
105	5				DEAD
PP	1				DEAD
PP*	2				DEAD
PP	3				DEAD
PP	4				DEAD
PP	5	3	5	2.75	
107	1	4	1.75	3	
107*	2				DEAD
107	3	5	1	2	top 2' dead
107	4				DEAD
107*	5	2	3.5	1.5	
MP 158	1	3	4	4	
MP 158	2	2	8.5	5	
MP 158	3	2	7	4	
MP 158	4	2	8.25	5.5	
MP 158	5	2	9	6	double leader
109*	1				DEAD
109*	2	2	5.5	3.5	double leader
109	3				DEAD
109*	4				DEAD
109*	5				DEAD
109	6	4	6.5	3.75	double leader
109	7				DEAD
109*	8	3	5.25	3.5	
109	9	4	2	2.25	top 3' dead
109	10	3	7.25	4.5	
1-10*	1	3	3.25	2.5	
1-10*	2				DEAD
1-10*	3	3	2.5	3	double leader
1-10*	4				DEAD
1-10	5	3	1.5	1.5	

* = Replanted spring 2009 to same accession

Table LP-6. Pine evaluation (replicated) near Hettinger, North Dakota. Data taken on 09/24/2008.

 = dead plant at 2008 evaluation

Rep	Accession	Plant #	Survived	Vigor (1-9) 1=best	Height (ft)	Remarks
1	70	1	x	3	1.25	
1	70	2	x	3	1.00	
1	70	3	x	2	1.00	
1	105	1	x	3	1.25	floppy
1	105	2	x	4	1.00	droopy needles
1	105	3	x	3	1.00	
1	108	1	x	4	0.75	
1	108	2	x	2	1.25	
1	108	3	x	3	1.00	
1	PP	1	x	4	1.00	big Russian thistle
1	PP	2	x	2	1.00	R. thistle and S. elm
1	PP	3	x	3	1.00	
1	107	1	x	3	1.25	
1	107	2	x	3	1.25	
1	107	3	x	2	1.50	
1	MP-718	1	x	4	1.25	
1	MP-718	2	x	3	1.25	
1	MP-718	3	x	3	1.25	
1	 109	1	dead			
1	109	2	x	3	1.00	
1	109	3	x	3	1.00	
1	1(10)	1	x	3	1.25	
1	1(10)	2	x	3	1.25	
1	1-10	3	x	4	1.00	
2	70	1	x	3	1.00	
2	70	2	x	3	1.00	
2	70	3	x	3	1.00	
2	105	1	x	2	1.25	
2	105	2	x	3	1.25	
2	105	3	x	4	1.00	
2	108	1	x	3	1.25	
2	108	2	x	4	0.75	
2	108	3	x	4	0.75	
2	PP	1	x	3	1.00	
2	PP	2	x	3	1.00	
2	PP	3	x	4	1.00	
2	107	1	x	3	1.25	
2	 107	2	dead			
2	107	3	x	3	1.25	
2	MP-718	1	x	3	0.75	
2	MP-718	2	x	4	1.00	
2	MP-718	3	x	4	1.00	
2	109	1	x	3	1.00	floppy
2	109	2	x	2	1.25	
2	109	3	x	3	1.25	
2	1(10)	1	x	3	1.75	
2	1(10)	2	x	3	1.25	
2	1(10)	3	x	4	1.50	

Rep	Accession	Plant #	Survived	Vigor (1-9) 1=best	Height (ft)	Remarks
3	70	1	x	4	1.25	
3	70	2	x	3	1.25	
3	70	3	x	4	1.00	
3	105	1	x	4	1.00	
3	105	2	dead			
3	105	3	x	4	1.00	Siberian elm seedlings
3	108	1	x	3	0.75	
3	108	2	x	3	1.00	
3	108	3	x	6	0.75	bud gone
3	PP	1	x	4	1.00	
3	PP	2	x	3	0.75	
3	PP	3	x	5	0.75	big Russian thistle
3	107	1	x	4	1.00	top dieback
3	107	2	x	3	1.25	
3	107	3	x	3	1.25	weeds in fabric opening
3	MP-718	1	x	4	1.25	big pigweed
3	MP-718	2	x	2	1.25	Russian thistles
3	MP-718	3	x	3	1.00	
3	109	1	x	6	0.75	
3	109	2	x	4	0.75	
3	109	3	dead			
3	1(10)	1	x	5	1.00	
3	1(10)	2	x	4	1.25	
3	1(10)	3	x	3	1.00	
4	70	1	x	3	1.00	
4	70	2	x	3	0.75	
4	70	3	x	3	1.25	
4	105	1	x	3	1.00	
4	105	2	x	3	1.25	
4	105	3	x	3	1.50	
4	108	1	x	3	0.75	
4	108	2	x	3	0.75	
4	108	3	x	3	0.75	
4	PP	1	x	3	0.75	big weed
4	PP	2	x	3	1.00	
4	PP	3	x	3	1.00	
4	MP-718	1	x	3	1.50	
4	MP-718	2	x	4	1.25	
4	MP-718	3	x	3	1.75	
4	107	1	x	4	1.50	
4	107	2	x	4	1.25	
4	107	3	x	4	1.25	
4	109	1	x	3	1.00	
4	109	2	dead			
4	109	3	x	3	1.00	
4	1(10)	1	x	3	1.25	
4	1(10)	2	x	3	1.00	
4	1(10)	3	x	3	1.00	
5	70	1	x	4	1.00	
5	70	2	x	3	1.00	
5	70	3	x	3	1.00	

Rep	Accession	Plant #	Survived	Vigor (1-9) 1=best	Height (ft)	Remarks
5	105	1	x	3	1.00	
5	105	2	x	2	1.00	
5	105	3	x	3	1.00	
5	108	1	x	3	0.75	
5	108	2	x	4	0.75	
5	108	3	x	3	1.00	
5	PP	1	x	3	1.00	big Russian thistle
5	PP	2	x	3	1.00	
5	PP	3	x	5	0.75	
5	107	1	x	3	1.25	
5	107	2	dead			
5	107	3	x	3	1.25	
5	MP-718	1	x	3	1.25	
5	MP-718	2	x	3	1.25	
5	MP-718	3	x	3	1.25	
5	109	1	dead			
5	109	2	x	3	1.00	
5	109	3	x	3	0.75	
5	1(10)	1	x	3	0.75	
5	1(10)	2	dead			
5	1(10)	3	dead			

Table LP-7. Pine evaluation (replicated) near Hettinger, North Dakota.
Data was collected on September 23, 2009, and September 27, 2010. Replants in 2010 are of different sources.

Accession No.	Plant No.	Survival	Vigor (1=highest, 9=poorest)		Height (ft)		Remarks (2009)
			2009	2010	2009	2010	
Rep 1							
70	1	x	3	3	1.25	2.00	
	2	x	4	3	1.25	1.75	
	3	x	NA	2	1.25	1.75	30% brown needles
105	1	x	3	1	1.25	2.25	
	2	x	3	1	1.50	2.00	good growth
	3	x	3	1	1.25	2.25	good growth
108	1	x	2	2	1.25	2.00	
	2	x	2	1	1.40	2.50	good growth
	3	x	4	3	1.00	1.25	stressed
PP	1	x	5	4	1.00	1.25	
	2	x	2	1	2.00	2.75	
	3	x	3	1	1.50	2.50	
107	1	x	2	1	1.75	2.75	good growth
	2	x	3	1	1.25	2.25	
	3	x	3	1	1.25	2.25	
MP-718	1	x	3	3	1.50	2.50	
	2	x	3	3	1.50	2.50	
	3	x	3	2	1.40	2.75	
109	1	x	3	3	1.50	2.00	
	2	x	3	2	1.50	2.50	
	3	x	4	2	1.50	2.00	exposed roots
1 (10)	1	x	4	2	1.25	2.00	
	2	x	2	1	1.75	3.00	
	3	x	4	3	1.25	2.00	
Rep 2							
70	1	x	3	1	1.50	2.50	
	2	x	2	1	1.75	2.75	
	3	x	3	3	1.50	2.25	
105	1	x	2	3	2.00	3.00	
	2	x	3	1	1.50	2.50	
	3	x	3	3	1.25	1.75	yellowish
108	1	x	4	4	1.25	1.75	bud gone
	2	x	4	3	1.50	2.00	
	3	x	4	3	1.25	3.00	
PP	1	x	4	2	1.50	2.50	
	2	x	4	2	1.50	2.25	
	3	x	3	2	1.50	2.25	

Accession No.	Plant No.	Survival	Vigor (1=highest, 9=poorest)		Height (ft)		Remarks (2009)
			2009	2010	2009	2010	
107	1	x	3	1	2.00	3.00	
	2	x	3	2	1.50	2.25	
	3	x	2	2	1.25	2.00	
MP-718	1	x	3	3	1.25	3.00	
	2	x	3	3	1.50	2.25	
	3	x	4	4	1.25	1.25	
109	1	x	3	3	1.50	2.75	
	2	x	2	1	1.75	2.75	
	3	x	4	2	1.25	2.00	
1 (10)	1	x	3	3	2.00	2.25	
	2	x	4	2	1.50	2.25	
	3	x	3	2	1.50	2.25	
Rep 3							
70	1	x	4	2	1.25	1.75	dense Russian thistle
	2	x	3	1	1.50	2.25	dense Russian thistle
	3	x	4	2	1.25	2.25	dense Russian thistle
105	1	x	4	1	1.25	1.75	dense Russian thistle
	2	x	4	2	1.25	1.75	dense Russian thistle
	3	x	4	2	1.00	1.75	dense Russian thistle
108	1	x	4	2	1.00	2.50	dense Russian thistle
	2	x	3	1	1.75	2.25	dense Russian thistle
	3	x	4	4	1.25	1.75	dense Russian thistle
PP	1	x	4	3	1.25	1.75	dense Russian thistle
	2	x	4	2	1.50	2.25	dense Russian thistle
	3	x	5	3	1.00	1.25	dense Russian thistle
107	1	x	3	2	1.75	3.00	dense Russian thistle
	2	x	2	1	2.25	3.25	dense Russian thistle
	3	x	3	2	1.50	2.25	dense Russian thistle
MP-718	1	x	2	3	1.75	2.75	dense Russian thistle
	2	x	2	3	1.75	2.50	dense Russian thistle
	3	x	3	4	1.50	2.00	dense Russian thistle
MP 157	1	x	(Repl)	3	(Repl)	1.50	dense Russian thistle
109	2	x	4	2	1.00	1.25	dense Russian thistle
	3	x	4	1	1.25	1.75	dense Russian thistle
MP 158	1	x	(Repl)	2	(Repl)	1.50	dense Russian thistle
PP	2	x	(Repl)	3	(Repl)	0.75	dense Russian thistle
1 (10)	3	x	(Repl)	1	(Repl)	2.50	
Rep 4							
70	1	x	6	3	1.00	1.25	
	2	x	4	2	1.00	1.75	
	3	x	4	1	1.25	2.25	

Accession No.	Plant No.	Survival	Vigor (1=highest, 9=poorest)		Height (ft)		Remarks (2009)
			2009	2010	2009	2010	
105	1	x	3	1	1.50	2.25	
	2	x	2	1	2.00	3.25	
	3	x	3	1	1.50	2.25	
108	1	x	5	3	1.00	1.00	
	2	x	5	2	1.25	1.75	
	3	x	5	1	1.25	2.25	
PP	1	x	6	2	0.75	1.75	
	2	x	6	4	1.00	1.25	
	3	x	4	2	1.00	2.00	
MP-718	1	x	3	2	1.50	2.35	
	2	x	3	3	1.75	1.25	dense Russian thistle
	3	x	3	3	1.75	2.50	dense Russian thistle
107	1	x	4	1	1.50	2.50	dense Russian thistle
	2	x	6	2	1.25	1.25	dense Russian thistle
MP 157	3	x	(Repl)	2	(Repl)	1.50	dense Russian thistle
109	1	x	4	1	1.25	1.50	dense Russian thistle
	2	x	3	1	1.50	2.00	dense Russian thistle
	3	x	4	2	1.25	1.50	dense Russian thistle
1 (10)	1	x	3	1	1.75	2.25	dense Russian thistle
	2	x	4	1	1.50	2.25	dense Russian thistle
	3	x	5	2	1.25	1.75	dense Russian thistle
Rep 5							
70	1	x	6	2	1.25	1.50	brown needles
	2	x	6	1	1.25	1.50	no bud
	3	x	6	1	1.50	1.50	dense Russian thistle
MP 156	1	x	(Repl)	2	(Repl)	1.50	dense Russian thistle
MP 157	2	x	(Repl)	1	(Repl)	1.25	brown needles
105	3	x	5	4	1.50	1.00	dense Russian thistle
MP 157	1	x	(Repl)	2	(Repl)	1.25	dense Russian thistle
MP 154	2	x	(Repl)	1	(Repl)	1.50	dense Russian thistle
MP 157	3	x	(Repl)	1	(Repl)	1.25	dense Russian thistle
PP	1	x	4	1	1.50	1.50	dense Russian thistle
	2	x	4	1	1.25	1.50	dense Russian thistle
	3	x	4	4	1.25	1.50	dense Russian thistle
107	1	x	(Repl)	2	(Repl)	1.50	dense Russian thistle
	2	x	4	2	1.25	2.25	dense Russian thistle
	3	x	3	1	1.75	2.75	dense Russian thistle
MP-718	1	x	2	2	2.00	2.75	dense Russian thistle
	2	x	2	3	2.00	2.75	dense Russian thistle
	3	x	2	3	2.00	2.75	dense Russian thistle

Accession No.	Plant No.	Survival	Vigor (1=highest, 9=poorest)		Height (ft)		Remarks (2009)
			2009	2010	2009	2010	
109	1	x	3	1	1.50	2.50	dense Russian thistle
	2	x	4	1	1.75	2.50	dense Russian thistle
	3	x	5	5	1.00	1.00	
1 (10)	1	x	4	1	1.50	2.75	
	2	x	3	1	1.25	2.25	
	3	x	2	1	1.75	2.25	

Table LP-8. Pine evaluation (replicated) near Hettinger, North Dakota. 2011 and 2012 data

MP-154 = replanted accession as of 2010

** Accession replant sources from 2008 and 2009 and accessions originally planted. No further replants unless planted by owners.

***Vigor rating (1-9): 1=best, 9=poorest

Site	Rep	Accession as of 2010**	Plant #	5/27/2011			10/16/2012			2012 Notes
				Vigor rating ***	Height (ft)	% brown top	Vigor rating ***	Height (ft)	Width (ft)	
Hettinger	1	070	1	3	2.25	15%	2	3.00	1.75	yellow with brown tips
Hettinger	1	MP-154	2	3	2.00	15%	2	2.75	1.75	
Hettinger	1	070	3	2	2.00	15%	4	3.75	2.00	
Hettinger	1	105	1	2	2.75	10%	2	4.25	3.00	
Hettinger	1	105	2	3	2.50	10%	2	3.25	2.50	
Hettinger	1	105	3	1	2.75	10%	2	4.25	2.75	
Hettinger	1	108	1	2	2.25	5%	2	3.50	2.25	
Hettinger	1	108	2	1	3.00	5%	2	5.00	3.75	
Hettinger	1	108	3	2	1.50	5%	2	2.75	1.25	
Hettinger	1	PP	1	3	1.25	10%	2	2.50	1.50	
Hettinger	1	PP	2	2	3.00	10%	2	5.75	4.50	
Hettinger	1	PP	3	2	2.75	10%	2	5.75	3.50	
Hettinger	1	107	1	1	3.25	< 5%	2	5.00	4.75	5% dead limbs
Hettinger	1	107	2	1	2.75	< 5%	3	4.75	2.50	
Hettinger	1	107	3	1	3.00	< 5%	1	4.75	3.50	
Hettinger	1	MP-718	1	1	3.00	< 5%	4	5.50	4.00	yellow needles
Hettinger	1	MP-718	2	1	3.00	< 5%	4	5.00	3.75	yellow needles
Hettinger	1	MP-718	3	1	3.25	< 5%	3	6.00	4.00	yellow needles
Hettinger	1	109	1	1	2.50	0%	2	4.25	3.50	
Hettinger	1	109	2	1	3.00	0%	2	5.00	4.00	
Hettinger	1	109	3	1	2.50	0%	2	4.75	3.00	
Hettinger	1	1-10	1	1	2.50	0%	2	5.50	3.00	
Hettinger	1	1-10	2	1	3.50	0%	2	5.50	4.50	
Hettinger	1	1-10	3	2	2.25	0%	2	4.75	3.25	
Hettinger	2	070	1	1	2.75	< 5%	2	4.75	2.75	
Hettinger	2	070	2	1	3.25	< 5%	2	6.00	3.75	
Hettinger	2	070	3	1	2.75	< 5%	2	4.75	2.50	

				5/27/2011			10/16/2012			
Site	Rep	Accession as of 2010**	Plant #	Vigor rating ***	Height (ft)	% brown top	Vigor rating ***	Height (ft)	Width (ft)	2012 Notes
Hettinger	2	105	1	2	3.50	0%	2	6.00	4.00	
Hettinger	2	105	2	1	3.00	0%	2	4.75	3.00	
Hettinger	2	105	3	3	3.00	0%	2	3.00	2.50	
Hettinger	2	108	1	5	2.00	10%	2	3.25	2.50	
Hettinger	2	108	2	3	2.25	10%	2	4.25	3.00	
Hettinger	2	108	3	3	2.25	10%	2	3.75	2.75	
Hettinger	2	PP	1	2	2.50	10%	2	5.00	3.75	
Hettinger	2	PP	2	2	2.50	10%	2	4.50	2.75	
Hettinger	2	PP	3	2	2.25	10%	2	4.75	4.50	
Hettinger	2	107	1	2	3.50	10%	2	5.00	3.50	
Hettinger	2	107	2	2	2.75	10%	2	4.25	3.00	
Hettinger	2	107	3	2	2.50	10%	2	4.00	2.75	
Hettinger	2	MP-718	1	4	2.75	20%	4	4.50	3.25	pale green with yellow tips
Hettinger	2	MP-718	2	3	2.50	20%	4	4.75	3.00	pale green with yellow tips
Hettinger	2	MP-718	3	4	2.00	20%	4	4.00	2.75	pale green with yellow tips
Hettinger	2	109	1	3	3.25	10%	5	4.75	4.00	30% laterals with live base and 6" dead tips
Hettinger	2	109	2	2	3.25	10%	3	5.00	4.50	10% laterals with live base and 6" dead tips
Hettinger	2	109	3	2	2.25	10%	3	4.25	3.00	5% laterals with live base and 6" dead tips
Hettinger	2	1-10	1	4	2.50	25%	4	4.00	3.25	20% laterals with live base and 6" dead tips
Hettinger	2	1-10	2	3	2.75	25%	3	4.25	2.25	5% laterals with live base and 6" dead tips
Hettinger	2	1-10	3	4	2.25	25%	3	4.00	3.25	
Hettinger	3	070	1	2	2.25	< 5%	2	3.75	2.75	
Hettinger	3	070	2	2	2.75	< 5%	2	5.25	3.25	grasshoppers ate 90% of needles on candle
Hettinger	3	070	3	2	2.50	< 5%	2	4.25	3.25	
Hettinger	3	105	1	2	2.00	< 5%	2	3.25	3.00	
Hettinger	3	105	2	2	2.00	< 5%	2	3.25	2.50	
Hettinger	3	105	3	2	2.00	< 5%	2	3.50	2.50	
Hettinger	3	108	1	3	3.00	< 5%	2	5.00	3.75	
Hettinger	3	108	2	1	2.75	< 5%	2	5.25	3.50	
Hettinger	3	108	3	3	1.75	< 5%	2	3.25	2.00	
Hettinger	3	PP	1	2	1.75	< 5%	2	4.25	3.00	

				5/27/2011			10/16/2012			
Site	Rep	Accession as of 2010**	Plant #	Vigor rating ***	Height (ft)	% brown top	Vigor rating ***	Height (ft)	Width (ft)	2012 Notes
Hettinger	3	PP	2	2	2.25	< 5%	2	5.25	2.75	
Hettinger	3	PP	3	3	1.25	< 5%	2	2.75	2.00	
Hettinger	3	107	1	3	3.50	< 5%	2	5.25	3.25	
Hettinger	3	107	2	2	3.75	< 5%	2	6.00	4.25	
Hettinger	3	107	3	3	2.75	< 5%	2	4.00	3.00	
Hettinger	3	MP-718	1	3	3.00	15%	3	4.75	3.00	yellow needles
Hettinger	3	MP-718	2	3	2.75	15%	3	5.00	3.00	yellow needles
Hettinger	3	MP-718	3	4	2.25	15%	3	4.00	3.00	yellow needles
Hettinger	3	MP-157	1	3	1.75	10%	5	3.50	2.25	pocket gopher under tree and yellow needles
Hettinger	3	109	2	4	1.75	10%	2	3.00	2.00	
Hettinger	3	109	3	4	2.25	10%	2	4.25	3.00	
Hettinger	3	MP-158	1	2	1.50	15%	3	3.25	2.25	5% laterals with live base and 6" dead tips
Hettinger	3	PP	2	3	1.00	15%	3	2.50	1.25	
Hettinger	3	1-10	3	3	3.00	15%	3	4.50	2.25	
Hettinger	4	070	1	4	1.50	20%	2	3.00	1.75	
Hettinger	4	070	2	3	2.00	20%	2	3.25	2.25	
Hettinger	4	070	3	2	2.75	20%	1	4.25	2.50	
Hettinger	4	105	1	2	2.75	10%	2	4.50	3.00	
Hettinger	4	105	2	2	3.75	10%	2	5.25	4.00	
Hettinger	4	105	3	2	2.25	10%	2	4.25	3.25	
Hettinger	4	108	1	5	1.00	20%	3	1.75	1.00	5% laterals with live base and 6" dead tips
Hettinger	4	108	2	3	2.25	20%	2	4.00	2.50	
Hettinger	4	108	3	3	2.75	20%	3	4.25	2.75	
Hettinger	4	PP	1	2	1.75	0%	3	3.75	2.75	smooth brome on edge of fabric
Hettinger	4	PP	2	5	1.25	0%	5	1.75	1.25	smooth brome on edge of fabric
Hettinger	4	PP	3	2	2.00	0%	3	4.00	3.00	smooth brome on edge of fabric
Hettinger	4	MP-718	1	2	2.50	20%	3	4.25	3.50	yellow needles
Hettinger	4	MP-718	2	4	1.50	20%	3	3.50	2.25	yellow needles
Hettinger	4	MP-718	3	3	3.00	20%	3	4.75	2.50	yellow needles
Hettinger	4	107	1	2	2.50	< 5%	4	3.50	1.50	limbs only on southeast side
Hettinger	4	107	2	3	1.25	< 5%	3	2.00	1.00	

				5/27/2011			10/16/2012			
Site	Rep	Accession as of 2010**	Plant #	Vigor rating ***	Height (ft)	% brown top	Vigor rating ***	Height (ft)	Width (ft)	2012 Notes
Hettinger	4	MP-157	3	3	1.75	< 5%	4	3.25	2.25	yellow needles
Hettinger	4	109	1	3	2.00	< 5%	3	2.75	1.75	
Hettinger	4	109	2	2	2.50	< 5%	2	3.75	3.00	bindweed
Hettinger	4	109	3	2	2.00	< 5%	3	3.00	2.25	bindweed
Hettinger	4	1-10	1	4	2.25	10%	3	3.50	1.75	bindweed
Hettinger	4	1-10	2	3	2.75	10%	4	4.00	2.25	bindweed
Hettinger	4	1-10	3	3	2.00	10%	4	4.00	1.75	bindweed
Hettinger	5	MP-154	1	2	1.75	0%	3	2.75	1.75	bindweed
Hettinger	5	MP-158	2	2	2.00	0%	3	3.75	2.75	bindweed
Hettinger	5	070	3	2	2.00	0%	2	3.50	1.25	bindweed
Hettinger	5	MP-156	1	3	1.75	10%	3	3.75	2.25	bindweed
Hettinger	5	MP-157	2	3	1.50	10%	4	2.25	1.50	bindweed
Hettinger	5	105	3	5	1.00	10%	7	1.00	0.50	bindweed
Hettinger	5	MP-157	1	2	1.50	0%	3	3.25	2.00	bindweed yellow needles
Hettinger	5	MP-154	2	2	1.75	0%	3	3.50	2.00	bindweed yellow needles
Hettinger	5	MP-157	3	3	1.50	0%	3	3.00	1.75	bindweed yellow needles
Hettinger	5	PP	1	3	1.50	0%	2	3.25	1.75	bindweed
Hettinger	5	PP	2	2	1.75	0%	2	3.25	2.50	bindweed
Hettinger	5	PP	3	4	1.50	0%	3	3.00	2.25	bindweed
Hettinger	5	UNKNOWN	1	3	1.75	10%	3	3.75	2.00	bindweed plus thistle
Hettinger	5	107	2	1	2.75	10%	2	4.25	2.50	bindweed
Hettinger	5	107	3	2	3.25	10%	3	4.75	2.75	bindweed 5% laterals with live base and 6" dead tips
Hettinger	5	MP-718	1	2	3.00	< 5%	2	5.00	3.75	bindweed yellow needles
Hettinger	5	MP-718	2	2	3.00	< 5%	3	4.75	4.00	bindweed yellow needles
Hettinger	5	MP-718	3	2	3.00	< 5%	3	5.00	4.00	bindweed yellow needles
Hettinger	5	109	1	3	3.00	10%	4	5.25	2.75	bindweed
Hettinger	5	109	2	3	3.00	10%	3	4.75	2.25	bindweed 15% laterals with live base and 6" dead tips
Hettinger	5	109	3	5	1.25	10%	4	1.75	1.00	bindweed
Hettinger	5	1-10	1	2	3.00	< 5%	2	4.75	2.75	
Hettinger	5	1-10	2	2	2.50	< 5%	2	4.75	3.25	
Hettinger	5	1-10	3	2	3.00	< 5%	2	5.25	3.25	

Table LP-9. Pine evaluation (replicated) near Hettinger, North Dakota, evaluated 10/6/2015

Rep	Seed Source (accession) as of Sept. 2010 ¹	Plant No.	Vigor (1-9) 1= best	Height (feet)	Width (feet)	Notes ²
Rep 1	070	1	3	3.5	3	first 6 trees competing with mature cottonwood roots
Rep 1	MP-154	2	2	4.5	3	double leader
Rep 1	070	3	3	6.25	3.5	double leader
Rep 1	105	1	2	6.25	5	double leader
Rep 1	105	2	3	5.25	3.5	crooked main stem
Rep 1	105	3	3	5.5	3.75	crooked main stem
Rep 1	108	1	2	5.75	3	nice form
Rep 1	108	2	3	7	4	damaged main trunk at 4'
Rep 1	108	3	3	4	2.5	double leader
Rep 1	PP	1	2	5.25	3	
Rep 1	PP	2	2	9	5.5	
Rep 1	PP	3	2	9.75	5	
Rep 1	107	1	2	7.75	5.5	double leader
Rep 1	107	2	2	8	4	main stem severely damaged, possibly hail
Rep 1	107	3	2	8.5	4.75	
Rep 1	MP-718	1	3	9.5	5	stem damage
Rep 1	MP-718	2	3	6.75	4.5	double leader
Rep 1	MP-718	3	3	7.5	4.75	double leader
Rep 1	109	1	2	7.25	5.25	double leader
Rep 1	109	2	2	8.5	5.25	double leader
Rep 1	109	3	2	9	5	double leader
Rep 1	1-10	1	3	8	3.5	
Rep 1	1-10	2	2	9	5	double leader
Rep 1	1-10	3	3	7.5	4.75	10% of buds with heavy pitch ooze
Rep 2	070	1	2	7.75	4.75	
Rep 2	070	2	2	9	5.5	double leader
Rep 2	070	3	3	8	5	double leader
Rep 2	105	1	3	8.75	6	
Rep 2	105	2	2	7.75	5.5	double leader
Rep 2	105	3	3	5.25	3.5	double leader
Rep 2	108	1	3	4.25	3.25	
Rep 2	108	2	3	6.5	4.5	tip damage and double leader
Rep 2	108	3	3	4.5	3.75	double leader
Rep 2	PP	1	2	8.75	5.5	
Rep 2	PP	2	2	9	5	
Rep 2	PP	3	2	8.75	5.25	

Rep	Seed Source (accession) as of Sept. 2010 ¹	Plant No.	Vigor (1-9) 1= best	Height (feet)	Width (feet)	Notes ²
Rep 2	107	1	3	7	3.75	double leader
Rep 2	107	2	3	4.5	3.25	double leader
Rep 2	107	3	2	5.75	2.75	
Rep 2	MP-718	1	3	8.25	4	
Rep 2	MP-718	2	3	6.5	4	
Rep 2	MP-718	3	4	4.5	3.5	
Rep 2	109	1	6	3.5	3	only bottom two whorls still alive; bad hail damage
Rep 2	109	2	2	6.75	5	double leader
Rep 2	109	3	2	6	5	double leader
Rep 2	1-10	1	5	5.5	2.75	bark still missing on half stem circumference
Rep 2	1-10	2				DEAD
Rep 2	1-10	3	3	5.5	2.75	
Rep 3	070	1	2	6.5	4	
Rep 3	070	2	2	8.25	5	
Rep 3	070	3	3	5	4	double leader
Rep 3	105	1	3	5.75	4.25	
Rep 3	105	2	3	4.75	3.75	double leader
Rep 3	105	3	2	5.5	3	
Rep 3	108	1	3	7	3.75	
Rep 3	108	2	3	8.75	4	
Rep 3	108	3	2	6.25	3	really nice form
Rep 3	PP	1	3	7.5	4.75	
Rep 3	PP	2	3	9	4.25	lots of volunteer elm
Rep 3	PP	3	3	4.25	2	PP callused quickly or was not as severely damaged
Rep 3	107	1	3	6.5	3.5	
Rep 3	107	2	4	6.5	3.75	
Rep 3	107	3	4	5.5	3	
Rep 3	MP-718	1	6	4.5	2.5	no ID stake
Rep 3	MP-718	2	3	6.75	4.5	
Rep 3	MP-718	3	4	6	3.5	
Rep 3	MP-157	1	4	5.5	3	no ID stake
Rep 3	109	2	3	4.5	2.75	
Rep 3	109	3	5	4	2.75	
Rep 3	MP-158	1	3	5.5	3.5	ID stake matches original rep, not current replacements
Rep 3	PP	2	4	4.5	2	
Rep 3	1-10	3	3	5.25	3.5	double leader

Rep	Seed Source (accession) as of Sept. 2010 ¹	Plant No.	Vigor (1-9) 1= best	Height (feet)	Width (feet)	Notes ²
Rep 4	070	1	4	4.25	2.5	
Rep 4	070	2	3	4	3.5	double leader
Rep 4	070	3	3	6.75	4.5	double leader
Rep 4	105	1	3	6.5	4	yellow foliage appears like Scots pine, double leader
Rep 4	105	2	2	7	5.5	double leader
Rep 4	105	3	2	6.5	5	double leader
Rep 4	108	1	4	2.75	2.25	
Rep 4	108	2	3	5.75	4.5	
Rep 4	108	3	2	6.5	3.5	double leader
Rep 4	PP	1	2	6	4	
Rep 4	PP	2	6	1.5	1.5	
Rep 4	PP	3	2	6.25	3	
Rep 4*	MP-718	1	3	6	5	
Rep 4*	MP-718	2	3	4.5	4	
Rep 4*	MP-718	3	2	6	5	
Rep 4*	107	1				DEAD
Rep 4*	107	2	4	1.75	1.5	
Rep 4*	MP-157	3	3	4	3	
Rep 4	109	1	3	3.25	2.75	double leader
Rep 4	109	2	3	4.25	3.5	double leader
Rep 4	109	3	3	4.75	3.5	
Rep 4	1-10	1				DEAD
Rep 4	1-10	2	7	3.25	1.75	
Rep 4	1-10	3	4	3.5	2.75	
Rep 5	MP-154	1	3	4.25	2.25	double leader
Rep 5	MP-158	2	2	6.25	4.5	double leader
Rep 5	070	3	6	3	1.75	gophers chewing roots
Rep 5	MP-156	1	3	6	4	double leader
Rep 5	MP-157	2	5	2.5	2.5	
Rep 5	105	3				DEAD
Rep 5	MP-157	1	3	4.5	4	double leader
Rep 5	MP-154	2	3	5.5	3.75	
Rep 5	MP-157	3	4	4.25	3	
Rep 5	PP	1	2	5.5	3	
Rep 5	PP	2	2	5.5	4.5	
Rep 5	PP	3	3	4.5	3	

Rep	Seed Source (accession) as of Sept. 2010 ¹	Plant No.	Vigor (1-9) 1= best	Height (feet)	Width (feet)	Notes ²
Rep 5	UNKNOWN	1				DEAD
Rep 5	107	2	6	3	2.5	
Rep 5	107	3	4	5.75	2.75	double leader
Rep 5	MP-718	1	3	6.25	4.75	double leader
Rep 5	MP-718	2	2	6.75	5.25	double leader
Rep 5	MP-718	3	3	6.5	5	double leader
Rep 5	109	1	5	5.25	3	
Rep 5	109	2	2	6.75	3.5	
Rep 5	109	3	3	3.75	2	
Rep 5	1-10	1	3	6.25	3	
Rep 5	1-10	2	3	6	4	
Rep 5	1-10	3	2	6.5	5	

¹ Seed source column accounts for all replant sources from 2009 and 2010 as well as the originals. In the future, seed sources should not change unless landowner replants any that die.

²This windbreak was subjected to a severe hail storm May 29, 2013 with 1-inch diameter hail. Many trees, especially lodgepole, had apical tips broken and up to 50%+ circumference of bark girdled. Some still show 30%+ circumference girdled in 2015.

Table LP-10. Pine evaluation planted in 2008 at Angustora State Park near Hot Springs, South Dakota. Data was collected on October 31, 2008.

Accession No.	Plant No.	Survival	Vigor (1 = highest, 9=poorest)	Height (ft)	Remarks
Rep 1					
70	1	dead	-	0.75	dead needles
70	2	x	6	1.00	
70	3	x	8	0.75	
105	1	dead	-		
105	2	x	7	1.00	
105	3	dead	-		
108	1	x	5	1.00	
108	2	dead	-		
108	3	x	4	1.00	
PP	1	x	4	1.25	
PP	2	x	3	1.25	
PP	3	x	3	1.25	
107	1	x	5	1.25	
107	2	x	5	1.25	needles at top only
107	3	x	5	1.25	needles at top only
MP-718	1	x	3	1.25	
MP-718	2	x	3	1.00	
MP-718	3	x	3	1.00	
109	1	x	4	1.50	
109	2	x	7	1.00	leader browsed
109	3	dead	-		
1 (10)	1	x	6	1.00	
1 (10)	2	x	7	0.75	
1 (10)	3	x	8	1.00	
Rep 2					
70	1	x	7	1.00	
70	2	x	8	1.00	
70	3	x	8	1.00	
105	1	dead	-		
105	2	dead	-		
105	3	dead	-		
108	1	x	5	0.75	
108	2	x	6	0.75	
108	3	x	6	1.00	
PP	1	x	2	1.50	
PP	2	x	3	1.00	
PP	3	x	3	1.00	
107	1	x	4	1.25	
107	2	x	5	1.50	needles on top only
107	3	x	6	1.25	
MP-718	1	x	4	1.25	
MP-718	2	x	4	1.25	
MP-718	3	x	5	1.00	

Accession No.	Plant No.	Survival	Vigor (1 = highest, 9=poorest)	Height (ft)	Remarks
109	1	x	6	1.00	
109	2	dead	-		
109	3	x	9	0.75	
1 (10)	1	x	6	0.75	
1 (10)	2	x	5	1.50	needles on top only
1 (10)	3	dead	-		
Rep 3					
70	1	x	9	0.50	
70	2	x	5	0.75	
70	3	x	6	1.00	
105	1	dead	-		
105	2	dead	-		
105	3	dead	-		
108	1	x	5	0.75	
108	2	x	3	0.75	
108	3	dead	-		
PP	1	x	3	1.25	
PP	2	x	4	1.00	
PP	3	x	3	1.00	
107	1	dead	-		
107	2	x	8	1.00	pulled out partially
107	3	dead	-		
MP-718	1	x	3	1.00	
MP-718	2	x	2	1.25	
MP-718	3	x	2	1.25	
109	1	x	4	1.00	
109	2	x	6	1.50	
109	3	dead	-		
1 (10)	1	x	4	1.25	
1 (10)	2	dead	-		
1 (10)	3	x	4	1.00	
Rep 4					
70	1	x	5	1.00	
70	2	dead	-		
70	3	x	5	1.00	
105	1	x	6	1.75	
105	2	x	6	0.75	
105	3	x	6	1.00	
108	1	x	9	0.50	
108	2	dead	-		
108	3	dead	-		
PP	1	x	2	1.25	
PP	2	x	3	1.00	
PP	3	x	3	1.00	
107	1	x	4	1.25	
107	2	x	6	1.00	

Accession No.	Plant No.	Survival	Vigor (1 = highest, 9=poorest)	Height (ft)	Remarks
107	3	x	5	1.25	
MP-718	1	x	4	1.25	
MP-718	2	x	4	1.75	leader browsed
MP-718	3	x	3	1.00	
109	1	x	6	1.25	
109	2	x	6	1.00	
109	3	dead	-		
1 (10)	1	x	7	1.00	
1 (10)	2	x	9	1.00	
1 (10)	3	dead	-		
Rep 5					
70	1	x	5	1.00	
70	2	x	6	1.00	
70	3	x	6	1.00	
105	1	x	3	0.75	
105	2	dead	-		
105	3	dead	-		
108	1	x	4	1.00	
108	2	x	3	0.75	
108	3	x	3	0.75	
PP	1	x	4	1.00	
PP	2	x	4	1.25	
PP	3	x	4	1.25	
107	1	x	7	1.25	
107	2	x	8	1.00	
107	3	dead	-		
MP-718	1	x	3	1.00	
MP-718	2	x	3	1.25	
MP-718	3	x	3	1.50	
109	1	x	6	0.75	
109	2	x	7	1.00	
109	3	dead	-		
1 (10)	1	x	7	1.00	
1 (10)	2	dead	-		
1 (10)	3	x	6	1.25	

Table LP-11. Pine evaluation at Angustora State Park near Hot Springs, South Dakota.
Data was collected on 10/13/09.



= dead plant at 2009 inventory

= dead plant at 2008 inventory and replanted spring 2009

= original accession died between 2008 inventory and spring 2009; replanted to listed accession in spring 2009.

Rep	Accession	Plant #	Vigor (1-9) 1 = best; 9=worst	Height (feet)	Remarks*
1	070	1	4	1.00	short with brown needles; protective cage
1	070	2	3	1.00	protective cage
1	070	3	4	1.25	very yellow but long needles; protective cage
1	105	1	4	1.00	protective cage
1	105	2	3	1.00	protective cage
1	105	3	2	1.00	protective cage
1	108	1	3	1.00	yellow but full; protective cage
1	108	2	4	0.75	short green needles; protective cage
1	108	3	9	0.00	protective cage
1	PP	1	3	1.25	protective cage
1	PP	2	4	1.00	laid over but alive; protective cage
1	PP	3	2	1.00	double leader; protective cage
1	107	1	9	0.00	protective cage
1	107	2	2	1.50	protective cage
1	107	3	9	0.00	protective cage
1	MP 158	1	3	1.50	protective cage
1	MP 718	2	4	0.50	only one branch not chewed; protective cage
1	MP 718	3	4	1.25	protective cage
1	109	1	9	0.00	protective cage
1	109	2	9	0.00	protective cage
1	109	3	2	1.75	protective cage
1	1-10	1	2	2.00	protective cage
1	1-10	2	2	1.50	protective cage
1	1-10	3	3	1.50	protective cage
2	070	1	3	1.00	protective cage
2	070	2	2	1.00	protective cage
2	070	3	9	0.00	protective cage
2	105	1	3	1.00	protective cage
2	105	2	9	0.00	protective cage
2	105	3	9	0.00	protective cage
2	108	1	3	1.25	protective cage
2	108	2	2	1.00	protective cage
2	108	3	3	1.00	protective cage
2	PP	1	3	1.00	protective cage
2	PP	2	3	1.25	protective cage
2	PP	3	3	1.00	protective cage

Rep	Accession	Plant #	Vigor (1-9) 1 = best; 9 = worst	Height (feet)	Remarks
2	107	1	9	0.00	protective cage
2	107	2	9	0.00	protective cage
2	107	3	2	1.25	protective cage
2	MP 158	1	3	1.50	protective cage
2	MP 158	2	3	1.50	protective cage
2	MP 718	3	4	0.75	protective cage
2	109	1	3	2.00	protective cage
2	109	2	3	1.50	protective cage
2	109	3	3	1.25	protective cage
2	1-10	1	2	2.00	protective cage
2	1-10	2	2	1.25	protective cage
2	1-10	3	2	1.50	protective cage
3	070	1	3	1.00	protective cage
3	070	2	3	1.00	protective cage
3	070	3	3	0.75	protective cage
3	105	1	9	0.00	protective cage
3	105	2	9	0.00	protective cage
3	105	3	3	0.75	protective cage
3	108	1	3	1.00	protective cage
3	108	2	3	1.00	protective cage
3	108	3	4	0.50	protective cage
3	PP	1	4	1.00	protective cage
3	PP	2	5	1.00	protective cage
3	PP	3	4	1.00	protective cage
3	107	1	2	1.00	protective cage
3	107	2	2	1.00	protective cage
3	107	3	3	1.00	protective cage
3	MP 158	1	3	1.50	no protective cage
3	MP 718	2	4	1.50	no protective cage
3	MP 718	3	4	1.00	no protective cage
3	109	1	5	1.50	very yellow; no protective cage
3	109	2	3	1.50	no protective cage
3	109	3	3	1.75	no protective cage
3	1-10	1	4	1.50	all yellow; no protective cage
3	1-10	2	3	1.75	no protective cage
3	1-10	3	4	1.00	no protective cage
4	PP	1	2	1.00	no protective cage
4	PP	2	2	1.25	no protective cage
4	PP	3	3	1.25	no protective cage
4	PP	1	2	1.25	no protective cage
4	PP	2	2	1.25	no protective cage
4	PP	3	3	0.75	no protective cage
4	PP	1	2	1.00	no protective cage

Rep	Accession	Plant #	Vigor (1-9) 1 = best; 9 = worst	Height (feet)	Remarks
4	PP	2	2	1.00	no protective cage
4	PP	3	3	1.25	no protective cage
4	PP	1	4	1.00	no protective cage
4	PP	2	4	1.00	2 plants in one hole or double leader; no cage
4	PP	3	3	1.00	no protective cage
4	PP	1	4	1.00	no protective cage
4	PP	2	3	1.00	no protective cage
4	PP	3	4	0.75	no protective cage
4	PP	1	2	1.00	no protective cage
4	PP	2	3	1.00	no protective cage
4	PP	3	3	0.75	no protective cage
4	PP	1	2	1.25	no protective cage
4	PP	2	6	0.25	only one live branch; no protective cage
4	PP	3	4	0.75	no protective cage
4	PP	1	2	1.00	no protective cage
4	PP	2	3	0.75	no protective cage
4	PP	3	2	0.75	no protective cage
5	PP	1	3	0.75	no protective cage
5	PP	2	3	1.00	no protective cage
5	PP	3	5	1.00	very bent; no protective cage
5	PP	1	3	1.00	no protective cage
5	PP	2	3	0.75	no protective cage
5	PP	3	5	1.00	no protective cage
5	PP	1	4	1.00	no protective cage
5	PP	2	4	1.00	no protective cage
5	PP	3	3	1.00	no protective cage
5	PP	1	5	1.00	no protective cage
5	PP	2	4	1.00	no protective cage
5	PP	3	4	1.25	no protective cage
5	PP	1	4	1.00	no protective cage
5	PP	2	4	1.00	no protective cage
5	PP	3	3	1.25	no protective cage
5	PP	1	2	1.00	no protective cage
5	MP 718	2	5	1.00	no protective cage
5	PP	3	3	1.00	no protective cage
5	PP	1	3	1.00	no protective cage
5	PP	2	3	1.00	no protective cage
5	PP	3	5	0.75	no protective cage
5	PP	1	3	0.75	no protective cage
5	PP	2	4	0.75	no protective cage
5	PP	3	4	1.00	no protective cage

*Most entries were replanted 5/6/09 due to deer damage. Protective cages were installed through most of replication 3 in 2009.

Table LP-12. Pine evaluation at Angustora State Park near Hot Springs, South Dakota. Data was collected on 9/28/10. (Replications 4 and 5 were replanted to ponderosa pine and are not included in this table.)

Accession No.	Plant No.	Survival	Vigor (1=highest, 9=poorest) 2010	Height (ft) 2010	Remarks 2010
Rep 1					
70	1	x	4	1.25	yellow foliage
	2	x	4	1.50	
	3	x	4	1.25	
105	1	x	8	1.00	2 green needles
	2	x	4	1.00	
	3	x	1	1.50	
108	1	x	4	1.50	
	2	x	7	0.75	
	3	dead	NA	NA	
PP	1	x	3	1.75	
	2	x	7	0.50	
	3	x	2	1.75	
107	1	x	4	1.50	
	2	x	3	2.00	
	3	dead	NA	NA	
MP 158	1	x	3	2.00	
MP 718	2	x	6	1.00	
MP 718	3	x	3	1.75	volunteer elm
109	1	x	5	1.75	
	2	x	5	1.50	
	3	x	3	2.25	
1 (10)	1	x	4	2.50	yellow foliage
	2	x	2	2.25	
	3	x	2	2.00	
Rep 2					
70	1	x	3	1.25	
	2	x	3	1.50	
	3	x	4	1.50	no cage, flood sediments
105	1	x	4	1.25	no id stake
	2	dead	NA	NA	no id stake
	3	dead	NA	NA	no id stake
108	1	x	2	1.50	flood sediments
	2	x	8	1.00	1 live limb
	3	x	3	1.25	
PP	1	x	4	1.25	
	2	x	3	1.50	
	3	x	3	1.00	

Accession No.	Plant No.	Survival	Vigor (1=highest, 9=poorest) 2010	Height (ft) 2010	Remarks 2010
107	1	dead	NA	NA	
	2	dead	NA	NA	
	3	x	1	1.75	
MP 158	1	x	3	2.25	
MP 158	2	x	4	2.00	yellow foliage
	3	x	5	1.00	yellow/brown foliage
109	1	x	3	2.25	
	2	x	3	2.00	
	3	x	8	2.25	
1 (10)	1	x	4	2.25	
	2	x	3	2.00	
	3	x	5	2.25	
Rep 3					
70	1	x	2	1.00	
	2	x	5	0.75	
	3	x	6	0.50	
105	1	x	8	1.75	few green needles
	2	x	8	1.50	few green needles
	3	x	5	1.25	yellow
108	1	x	3	1.50	
	2	x	3	1.25	
	3	dead	NA	NA	
PP	1	x	7	1.00	
	2	dead	NA	NA	
	3	x	6	1.00	
107	1	x	4	1.75	
	2	dead	NA	NA	
	3	x	5	1.25	
MP 158	1	x	4	1.00	
MP 718	2	x	4	1.50	
MP 719	3	x	3	2.00	
109	1	x	5	1.50	
	2	x	5	1.25	
	3	x	NA	NA	
1 (10)	1	x	5	1.25	
	2	x	NA	NA	
	3	x	NA	NA	

Table LP-13. Pine evaluation (replicated) at Angostura State Park near Hot Springs, South Dakota, 2011 and 2012 data.

☐ = original accession was replanted to listed accession in spring 2009.

Accessions marked **MP** were replanted to unknown accession of Mongolian pine by field staff on 5/14/2010.

▨ = plant has been replaced with another unknown accession (do not use the data for analysis of accessions)

*Vigor rating: 1-9; 1=best, 9=worst

Site	Rep	Accession	Plant #	5/26/2011		10/17/2012		
				Vigor rating*	Length (ft)	Vigor rating*	Height (ft)	Width (ft)
Angostura	1	070	1	4	1.50	9		
Angostura	1	070	2	5	1.50	9		
Angostura	1	070	3	3	1.50	9		
Angostura	1	105	1	9		9		
Angostura	1	105	2	5	1.00	9		
Angostura	1	105	3	2	2.00	4	2.25	2.25
Angostura	1	108	1	3	1.75	5	1.75	1.00
Angostura	1	108	2	4	2.00	9		
Angostura	1	MP	3	4	2.00	9		
Angostura	1	PP	1	2	2.00	3	2.25	1.00
Angostura	1	PP	2	8	0.50	9		
Angostura	1	PP	3	7	2.00	3	2.50	2.00
Angostura	1	MP	1	6	1.75	9		
Angostura	1	107	2	2	2.25	9		
Angostura	1	107	3	9		9		
Angostura	1	MP 158	1	4	2.25	9		
Angostura	1	MP 718	2	9		9		
Angostura	1	MP 718	3	4	2.00	9		
Angostura	1	MP	1	6	1.75	9		
Angostura	1	MP	2	6	1.50	9		
Angostura	1	109	3	2	3.00	3	2.75	1.75
Angostura	1	1-10	1	3	3.00	3	3.25	1.75
Angostura	1	MP	2	3	2.75	5	3.00	1.50
Angostura	1	MP	3	4	2.25	5	2.75	1.50
Angostura	2	070	1	2	1.50	2	1.75	1.50
Angostura	2	070	2	3	1.75	4	1.75	1.50
Angostura	2	MP	3	8	1.50	9		
Angostura	2	MP	1	4	1.50	9		
Angostura	2	MP	2	9		9		
Angostura	2	105	3	9		9		
Angostura	2	108	1	4	1.50	3	2.00	1.25
Angostura	2	108	2	7	1.00	5	1.00	0.50
Angostura	2	108	3	3	1.50	3	1.75	1.00
Angostura	2	PP	1	5	1.25	8	1.25	0.50
Angostura	2	PP	2	4	1.75	3	1.75	1.25
Angostura	2	PP	3	4	1.25	9		

				5/26/2011		10/17/2012		
Site	Rep	Accession	Plant #	Vigor rating*	Length (ft)	Vigor rating*	Height (ft)	Width (ft)
Angostura	2	MP	1	9		9		
Angostura	2	107	2	9		9		
Angostura	2	107	3	2	2.50	9		
Angostura	2	MP 158	1	3	2.50	9		
Angostura	2	MP 158	2	4	2.25	9		
Angostura	2	MP 718	3	5	1.25	9		
Angostura	2	109	1	3	3.00	4	3.25	2.00
Angostura	2	109	2	4	2.25	9		
Angostura	2	109	3	9		9		
Angostura	2	1-10	1	5	2.75	5	2.50	1.25
Angostura	2	1-10	2	4	2.25	4	2.50	2.00
Angostura	2	1-10	3	6	2.75	9		
Angostura	3	070	1	4	1.75	9		
Angostura	3	070	2	9		9		
Angostura	3	070	3	9		9		
Angostura	3	MP	1	9		9		
Angostura	3	MP	2	9		9		
Angostura	3	105	3	8	1.50	9		
Angostura	3	108	1	4	1.75	9		
Angostura	3	108	2	5	1.50	9		
Angostura	3	108	3	9		9		
Angostura	3	PP	1	8	1.25	9		
Angostura	3	MP	2	9		9		
Angostura	3	PP	3	8	1.00	9		
Angostura	3	107	1	7	2.00	9		
Angostura	3	MP	2	9		9		
Angostura	3	107	3	9		9		
Angostura	3	MP 158	1	9		9		
Angostura	3	MP 718	2	9		9		
Angostura	3	MP 718	3	9		9		
Angostura	3	MP	1	9		9		
Angostura	3	MP	2	9		9		
Angostura	3	MP	3	9		9		
Angostura	3	1-10	1	8	1.50	9		
Angostura	3	MP	2	9		9		
Angostura	3	1-10	3	9		9		
Angostura	4	PP	1	4	1.75	9		
Angostura	4	PP	2	4	1.75	3	2.00	1.50
Angostura	4	PP	3	4	1.50	3	1.75	1.50
Angostura	4	PP	1	4	2.00	3	1.75	1.50
Angostura	4	PP	2	5	1.75	6	1.75	1.00
Angostura	4	PP	3	4	1.25	4	1.75	1.00
Angostura	4	PP	1	9		9		

				5/26/2011		10/17/2012		
Site	Rep	Accession	Plant #	Vigor rating*	Length (ft)	Vigor rating*	Height (ft)	Width (ft)
Angostura	4	PP	2	5	1.50	5	1.50	1.00
Angostura	4	PP	3	5	1.00	9		
Angostura	4	PP	1	4	1.25	5	1.75	1.00
Angostura	4	PP	2	9		9		
Angostura	4	PP	3	3	1.75	4	2.00	1.50
Angostura	4	PP	1	9		9		
Angostura	4	PP	2	9		9		
Angostura	4	PP	3	5	1.50	6	1.00	0.50
Angostura	4	PP	1	9		9		
Angostura	4	PP	2	9		9		
Angostura	4	PP	3	4	1.25	9		
Angostura	4	PP	1	4	2.00	6	2.00	1.25
Angostura	4	PP	2	9		9		
Angostura	4	PP	3	9		9		
Angostura	4	PP	1	8	0.25	9		
Angostura	4	PP	2	9		9		
Angostura	4	PP	3	8	0.75	6	1.00	0.50
Angostura	5	PP	1	9		9		
Angostura	5	PP	2	9		9		
Angostura	5	PP	3	8	0.75	8	1.00	0.25
Angostura	5	PP	1	9		9		
Angostura	5	PP	2	9		9		
Angostura	5	PP	3	9		9		
Angostura	5	PP	1	9		9		
Angostura	5	PP	2	9		9		
Angostura	5	PP	3	9		9		
Angostura	5	PP	1	9		9		
Angostura	5	PP	2	9		9		
Angostura	5	PP	3	9		9		
Angostura	5	PP	1	9		9		
Angostura	5	MP 718	2	9		9		
Angostura	5	PP	3	9		9		
Angostura	5	PP	1	9		9		
Angostura	5	PP	2	9		9		
Angostura	5	PP	3	9		9		
Angostura	5	PP	1	9		9		
Angostura	5	PP	2	9		9		
Angostura	5	PP	3	9		9		

Figure LP-1. 2012 survival summary by site and accession

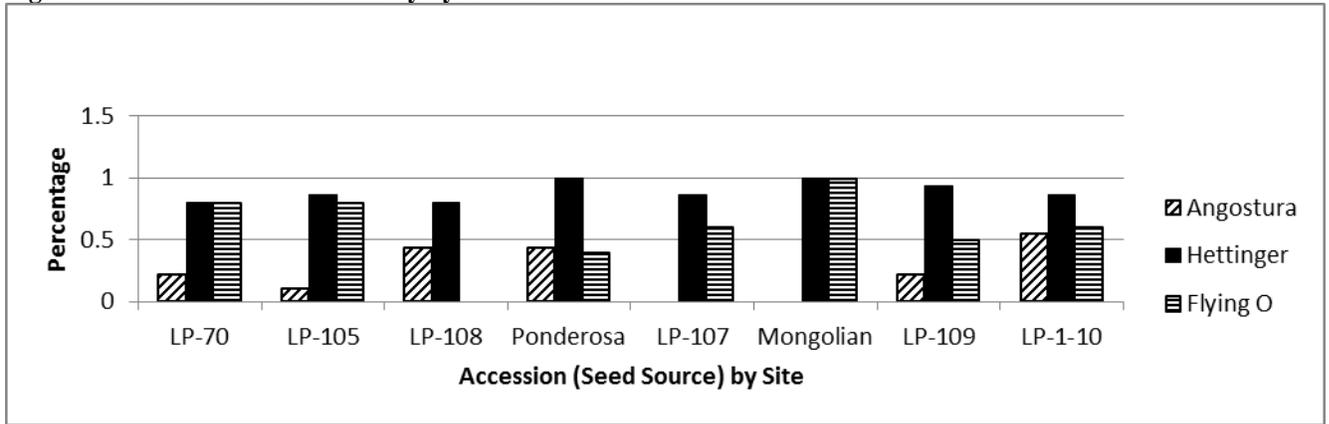


Figure LP-2. 2012 vigor summary by site and accession

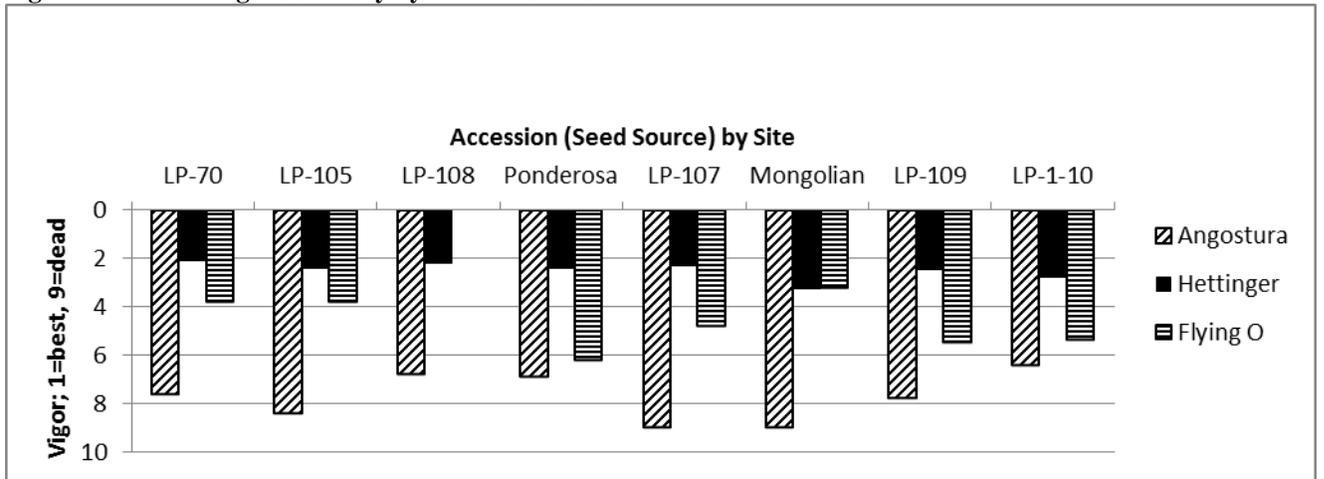


Figure LP-3. 2012 height summary by site and accession

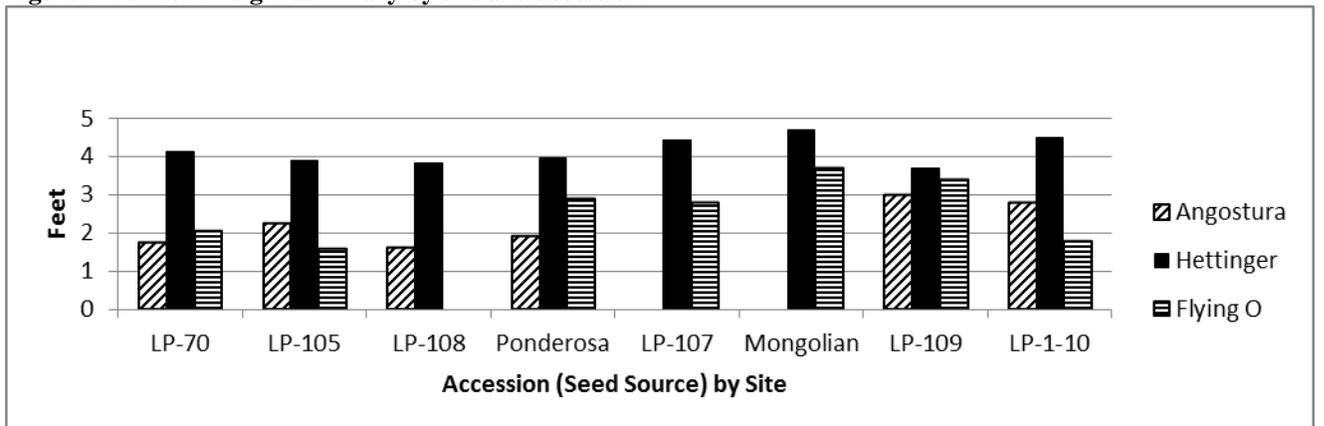
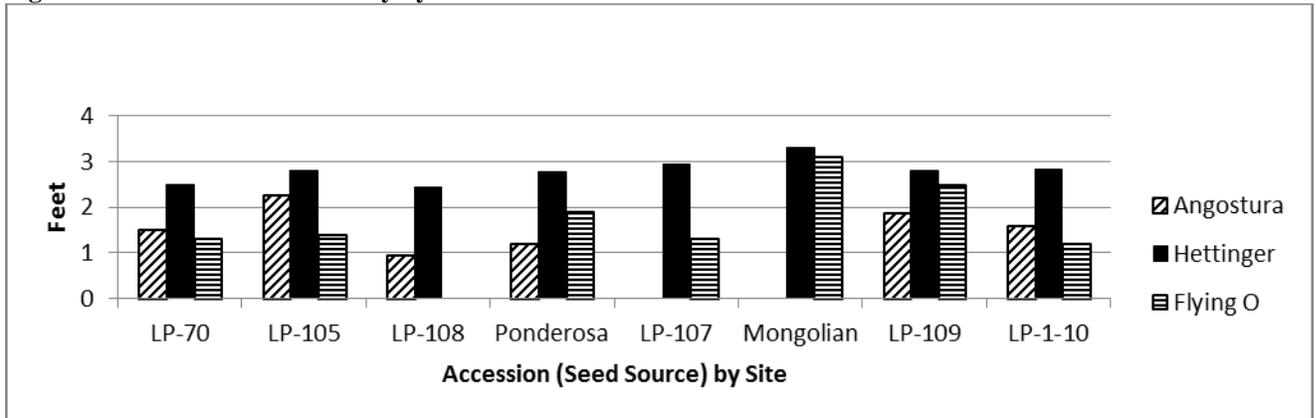


Figure LP-4. 2012 width summary by site and accession



FigureLP-5. 2015 height summary after 8 growing seasons at Hettinger location

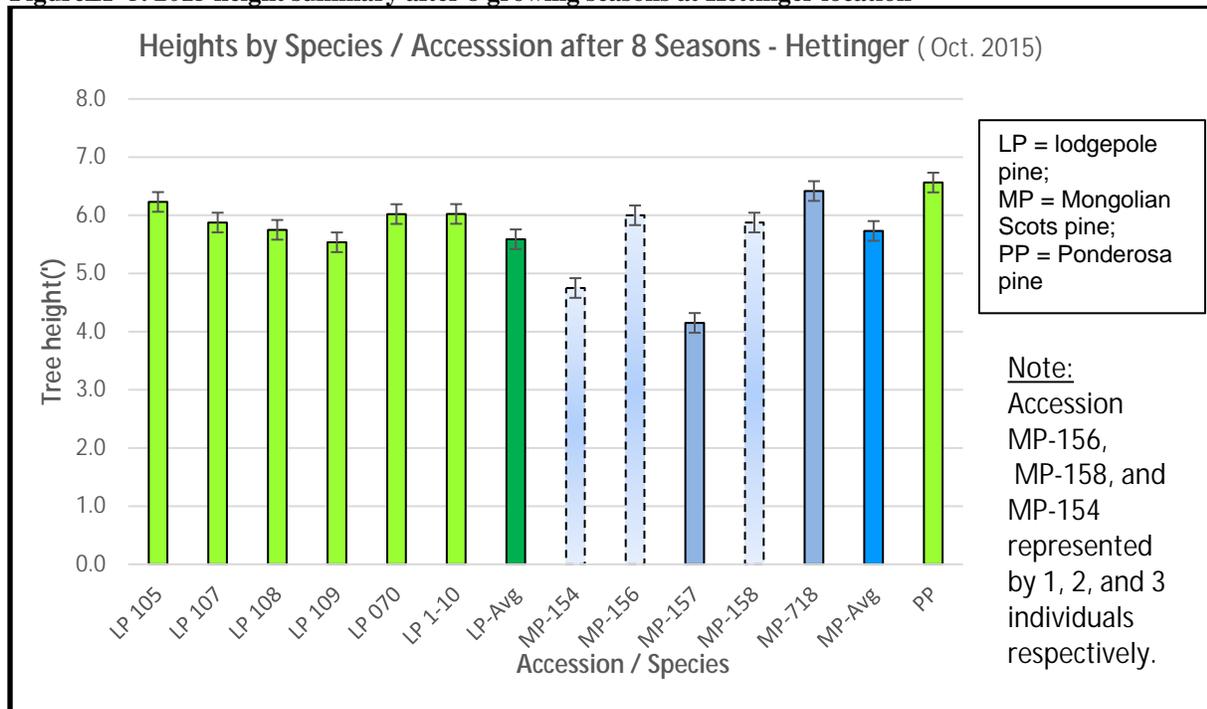
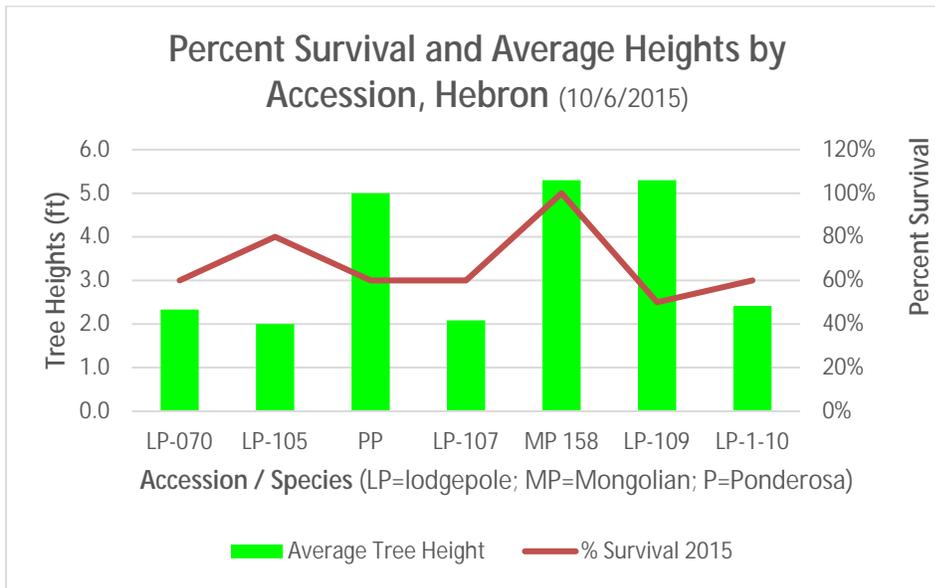


Figure LP-6. 2015 survival and average heights at Hebron location



MAJOR SEED SOURCE STUDIES AND ASSEMBLIES: TECHNICAL REPORT 2015

Study NDPMC-P-1102

Study Title: Evaluation of sandcherry *Prunus besseyi*

FINAL STUDY REPORT

ABSTRACT

The need for additional tree and shrub species that would provide fruit for human consumption and be suitable for windbreak plantings has been identified by NRCS Plant Materials Committees in North Dakota, South Dakota, and Minnesota. Western sand cherry is one such shrub adapted to the Northern Great Plains. Very few cultivars of the species are currently available. The goal of the study was to find seed sources that would produce long lived plants with abundant, tasty fruit. Seed was collected in 2011 from a wide geographic area including North Dakota, South Dakota, Minnesota, Montana, and Nebraska. Collections were from shrubs in natural areas and shelterbelts that exhibited high yields of large, tasty fruit. The collected fruit was processed to clean seed and is being stored in a cooler at low temperature and humidity at the Bismarck Plant Materials Center. The seed was accessioned and information on each collection site was recorded. No further work was done on the collections.

INTRODUCTION

Western sand cherry (*Prunus besseyi*) has potential to be beneficial for agroforestry markets (fruits and preserves), windbreaks and wildlife. It is a shrub native from the central Great Plains to the Canadian Prairie Provinces. It is found on rocky cobbly sites, usually on side slopes. It prefers sites with some bare soil as it does not compete with aggressive vegetation such as smooth brome (*Bromus inermis*), Kentucky bluegrass (*Poa pratensis*), crested wheatgrass (*Agropyron cristatum*) or suckering shrubs. Associated plants in natural sites are snowberry (*Symphoricarpos occidentalis*) and poison ivy (*Toxicodendron radicans*). Western sand cherry spreads slowly from basal sprouts and does not sucker far from the plant. Fruit is usually scarce on plants in the wild because of berry consumption by rodents and other wildlife. As with many *Prunus*, seed exhibits high incidences of seed weevils, sometimes exceeding 50% damaged seed. A very similar species is eastern sand cherry (*Prunus pumila*). Both species can be found in the eastern part of the Dakotas and western Minnesota.

Twenty-four named releases of western sand cherry have been identified. See Table 1 for a list. Most are releases from the early 20th century. None are listed in the National Plant Germplasm Storage. As of 2011, only 'Pawnee Buttes', 'Hansen's dwarf cherry' (Lawyer Nursery in Montana), and a purple leaf sand cherry in the ornamental trade (*P. pumila* X *P. cerasifera*) are available in the commercial market. Pawnee Buttes is the only improved commercial cultivar. It is described as a ground cover version of sand cherry.

Table 1. Named releases of western sand cherry

Sioux (1913 Cornell)	Compass	St. Anthony	Monmoor
Brooks (Cornell)	Zumbra	Golden Boy	Champa (from Sioux)
Black Beauty (Cornell)	Sapa	Honeywood	Heideman Black (1913)
Oka	Opata	South Dakota Ruby	Heideman Red (1913)
Tom Thumb	Nicollet	Mando	Heideman Yellow(1913)
Rocky Mountain Cherry (1913)	Tomahawk (1913)	*Pawnee Butte ®	*Hansen's Dwarf Cherry ®

*Registered by Botanic Gardens Conservation Int.

MATERIALS AND METHODS

Cherries were collected in 2011 from 38 sites; 19 in North Dakota, 3 in Montana, 11 in South Dakota, 1 in Minnesota, and 4 in Nebraska. Collections were made from native stands and conservation plantings. See Table 2 for collection site information. A map showing collection locations is found in Figure 1. Fruits were processed down to clean seed. Seed is being stored at low humidity and temperature in a cooler at the Bismarck Plant Materials Center. Many of the collections have fewer than 100 seeds each.

Table 2. Evaluation of western sand cherry (*Prunus besseyi*) seed collection sites includes native and nonnative. Collections made by USDA-NRCS Plant Materials Center, Bismarck, North Dakota.

Accession	Quarter	Section	Township	Range	State	Planting type
9094360		3	14	54	ND	windbreak
9094361		6	140	54	ND	windbreak
9094362					MT	windbreak
9094363	NW	15	138	80	ND	Lincoln-Oakes Nursery
9094364	SW	15	138	80	ND	Lincoln-Oakes Nursery
9094365	NW	8	129	91	ND	windbreak
9094366					ND	native stand
9094367					ND	native stand
9094368					ND	native stand
9094369					ND	native stand
9094370					ND	native stand
9094371	SW	36	149	74	ND	wildlife
9094372	NE	17	184	73	ND	wildlife
9094373					SD	native stand
9094374					SD	native stand
9094375	SW	20	2	12	SD	windbreak
9094376					SD	native stand
9094377					SD	native stand
9094378					SD	windbreak
9094379					SD	native stand
9094380	SW	23	23	21	SD	wildlife
9094381					SD	native stand
9094382					NE	native stand
9094383					NE	native stand
9094384					NE	native stand
9094385					NE	windbreak
9094386	NW	18	125	15	SD	wildlife
9094387	NW	27	152	84	ND	windbreak
9094388	SE	35	144	84	ND	windbreak
9094389	NE	18	144	85	ND	windbreak
9094390	SE	16	138	80	ND	Lincoln-Oakes Nursery
9094391	NE	2	117	53	SD	Big Sioux Nursery
9094392					ND	wildlife
9094393					ND	wildlife
9094394					ND	wildlife
9094395		10	119	42	MN	windbreak
9094404					NE	Bessey Nursery
9094401					MT	orchard
9094402					MT	orchard
9094414					ND	orchard
9094415					ND	orchard

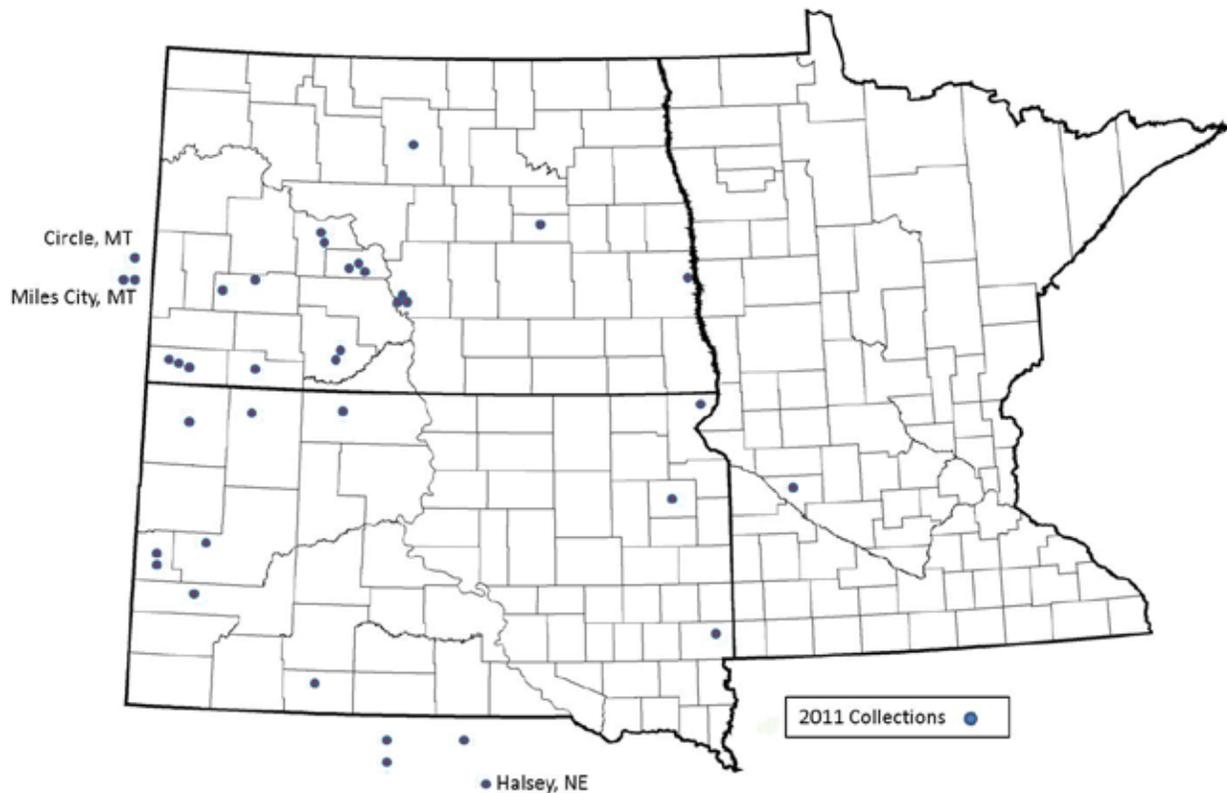


Figure 1. Evaluation of western sand cherry (*Prunus besseyi*). The map shows sites of seed collections made in 2011 by the USDA-NRCS Plant Materials Center, Bismarck, North Dakota

RESULTS AND DISCUSSION

Due to changing priorities, staffing, land availability, commercial alternatives, short life of the plant and funding, the study was terminated. With development of sour cherries that continues today, there are many varieties of highly productive, edible fruit cherries on the market. The need for sand cherry is currently small. For conservation purposes, a viable alternative would be to find commercial sour cherry varieties capable of withstanding conservation field conditions. Some varieties of sour cherry develop dense thickets which could be beneficial for wildlife and snow management. Height can reach 10 feet and large quantities of fruit are possible. Black chokeberry (*Aronia melanocarpa*) is a species that is adapted to conservation plantings in the Dakota's and Minnesota and produces large amounts of edible fruit. Cultivars are available in the market. Chokeberry is currently being processed for food, wines and pharmaceuticals.

CONCLUSION

Over the past century, 24 named varieties of sand cherry have been released. Currently only 2-3 ornamental varieties are on the market. Public and research interest appears limited at this time. Western sand cherry seed collected for this study are being stored in a cooler at the Bismarck Plant Materials Center. Seed is available for future research upon request. Amounts range from a dozen seeds to several grams.

Thanks to Field Offices and other agency staff and individuals who assisted with seed collection.

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MAJOR SEED SOURCE STUDIES AND ASSEMBLIES: TECHNICAL REPORT 2015

Study NDPMC-T-0008-WL

Study Title: Evaluation of Skunkbush Sumac *Rhus trilobata*

FINAL STUDY REPORT

ABSTRACT

A study was initiated to find a leaf spot resistant skunkbush sumac (Rhus trilobata) that would perform well in eastern North and South Dakota conservation plantings. Seed from 24 promising native stands was collected, grown in a greenhouse, planted in a replicated block and evaluated for three years. All plants showed varying degrees of leaf spot disease from a rating of 2, (leaf spots covering 10-20% of the total leaf surface on the plant) to 6 (leaf spots covering 60-70% of the leaf surface on each plant.). A later addition to the planting, Rhus aromatica 'Konza' released by the Manhattan, Kansas Plant Materials Center, showed the least amount of leaf spot and exhibited the highest vigor of any of the seed sources. After two years of observations, it appears if there is still a need for a sumac in the eastern Dakotas 'Konza' would be the recommended source. Due to changing PMC priorities, this study has been discontinued. The material will be maintained for future researchers.

INTRODUCTION

Skunkbush sumac is a deciduous, flowering native shrub growing from 2 to 12 feet tall, averaging 4 feet tall. It has both a taproot and a fibrous root system. Roots are deep and extensively branched with somewhat shallow, spreading woody rhizomes. It sprouts readily from the root crown, especially after a severe disturbance. Sumac prefers well-drained sites, but is tolerant of most soil textures. It is intolerant of flooding and high-water tables, but tolerant of a wide range of soil pH. (Francis 2004)

Native to the Great Plains and the intermountain West, it is generally found west of the Missouri River. *Rhus trilobata* closely resembles *R. aromatica*, a more eastern species, and is often treated as a variety of *R. aromatica*. *R. trilobata* succumbs to wide-spread leaf rust infestations when planted east of its native range. *Rhus trilobata* 'Bighorn', a Wyoming seed source released by the USDA-NRCS Plant Materials Center, Los Lunas, New Mexico, is subject to the same rust infestations as the native *R. trilobata* when planted in eastern Dakota precipitation zones. (Francis 2004)

The study objective was to find seed sources from the eastern part of skunkbush sumac's native range and test for rust resistance. Proven seed sources would be developed for planting in the eastern Dakotas.

MATERIALS AND METHODS

Seeds were collected from native stands in North and South Dakota beginning in 1999 and continuing through 2007. Bighorn sumac, a 1979 release from the USDA-NRCS Plant Materials Center, Los Lunas, New Mexico, was also included. In 2008, seeds were planted in the greenhouse and in May 2010, the seedlings were planted in a field at the Plant Materials Center, Bismarck, North Dakota. Each of the 24 accessions were planted in three-plant plots. There were three replications. In an effort to maintain equal competition within and between rows, Riverview Germplasm American black currant (*Ribes americanum*) seedlings were planted in gaps resulting from missing plants of an accession. The black currant, however, was removed in 2011, and replaced with Konza skunkbush sumac (*Rhus aromatica*), a release from the USDA-NRCS Plant Materials Center, Manhattan, Kansas. The entire planting was seeded to blue grama in 2011 to reduce maintenance costs.

The planting was maintained using herbicide, hand pruning, and roguing. Woody contaminants were removed by periodic cutting and stump treatment. The weeds immediately adjacent to each plant were controlled by hoeing the first year. Casoron® 4G was applied at 150 lbs/acre in 3 to 4-foot diameter circles around each plant in November 2011 to control annual and perennial weeds and grasses. In June 2012, clopyralid was broadcast applied at 3 ml/3 gallons water/3000 ft² to control a heavy infestation of thistle.

Field plot evaluation began in the fall of 2010 and continued through 2012. Plants were scored 1-9 for leaf diseases. A score of 1 indicated very little evidence of leaf spots and a score of 9 indicated the entire leaf was covered with leaf spot. See **Table 1** for average leaf disease ratings on the shrubs in 2012. A complete set of data from 2010 through 2012 is available from the Plant Materials Center or can be found in the PMC's Technical Report, 2014; Part 2 of 2: Trees and Shrubs.

The planting continues to be maintained but no data is formally being collected.

RESULTS AND DISCUSSION

Most plants exhibited leaf spot disease beginning in 2010. In 2011, most plants showed moderate to severe leaf diseases. Bighorn sumac was the most susceptible to leaf rust compared to all accessions. Bighorn was also subject to severe stem breakage at the ground line. The broken stems remained attached to the root collar and alive but easily torn off with maintenance equipment. According to its staff, Bighorn sumac does not break down at the Plant Materials Center, Bridger, Montana. Observations in July 2012 showed 30-80% of the sumac leaves were brown with curled leaf margins; a classic sign of herbicide injury. General observations showed Konza with the least amount of apparent herbicide injury. Clopyralid herbicide, applied earlier in 2012, appeared to be the cause of injury even though it is labeled for use on sumac. After discussion with the chemical representative (Dow Agra), it was concluded that the labeled sumac was probably staghorn sumac (*Rhus typhina*). Staghorn sumac is native to the area where the herbicide was originally tested. Skunkbush sumac appears highly sensitive to clopyralid herbicide.

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Table 1. Average leaf disease 2012, skunk-bush sumac study at USDA-NRCS Plant Materials Center, Bismarck, North Dakota

Accession (seed source)	Average. disease all plants*
9009467	2.6
9092058	2.6
9092059	2.5
9092060	2.9
9092061	3.4
9092062	2.4
9092063	2.8
9092064	2.2
9092065	2.4
9092066	2.9
9092067	2.3
9092069	2.9
9092128	2.6
9092130	2.9
9092217	2.6
9092219	2.9
9092220	2.2
9092222	2.9
9092223	2.8
9094338	2.7
9094346	2.6
9094347	3.2
9094348	2.6
Bighorn	4.0
Konza	1.5
*1 = least incidence, 9 = greatest incidence	

MAJOR SEED SOURCE STUDIES AND ASSEMBLIES: TECHNICAL REPORT – 2015

Study NDPMC-P-1103-WI

Study Title: Evaluation of Mongolian Scots Pine *Pinus sylvestris* var. *mongolica*

Commonly available Scots pine comes primarily from European and Eurasian seed sources. It has become naturalized throughout much of the upper Midwest. The commonly available sources have a few negative characteristics such as form, growth rate, disease resistance, etc. However, Mongolian Scots pine, *Pinus sylvestris* var. *mongolica*, seed collected in and around Heilongjiang Province (Nenjiang, Kedong, Bayan, Shangzhi) as part of a tree improvement program in China, has performed well over the past 14 years at multiple locations in Minnesota, North Dakota and South Dakota. It has exhibited higher vigor, insect, and disease ratings than commonly available Scots pines.

Originally this Mongolian seed source was valued in America for its more rapid growth (up to 2 feet per year at one Minnesota location), its denser foliage, and apparent increased disease and insect resistance. Perhaps this particular Mongolian source is resistant to pine wilt, caused by the pine nematode *Bursaphelenchus xylophilus*.

The nematode is native to North America and causes no damage to native pine trees. Over the past decade it has proven devastating to introduced pines such as Austrian and Scots pine planted in America. It has also been quite damaging to pines in their native ranges in China and Europe. Late in 2013, Bismarck PMC staff learned of a Chinese study to test assorted sources of pine for resistance to pine nematode. The 1989 Chinese study showed Mongolian pine as relatively resistant to pinewood nematode. An earlier Chinese study listed Mongolian pine as being susceptible to the nematode. The different study results could very well be a result of different seed sources or different strains of the nematode. As of 2015 there is no evidence of the nematode in North Dakota. The Bismarck PMC has provided Mongolian source Scots pine to Kansas and Missouri in the heart of the nematode devastation to check performance.

2012

Seed was collected from Mongolian pine in Off Center plantings at Grand Rapids, Becker, and Morris, MN. These seeds were processed, grown by Towner State Nursery and will be available for field planting in 2013. A portion of these seedlings have been made available to Kansas and Nebraska, in the heart of the nematode epidemic. Nearly 30 different locations in 5 states will receive material this year for field evaluation. A like number of seedlings will be available for next year. If annual field evaluations show decline or die off, samples should be sent to a diagnostic lab to determine if death was caused by the nematode.

2013

Distributed 625 seedlings to 25 landowners in MN, ND, and SD for field plantings. Seedlings were grown by Towner State Nursery from seed we collected and processed in 2012.

2014

Distributed 500 seedlings to 20 landowners in MN, ND, and SD for field plantings. Seedlings were grown by Towner State Nursery from seed we collected and processed in 2012.

The seed orchard at the Grand Rapids Off-Center Evaluation Planting was removed by the university. This places a greater need for the PMC to continue developing the seed orchard in Panel A at the PMC. Trees from different seed sources have been growing for several years. Each is marked with a stamped aluminum tag pop-riveted to a fiberglass stake. Due to some tree mortality caused by burrowing rodents, control in 2015 will be a high priority.

2015

Cones from Becker, MN, accession 9069164 were harvested and processed yielding 22.8 grams of clean seed. Cones from Morris, MN accession 9094449 were harvested and processed yielding 48.1 grams of clean seed. Field planting survivals of Mongolian pine showed 74% and 59% for 2013 and 2014 planted stock respectively. Deer browse on Scotch pine can be severe. To make better recommendations on where these trees will perform satisfactorily, each field planting site, both successes, and failures should be evaluated by a soil scientist to identify the specific soil component affecting survival and performance.

MAJOR SEED SOURCE STUDIES AND ASSEMBLIES: TECHNICAL REPORT – 2015

Study NDPMC-P-1403

Study Title: Evaluation of Douglas fir *Pseudotsuga menziesii*

From observation and conversation with foresters and others around the state, we note that there are four stands of Douglas fir in North Dakota old enough to indicate adaptability to our climate.

1. Agricultural Research Station, Mandan, ND 80-90 years old with tallest trees reaching 65 feet tall, growing on a sandy loam soil.
2. Hillside Park pool area, Bismarck, ND, 63 years old, 30-35 feet tall growing on loam soils.
3. Denbigh National Forest, southwest of Towner, North Dakota; Trees established in the 1930's growing on high water table sands with cones too high to be harvested by readily available boom lifts.
4. Wheatland cemetery, on the northeast edge of Wheatland, North Dakota, 60 or more years old, growing on sandy loams of glacial Lake Agassiz beach ridges.

These four Douglas fir plantings are quite isolated from any other potential sources of Douglas fir pollen, therefore, progeny from these sources should grow true to the genetics of the parent plant's North Dakota climatic adaptability.

There are other plantings doing well that are not as old, Bowman-Haley recreational area in southwest North Dakota; Williston Research and Extension Center in northwest North Dakota. Additional reports of individual trees doing well in isolated plantings or urban areas have also been received.

With the ever increasing threat of exotic pests, it would be beneficial to have another tree species to add to the Field Office Technical Guide. If successful, Douglas fir would represent an entirely different genus, which should improve resilience to pests and pathogens that could affect our existing list of conifers.

This species would be a good candidate for a full-fledged study. It has the potential to add a climatically adapted tall tree species to the Field Office Technical Guide. It appears most adapted to western Dakotas which has few adapted tall tree species for erosion control, snow management, energy conservation, or wildlife woody habitat cover.

2013

A boom lift was used to harvest cones from the four producing trees in 2013. The 50-foot boom still did not reach the top 10-15 feet of tree which contained 40-50% of the cones. Harvest occurred about 3 days too late since with each cone pulled from the tree a cloud of seed rained to the ground. The 9 gallons of cones from ARS yielded 14.1 g. of clean seed (just over 1000 seeds) that will be grown by Towner State Nursery for field plantings in 2015.

2014

No cones set on the trees at the ARS location. Cones were harvested from a 63-year-old stand of Douglas fir just a few feet southwest of Hillside Park Swimming Pool in Bismarck. A boom lift was used to harvest 3 bushels of cones that yielded 487 grams clean seed. Some of the seed was provided to Towner State Nursery to grow approximately 500 seedlings for distribution for field plantings in the spring of 2016.

2015

Nearly 2 bushel of cones from accession 9094434 at the Northern Great Plains Research Center yielded 44 grams of clean seed. Nearly 2 bushels of cones from accession 9094435 at Hillside park in Bismarck, yielded 180 grams of clean seed.

First year field plantings of stock planted in 2014 showed a 76% survival. To make better recommendations on where these trees will perform satisfactorily, each field planting site, both successes, and failures should be evaluated by a soil scientist to identify the specific soil component affecting survival and performance.

TECHNOLOGY DEVELOPMENT

TECHNOLOGY DEVELOPMENT: TECHNICAL REPORT – 2015

Study NDPMC-T-1303

Study Title: Cottonwood Restoration Method Evaluation

Objective: To determine an economical, effective method to reestablish native cottonwood on dewatered flood plains in the Northern Great Plains.

Introduction: Damming of major interior streams within the Great Plains has altered the hydrologic regime of entire river systems. In the free flowing reaches, water tables have dropped while areas above the dams have experienced flooding for long periods of time. Both situations are beyond the norm for cottonwood establishment. For the Missouri River reach below Garrison Dam and above Bismarck, the level of the river during the summer can be as much as 10 feet below the land surface adjacent to the river. “Model calculations predict that without changes to the current management regime cottonwood forests in the Garrison reach of the river will essentially be lost as a significant community on remnant floodplains in less than a century.” (Johnson 1992)

Additionally, upland grasses such as smooth brome grass *Bromus inermis*, and reed canarygrass *Phalaris arundinacea*, have created dense sods covering much of the previously flooded riparian forest. The dense sod and deeper soil water make natural recruitment of cottonwood impossible.

Numerous groups and individuals have attempted cottonwood restoration within the old floodplains of highly regulated rivers with mixed success. Methods have included managing soils and vegetation for natural regeneration from locally dispersed seeds; planting bare root seedlings via traditional methods; planting unrooted cuttings ranging from 8 to 30-inch lengths; and irrigating bare soils during and after the time of cottonwood seed dispersal, to name a few.

Cooperators: The USDA Natural Resources Conservation Service, Plant Materials Center (PMC), Bismarck, North Dakota, in cooperation with The Nature Conservancy (TNC), Cross Ranch Preserve.

Location: The Nature Conservancy, Cross Ranch Preserve, 1401 River Road, Center, North Dakota.

Rationale: This study evaluates three cottonwood planting materials/techniques to reestablish cottonwoods on sandy, dewatered areas that had previously been flood plains. The study is a complete block randomized design. The impacts of fabric weed control will also be evaluated by “protecting” half of each stock type in each of the four blocks with 6-foot x 6-foot weed control fabric squares. The theory behind the fabric treatment is that the deep pot plant stock will be planted with the root mass below the average rooting depth of the existing smooth brome sod. The 6-foot unrooted cuttings should develop most of the roots below the root mass of the smooth brome. To determine if the above rooting scenarios really occur, half the stock will be treated with 6-foot square weed control fabric. This should show if rooting below the brome will eliminate the need for weed control with those stock types. If it is not needed, establishment cost can be reduced by \$5-\$10 per tree. A marked difference in survival and growth is anticipated with respect to the fabric on the conservation stock.

Randomized Complete Block Design

Three stock types and planting methods are being evaluated using individual plant plots. There are six replications of each treatment per block. Each of four blocks are located at different elevations above ground water. The 36 trees in each block were planted on 8-foot x 8-foot spacing.

Plant Stock (Material)

Deep pot planting techniques consist of cottonwoods grown in pots that have 3-6-inch diameters and are 14-36 inches deep. Traditional potted material is then planted so the top of the root ball is at the soil surface. The intent of this planting method is to place a large mass of very active roots in the soil capable of capturing any water or nutrients that are within reach. The larger root mass should keep the material alive until active root growth can begin supporting the top growth. This method has been used for riparian restoration projects in New Mexico and Montana.

This study is different from those in the other states in that this material was not placed within the capillary fringe of a water table on the edge of a stream and the planting area is not subject to flooding, even from 500-year storm events. For this study, the deep pot material consists of 3.5-foot to 5-foot cottonwoods growing in 4-inch x 4-inch x 14-inch pots planted so that the top of the root ball is 3 feet below the soil surface. It is hoped that the dense root mass below the roots of the bromegrass will initiate growth and expand to the capillary fringe of the water table. Unrooted cutting material consists of dormant cottonwood stock that has all limbs and apical buds removed. The material is harvested when dormant, and then frozen until ready for use. Unrooted cuttings range from ½-inch diameter to 1.5-in diameter and usually are 12-36 inches long. They are often used in stream bioengineering. The base ends of the stock are drilled, augered, or water-jetted into the soil so that the base is within the capillary fringe of the growing season water table.

This study used locally harvested wild material processed into 6-foot long cuttings. This is a much longer length than used in most bioengineering projects. The cuttings for this project will be water-jetted into the soil until only 1-2 buds are above the soil surface. Base end of the cutting will be planted 5.5 feet deep. Longer material was not used because 5.5 feet is about the maximum length of a waterjet stinger that a person can handle.

Containerized conservation grade stock commonly will be used as the control. There will be no replanting of stock that dies.

Stock Preparation and Handling Procedures:

March 1, 2012: Planted 3-6-inch unrooted cottonwood cuttings in 4-inch x 4-inch x 14-inch pots in the greenhouse.

May 15, 2012: Moved the deep pot material to the lath house to develop wind hardiness. Trees were watered every other day on average throughout the season.

September 15, 2012: Eric Rosenquist, Wayne Markegard, and Craig Stange used a TNC wildland fire truck to determine if the waterjet stinger and a fire truck can drill holes to a 5.5-foot depth in sand. It can, within a few seconds, but the sand refills the hole once the water stream stops. This problem can be alleviated by grasping the cutting next to the waterjet stinger and working both into the soil at the same time.

November 10, 2012: Deep pot material was pulled out of stands and laid over, along with other lath house material, on a heavy white plastic. Mice baits were scattered amongst the trees. The heavy plastic was folded over trees and edges sealed with boards and concrete blocks. Later in the month, 6 inches of wet heavy snow was scooped onto the plastic.

February 7, 2013: PMC staff harvested and processed about 80 native cottonwood cuttings from a nearby wetland. Material was cut to a 6.5-foot length allowing 6 inches to be cut off the base end just prior to planting in the spring. Material was frozen at Lincoln-Oakes Nursery.

May 7, 2013: Unrooted stock was removed from Lincoln-Oakes Nursery cooler and allowed to warm to near room temperature. The lower 6 inches of each cutting was cut off at a sharp angle. The sharp angle was an easy way to determine the bottom of the cutting at planting time.

May 21, 2014: All stock types except unrooted cuttings were handled the same way as the previous year. Took delivery of unrooted cuttings from Lincoln-Oakes Nursery. They were multi-branched trees about 8 feet long. Lateral branches were removed. 4-6 inches of the base was cut off at an angle and the top cut at 6 feet from the base. Cuttings were stored with base ends in water and the tops wrapped in plastic in the tree cooler.

May 22, 2014: Deep pot stock was collected from the lath house and the most robust 36 plants were selected for planting. Conservation stock from Big Sioux Nursery was quickly looked at, left in the waxed shipping box and returned to the tree cooler.

May 23, 2014: Stock was loaded for transport and wrapped according to standard procedures to protect from desiccation on the 45-minute trip.

Site Preparation: Plans were to prepare all sites by mowing in late summer 2012 and applying glyphosate in mid-September. TNC was unable to mow the site in the fall 2012. All planting sites were prepared by mowing and glyphosate application before planting during the spring of 2013. Spring and summer 2011 was exceedingly wet. Block 1 was under 2 feet of flowing Missouri River water for about a month. There was below normal precipitation throughout the remainder of the summer and into the fall of 2011. Winter precipitation was below normal. The only major moisture event since the flood was 17 inches of wet snow in late April 2012.

May 3, 2013: The sites were mowed and a 1.5% solution of Cornerstone was applied to each block in 7 quarts of water.

May 3, 2013: Each individual tree location was marked in the field. The location of each tree within the each of the four blocks as well as whether protected by fabric or not, was determined by drawing numbers from a hat. Tree assignments began in the northwest corner of each block.

April 23, 2014: Blocks 5-7 were staked, marking each treatment and stock type.

April 24, 2014: Dense stands of dead Russian thistle from block 5 were brush-bladed. Grass and scouring rush were brush-bladed from blocks 6-7.

Tree Planting: All trees were planted according to plans.

May 7, 2013: To minimize confusion at planting time, each tree planting spot was marked with flags; orange for unrooted cuttings, pink for deep pot and white for conservation stock. Each flag was marked if weed barrier was to be applied.

May 8, 2013: Unrooted cuttings were water-jetted to a 5.5-foot depth as planned. The larger diameter stock and stock with crooks in the stem proved more difficult and took longer to jet into the ground. Care was taken to ensure that the base ends were planted down. It was estimated that about 4 gallons of water were used to jet the holes. The top of each waterjet hole was pressed closed by stepping on the hole. *(Note: It was anticipated that these cuttings would be long enough to have reached the water table because pre-study site investigation showed soil mottling at 30-40 inches in each of the 4 study blocks. It was not until much later that we learned that soil mottling will remain for many decades after the fluctuating water tables that caused the mottling have been lowered. The mottling probably developed when the area was subject to flooding, prior to the closure of Garrison dam in 1953. With the dewatering of the river channel since dam closure, the sites have been dewatered.)*

Deep pot material was planted in a hole drilled 4 feet deep by a tractor powered post auger. The hole was cleaned to a precise 4-foot depth with hand posthole diggers. (That is the maximum depth the tractor driven auger could dig.) Deep pot material was removed from the pot and gently lowered to the bottom of the hole. Soil was lightly tamped around the root mass to the top of the root ball. About 4 gallons of water were added to the hole after tamping to keep treatments similar to the water added with the water jetting. Once the water soaked away, soil was gently tamped in the hole filling it to the surface. Most of the deep pot material had 10-18 inches of live stem above the soil surface after planting.

Conservation stock was hand planted with a shovel. Since the vegetation had been killed by herbicide, no scalping was done. The hole was dug large enough to easily accommodate the 20-in³ root ball. After planting, about 4 gallons of water were slowly added to the planting site to equalize with the other planting methods. Most conservation stock was 12-18 inches tall at planting.

Monitoring test wells were hand installed in the middle of each block by employees of the North Dakota State Water Commission and the staff forester on the same day the trees were planted. Test wells were hand augured to 12 feet deep. A 1.5-inch diameter PVC pipe with 2-foot screen on the bottom was placed in the hole with sand for the lower 10 feet and bentonite clay for the upper 2 feet of the hole. A cap on the top kept debris out and was easily removed for measuring tape access. Water depths at planting were: Block 1, 8.0 feet; Block 2, 10.4 feet; Block 3, 8.2 feet; Block 4, 10.0 feet. Due to the coarse textures of the soils, it is unlikely that any of the stock reached the capillary fringe of the water table. However, it is possible that the varied layers of different soil textures within the profile may have perched water tables that provided a bit of moisture.

Four-foot tree shelters were installed on each tree to protect from deer browse. Some of the tree shelters were supported with white oak stakes and some were supported with ¾-inch PVC electrical conduit. One-half of each tree stock type within each block had a six-foot fabric square installed to control weeds. Fabric squares were anchored at the corners with 2-inch x 8-inch 9-gauge staples.

May 23, 2014: Planting, fabric installation, and tree shelter installation were performed in the same manner as the previous year. The borrowed pumper truck had mechanical issues and delayed the water jet planting process 2-3 hours. Conservation stock and deep pots were planted with most of the fabric and tree shelters installed while awaiting the fire truck so that unrooted cuttings could be planted. When digging deep pot holes (4-foot deep with an 8-inch post hole auger) on block 7, the top of the water table was above the bottom of the hole. When planting the unrooted cuttings, the unrooted cutting floated in the hole on blocks 6 and 7. The top of the hole was stomped shut to prevent floating. The scouring rush roots greatly complicated planting the unrooted cuttings. The fins on the waterjet were unable to easily create a large enough opening for the waterjet plus a cutting nested against the pipe. In 3-5 cases, the tops of the cuttings were left 12-18 inches above the soil surface.

Maintenance

June 21, 2013: Brush blades were used to cut thistles and weeds that were growing through the herbicide site preparation. Block 1 in the old overflow channel was a solid stand of Canadian thistles 3-4 feet tall. Mowing them down was mostly for access and public relations. The thistles in block 1 were a direct result of the 2011 flooding. The entire overflow channel was solid thistles. Tall herbaceous vegetation was also mowed on the other plots to keep treatments equal. Due to the sandy nature of the soil, proximity to water tables, and the public exposure, no

herbicide application was done for thistle control. The North Dakota Ag Weather Network monitor at Hazen, approximately 12 miles away, recorded 8.65 inches of precipitation in April of the planting year.

June 3, 2014: Installed test wells with Scott Parkin from the State Water Commission. Applied glyphosate to emerged vegetation on blocks 5-7.

Observations and Measurements

2013

The following was observed (no statistical analysis at this time).

- The deep pot plant stock grew the tallest and had the best survival with and without fabric.
- The conservation stock had much better survival than anticipated with a slightly better growth where weeds were controlled with fabric.
- The unrooted cuttings had around 20% survival and height growth was considerably less than the other treatments. Surprisingly, the unrooted cuttings with fabric performed slightly better than those without fabric.

2014

The following was observed. No statistics have been run, but some charts have been included to illustrate what has been observed to date.

- Blocks 1-4 continue to show low survival on the unrooted cuttings, slightly better when protected with fabric. Any apparent resurrection of dead plants to live plants a year later is most likely an error of measurement or a re-sprout from the base of a dead top.
- A perplexing phenomenon was observed in July of 2014. The deep pot plants with fabric had overwintered with a “normal” over winter mortality, just like all the other stock types and treatments. However, between May and July, this stock type dropped from 92% survival to 67%. That did not happen to any of the other stock types nor any of the others with fabric. Why only that stock type under fabric showed mortality is a mystery. See **Figure CR-1**.
- By the end of 2014, most of the treatments (blocks 1-4) had grown to the top of, or out of the 4-foot tree shelters. As more plants grow out of the reach of the deer, there should be a rapid increase in growth. The deep pot stock, with and without fabric, exhibited the most height growth. With conservation stock not far behind. See **Figure CR-2**.
- Three more blocks were established in areas more likely to have a high water table. The same protocol and stock types were used to establish each block as had been used on the first four blocks. In 2014, the unrooted cuttings came from 1 year old stock from conservation nursery stooling block. These were straighter and smaller in diameter than the naturally harvested 2-3 year-old cuttings of blocks 1-4. After the study began it was learned that younger cuttings initiate rooting easier from lenticels. Blocks 6 and 7 should show better survival of unrooted cutting since all cuttings on these blocks reached the water table. (Some floated in the planting holes until the top of the hole was pressed shut. On blocks 6 and 7, over half of the deep pots were planted in the capillary fringe of the water table.
- The survival summary of these 3 blocks showed lowest survival on the conservation stock with highest survival on the deep pots. Unrooted cuttings established only slightly less successfully than the deep pots. Fabric weed control seemed to have the most beneficial impact on the conservation stock. See **Figure CR-4**.
- Surprisingly, the unrooted cuttings with fabric showed the greatest height growth. See **Figure CR-5**.

2015

See **Table CR-2** for all years of evaluation data (water table depth, survival and height). Survival and growth on blocks 1-4 continues the trend of previous years though 1-2 more trees seem to die each year. Conservation stock with and without fabric and deep pot stock without fabric continue to show the best survival, greater than 60%. Amazingly the unrooted cuttings protected by fabric show the greatest heights by nearly 1 foot. See **Figure CR-3**. This is intriguing since deer keep most stock mowed off at the top of the tree shelters. In 2015, blocks 5-7 showed survival and growth at levels expected at the start of the study – lowest survival on conservation stock without fabric (33%) and the highest survival on deep pots with fabric (94%). See **Figure CR-6**.

Though the study has only been observed for three years this study has confirmed two facts about cottonwood that have been known for decades.

1. Cottonwoods, when planted in alluvial, sandy soils must have access to the capillary fringe of a growing season water table.

2. When planted near riparian forests, the trees must be protected from deer browse. Most plants have been continuously browsed to the top of the 4' tree shelters. (4' tree shelters were used because they were on hand and it was thought the trees could grow past the reach of the deer in 1-2 years.) This phenomenon was observed on hundreds of shrubs and small trees planted by the local soil conservation district adjacent to our plots.

Much of the study may fail because these two facts, though known and considered in the study design did not adequately address the specific onsite conditions.

See **Table CR-1** for temperature and precipitation data (NDAWN) from Mandan which is the closest weather station.

Results and Conclusions:

1. The failure of the unrooted cutting base ends to reach the capillary fringe of the water table was most likely the main cause of death. Another complicating factor learned after the study was planted – Unrooted cutting stock older than one year has a reduced rate of survival. The unrooted cuttings on blocks 1-4 ranged in age from 2-3 years since they were collected in the wild. The thicker bark reduced the cutting's ability to initiate rooting. One year old nursery-grown cuttings used for blocks 5-7 were smaller in diameter, easier to plant and showed higher survival. Additionally, blocks 6 and 7 were lower on the landscape with water tables at 4-5 feet. In fact some of the unrooted cuttings floated out of the holes until the top of the hole was pressed closed with the heel of a shoe.
2. Data from blocks 5 -7 show results somewhat similar to those expected at the beginning of the study. The conservation stock did not do well as the sites were very sandy and they did not survive long enough for newly developing roots to reach the capillary fringe of the water table.
3. There is no explanation for the following observation: survival of conservation stock and deep pot stock on blocks 1-4 with weed control fabric. Unrooted cutting showed marginally better survival when protected with fabric. See **Figure CR-3**.
4. Though many of the unrooted cuttings had the base ends fully in the water table, in theory providing all the water they needed, the ones protected with weed control fabric showed seven percent better survival and nearly a ½-foot better growth. Remember, the deer mowed everything off at the top of the four-foot tree shelters.
5. This project appears to confirm what we suspected about such riparian sites;
 - a. Most of the site is no longer a riparian site as it is no longer subject to flooding,
 - b. There is little extra water (high water table or run-on).
 - c. There is a very dense cover of smooth brome grass and/or Canadian thistle which hinders most natural regeneration.
 - d. Based on soil textures and the reduced available water, the site is better suited for pine or juniper and those late successional hardwood species found on second bottom benches (ash, oak, Russian olive, buffaloberry, etc.)

Future Plans

Consider using a backhoe to excavate some of the dead deep pot sites to determine if root origination and development affected mortality.

2016

- Continue observations to determine if some of the trees eventually grow past the deer. One option would be to raise the shelters 1-1.5 feet. This would require drilling a new set of holes for the top tie and stapling or some other method to ensure ties do not slide down the stake. Such activity might improve survival of the trees and show how the different stock types fare over time. There are 66 live plants in blocks 1-4 and 75 live plants in blocks 5-7. Remove stakes, tubes, and fabric from the dead trees.
- Work with the local SCD to inventory the traditional conservation planting established immediately adjacent to this study and determine the survival by species. Their traditional planting methods with 6-foot tree shelters may be an alternative reforestation method.

References:

Johnson WC, Dixon MD, Scott ML, Rabbe L, Larson G, Volke M, Werner B. 2012. Forty Years of Vegetation Change on the Missouri River Flood plain. *BioScience* 62:123-135.

Tilley, DJ, St. John, L. 2012. Cottonwood Planting Depth. Idaho Plant Materials Center Technical Report 1104-RI.

Deep Planting – The Ground Water Connection, Los Lunas Plant Materials Center, Natural Resources Conservation Service.

Hoag, JC, Simonsen, B, Cornforth, B, St. John, L, 2001. Waterjet Stinger: A tool to plant dormant unrooted cuttings of willows, cottonwoods, dogwoods, and other species. Idaho Plant Materials Center Riparian/Wetland Project Information Series No. 17, June 2001.

Table CR-1: 2015 Weather Summary - Official Station - Mandan, North Dakota

Month	Mean Temperature (degrees Fahrenheit)		Precipitation (inches)		
	2015	Normal*	Actual 2015	Normal*	Deviation from Normal 2015
January	18.3	12.7	0.31	0.37	-0.06
February	10.3	17.7	0.41	0.40	0.01
March	34.4	29.2	0.22	0.64	-0.42
April	45.4	43.4	0.59	1.20	-0.61
May	53.2	55.1	4.99	2.61	2.38
June	65.1	64.3	4.67	3.31	1.36
July	70.6	70.6	2.05	3.26	-1.21
August	69.6	68.9	1.10	2.15	-1.05
September	64.1	58.1	0.45	1.54	-1.09
October	48.3	44.4	1.16	1.37	-0.21
November	33.2	29.2	0.00	0.68	-0.68
December	21.9	16.4	0.41	0.42	-0.01
Annual	44.5	42.5	16.36	17.80	-1.59
*National Climate Data Center 1981-2010 Monthly Normals					
		<u>2015</u>			
Last Frost (28 degrees)		19-May			
First Frost (28 degrees)		16-Oct			
Frost Free Period		149 days			

Key to Table CR-2.

Fabric: Y=yes (6' x 6' fabric square), N=no
Survival: 1=live plant, 0=dead
Stock type: P=deep pot, U=unrooted cutting, C=conservation grade
Plant height (feet)
Depth to water table (feet)
Date: date of evaluation

Table CR-2. Survival, height, and water table depth, cottonwood restoration study, 2013-2015

Plot ID	Stock Type	Stock Type / Fabric	Fabric	Date	Water Table (ft)	Survival	Height (ft)	Comments
1.1	P	P	No	5/23/2013	8.0	1	NA	
1.1	P	P	No	6/13/2013	7.6	1	NA	
1.1	P	P	No	7/26/2013	8.1	1	4.00	
1.1	P	P	No	9/20/2013	8.3	1	4.50	
1.1	P	P	No	5/19/2014	6.8	1	4.00	
1.1	P	P	No	7/7/2014	6.4	1	2.50	
1.1	P	P	No	9/24/2014	6.8	1	5.00	
1.1	P	P	No	7/22/2015	8.7	0		07/2015 4' dead
1.1	P	P	No	9/23/2015	9.9	0		
1.2	U	U	No	5/23/2013	8.0	0	NA	
1.2	U	U	No	6/13/2013	7.6	0	NA	
1.2	U	U	No	7/26/2013	8.1	1	1.00	
1.2	U	U	No	9/20/2013	8.3	0	NA	
1.2	U	U	No	5/19/2014	6.8	0	NA	
1.2	U	U	No	7/7/2014	6.4	0	NA	
1.2	U	U	No	9/24/2014	6.8	0	NA	
1.2	U	U	No	7/22/2015	8.7	0		
1.2	U	U	No	9/23/2015	9.9	0		
1.3	U	UF	Yes	5/23/2013	8.0	1	NA	
1.3	U	UF	Yes	6/13/2013	7.6	0	NA	
1.3	U	UF	Yes	7/26/2013	8.1	1	0.50	
1.3	U	UF	Yes	9/20/2013	8.3	0	NA	
1.3	U	UF	Yes	5/19/2014	6.8	0	NA	
1.3	U	UF	Yes	7/7/2014	6.4	0	NA	
1.3	U	UF	Yes	9/24/2014	6.8	0	NA	
1.3	U	UF	Yes	7/22/2015	8.7	0		
1.3	U	UF	Yes	9/23/2015	9.9	0		
1.4	C	CF	Yes	5/23/2013	8.0	1	NA	
1.4	C	CF	Yes	6/13/2013	7.6	1	NA	
1.4	C	CF	Yes	7/26/2013	8.1	1	3.00	
1.4	C	CF	Yes	9/20/2013	8.3	0	NA	
1.4	C	CF	Yes	5/19/2014	6.8	1	3.00	
1.4	C	CF	Yes	7/7/2014	6.4	1	3.50	
1.4	C	CF	Yes	9/24/2014	6.8	1	3.25	
1.4	C	CF	Yes	7/22/2015	8.7	0		
1.4	C	CF	Yes	9/23/2015	9.9	0		
1.5	C	C	No	5/23/2013	8.0	1	NA	
1.5	C	C	No	6/13/2013	7.6	1	NA	
1.5	C	C	No	7/26/2013	8.1	1	3.00	
1.5	C	C	No	9/20/2013	8.3	1	2.50	
1.5	C	C	No	5/19/2014	6.8	1	3.00	
1.5	C	C	No	7/7/2014	6.4	1	3.75	
1.5	C	C	No	9/24/2014	6.8	1	3.25	
1.5	C	C	No	7/22/2015	8.7	1	4.00	
1.5	C	C	No	9/23/2015	9.9	1	4.25	
1.6	P	PF	Yes	5/23/2013	8.0	1	NA	
1.6	P	PF	Yes	6/13/2013	7.6	1	NA	
1.6	P	PF	Yes	7/26/2013	8.1	1	4.50	
1.6	P	PF	Yes	9/20/2013	8.3	1	4.50	
1.6	P	PF	Yes	5/19/2014	6.8	1	4.00	
1.6	P	PF	Yes	7/7/2014	6.4	1	4.50	
1.6	P	PF	Yes	9/24/2014	6.8	1	5.00	
1.6	P	PF	Yes	7/22/2015	8.7	0		07/2015 4.5 dead
1.6	P	PF	Yes	9/23/2015	9.9	0		
1.7	U	U	No	5/23/2013	8.0	0	NA	
1.7	U	U	No	6/13/2013	7.6	1	NA	
1.7	U	U	No	7/26/2013	8.1	1	2.00	
1.7	U	U	No	9/20/2013	8.3	1	1.50	
1.7	U	U	No	5/19/2014	6.8	1	1.50	
1.7	U	U	No	7/7/2014	6.4	0	NA	

Plot ID	Stock Type	Stock Type / Fabric	Fabric	Date	Water Table (ft)	Survival	Height (ft)	Comments
1.7	U	U	No	9/24/2014	6.8	0	NA	
1.7	U	U	No	7/22/2015	8.7	0		
1.7	U	U	No	9/23/2015	9.9	0		
1.8	P	PF	Yes	5/23/2013	8.0	1	NA	
1.8	P	PF	Yes	6/13/2013	7.6	1	NA	
1.8	P	PF	Yes	7/26/2013	8.1	1	4.50	
1.8	P	PF	Yes	9/20/2013	8.3	1	4.50	
1.8	P	PF	Yes	5/19/2014	6.8	1	4.00	
1.8	P	PF	Yes	7/7/2014	6.4	1	4.25	
1.8	P	PF	Yes	9/24/2014	6.8	1	4.25	
1.8	P	PF	Yes	7/22/2015	8.7	1	4.25	
1.8	P	PF	Yes	9/23/2015	9.9	1	3.50	
1.9	C	C	No	5/23/2013	8.0	1	NA	
1.9	C	C	No	6/13/2013	7.6	1	NA	
1.9	C	C	No	7/26/2013	8.1	1	3.00	
1.9	C	C	No	9/20/2013	8.3	1	3.00	
1.9	C	C	No	5/19/2014	6.8	1	3.00	
1.9	C	C	No	7/7/2014	6.4	1	3.50	
1.9	C	C	No	9/24/2014	6.8	1	4.00	
1.9	C	C	No	7/22/2015	8.7	1	4.00	
1.9	C	C	No	9/23/2015	9.9	1	3.50	
1.10	C	CF	Yes	5/23/2013	8.0	1	NA	
1.10	C	CF	Yes	6/13/2013	7.6	1	NA	
1.10	C	CF	Yes	7/26/2013	8.1	1	2.00	
1.10	C	CF	Yes	9/20/2013	8.3	1	2.50	
1.10	C	CF	Yes	5/19/2014	6.8	1	2.50	
1.10	C	CF	Yes	7/7/2014	6.4	1	2.75	
1.10	C	CF	Yes	9/24/2014	6.8	1	2.00	
1.10	C	CF	Yes	7/22/2015	8.7	1	2.00	
1.10	C	CF	Yes	9/23/2015	9.9	0		
1.11	P	P	No	5/23/2013	8.0	1	NA	
1.11	P	P	No	6/13/2013	7.6	1	NA	
1.11	P	P	No	7/26/2013	8.1	1	4.50	
1.11	P	P	No	9/20/2013	8.3	1	4.50	
1.11	P	P	No	5/19/2014	6.8	1	4.50	
1.11	P	P	No	7/7/2014	6.4	1	5.00	
1.11	P	P	No	9/24/2014	6.8	1	5.00	
1.11	P	P	No	7/22/2015	8.7	0		07/2015 4' dead
1.11	P	P	No	9/23/2015	9.9	1	3.50	
1.12	P	PF	Yes	5/23/2013	8.0	1	NA	
1.12	P	PF	Yes	6/13/2013	7.6	1	NA	
1.12	P	PF	Yes	7/26/2013	8.1	1	4.50	
1.12	P	PF	Yes	9/20/2013	8.3	1	4.00	
1.12	P	PF	Yes	5/19/2014	6.8	1	3.00	
1.12	P	PF	Yes	7/7/2014	6.4	0	NA	
1.12	P	PF	Yes	9/24/2014	6.8	0	NA	
1.12	P	PF	Yes	7/22/2015	8.7	0		07/2015 3.5' dead
1.12	P	PF	Yes	9/23/2015	9.9	0		
1.13	C	CF	Yes	5/23/2013	8.0	1	NA	
1.13	C	CF	Yes	6/13/2013	7.6	1	NA	
1.13	C	CF	Yes	7/26/2013	8.1	1	3.00	
1.13	C	CF	Yes	9/20/2013	8.3	1	3.50	
1.13	C	CF	Yes	5/19/2014	6.8	1	3.50	
1.13	C	CF	Yes	7/7/2014	6.4	1	4.00	
1.13	C	CF	Yes	9/24/2014	6.8	1	4.50	
1.13	C	CF	Yes	7/22/2015	8.7	0		07/2015 1.5' dead
1.13	C	CF	Yes	9/23/2015	9.9	1	1.00	
1.14	P	P	No	5/23/2013	8.0	1	NA	
1.14	P	P	No	6/13/2013	7.6	1	NA	
1.14	P	P	No	7/26/2013	8.1	1	4.00	

Plot ID	Stock Type	Stock Type / Fabric	Fabric	Date	Water Table (ft)	Survival	Height (ft)	Comments
1.14	P	P	No	9/20/2013	8.3	1	5.00	
1.14	P	P	No	5/19/2014	6.8	1	4.50	
1.14	P	P	No	7/7/2014	6.4	1	4.75	
1.14	P	P	No	9/24/2014	6.8	1	5.25	
1.14	P	P	No	7/22/2015	8.7	1	2.00	
1.14	P	P	No	9/23/2015	9.9	1	1.50	
1.15	U	UF	Yes	5/23/2013	8.0	0	NA	
1.15	U	UF	Yes	6/13/2013	7.6	0	NA	
1.15	U	UF	Yes	7/26/2013	8.1	1	0.50	
1.15	U	UF	Yes	9/20/2013	8.3	0	NA	
1.15	U	UF	Yes	5/19/2014	6.8	0	NA	
1.15	U	UF	Yes	7/7/2014	6.4	0	NA	
1.15	U	UF	Yes	9/24/2014	6.8	0	NA	
1.15	U	UF	Yes	7/22/2015	8.7	0		
1.15	U	UF	Yes	9/23/2015	9.9	0		
1.16	U	U	No	5/23/2013	8.0	0	NA	
1.16	U	U	No	6/13/2013	7.6	0	NA	
1.16	U	U	No	7/26/2013	8.1	1	0.50	
1.16	U	U	No	9/20/2013	8.3	0	NA	
1.16	U	U	No	5/19/2014	6.8	0	NA	
1.16	U	U	No	7/7/2014	6.4	0	NA	
1.16	U	U	No	9/24/2014	6.8	0	NA	
1.16	U	U	No	7/22/2015	8.7	0		
1.16	U	U	No	9/23/2015	9.9	0		
1.17	C	C	No	5/23/2013	8.0	1	NA	
1.17	C	C	No	6/13/2013	7.6	1	NA	
1.17	C	C	No	7/26/2013	8.1	1	2.00	
1.17	C	C	No	9/20/2013	8.3	1	2.50	
1.17	C	C	No	5/19/2014	6.8	1	2.00	
1.17	C	C	No	7/7/2014	6.4	1	NA	
1.17	C	C	No	9/24/2014	6.8	1	2.50	
1.17	C	C	No	7/22/2015	8.7	1	2.75	
1.17	C	C	No	9/23/2015	9.9	1	3.00	
1.18	U	UF	Yes	5/23/2013	8.0	0	NA	
1.18	U	UF	Yes	6/13/2013	7.6	0	NA	
1.18	U	UF	Yes	7/26/2013	8.1	1	1.00	
1.18	U	UF	Yes	9/20/2013	8.3	1	2.00	
1.18	U	UF	Yes	5/19/2014	6.8	1	1.50	
1.18	U	UF	Yes	7/7/2014	6.4	1	2.50	
1.18	U	UF	Yes	9/24/2014	6.8	1	2.50	
1.18	U	UF	Yes	7/22/2015	8.7	1	3.00	
1.18	U	UF	Yes	9/23/2015	9.9	1	3.00	
1.19	U	UF	Yes	5/23/2013	8.0	0	NA	
1.19	U	UF	Yes	6/13/2013	7.6	0	NA	
1.19	U	UF	Yes	7/26/2013	8.1	1	0.50	
1.19	U	UF	Yes	9/20/2013	8.3	1	1.00	
1.19	U	UF	Yes	5/19/2014	6.8	1	0.50	
1.19	U	UF	Yes	7/7/2014	6.4	0	NA	
1.19	U	UF	Yes	9/24/2014	6.8	0	NA	
1.19	U	UF	Yes	7/22/2015	8.7	0		
1.19	U	UF	Yes	9/23/2015	9.9	0		
1.20	C	C	No	5/23/2013	8.0	1	NA	
1.20	C	C	No	6/13/2013	7.6	1	NA	
1.20	C	C	No	7/26/2013	8.1	1	2.00	
1.20	C	C	No	9/20/2013	8.3	1	2.50	
1.20	C	C	No	5/19/2014	6.8	1	3.00	
1.20	C	C	No	7/7/2014	6.4	1	3.50	
1.20	C	C	No	9/24/2014	6.8	1	4.25	
1.20	C	C	No	7/22/2015	8.7	1	3.50	07/2015 dead top
1.20	C	C	No	9/23/2015	9.9	1	2.75	

Plot ID	Stock Type	Stock Type / Fabric	Fabric	Date	Water Table (ft)	Survival	Height (ft)	Comments
1.21	P	P	No	5/23/2013	8.0	1	NA	
1.21	P	P	No	6/13/2013	7.6	1	NA	
1.21	P	P	No	7/26/2013	8.1	1	3.00	
1.21	P	P	No	9/20/2013	8.3	1	3.50	
1.21	P	P	No	5/19/2014	6.8	1	3.50	
1.21	P	P	No	7/7/2014	6.4	1	3.25	
1.21	P	P	No	9/24/2014	6.8	1	4.00	
1.21	P	P	No	7/22/2015	8.7	0		07/2015 3.5' dead
1.21	P	P	No	9/23/2015	9.9	0		
1.22	C	CF	Yes	5/23/2013	8.0	1	NA	
1.22	C	CF	Yes	6/13/2013	7.6	1	NA	
1.22	C	CF	Yes	7/26/2013	8.1	1	3.00	
1.22	C	CF	Yes	9/20/2013	8.3	1	3.00	
1.22	C	CF	Yes	5/19/2014	6.8	1	3.00	
1.22	C	CF	Yes	7/7/2014	6.4	1	4.00	
1.22	C	CF	Yes	9/24/2014	6.8	1	4.25	
1.22	C	CF	Yes	7/22/2015	8.7	1	4.00	
1.22	C	CF	Yes	9/23/2015	9.9	1	1.50	
1.23	P	PF	Yes	5/23/2013	8.0	1	NA	
1.23	P	PF	Yes	6/13/2013	7.6	1	NA	
1.23	P	PF	Yes	7/26/2013	8.1	1	5.00	
1.23	P	PF	Yes	9/20/2013	8.3	1	6.00	
1.23	P	PF	Yes	5/19/2014	6.8	1	4.00	
1.23	P	PF	Yes	7/7/2014	6.4	1	5.25	
1.23	P	PF	Yes	9/24/2014	6.8	1	5.50	
1.23	P	PF	Yes	7/22/2015	8.7	1	3.00	07/2015 dead top
1.23	P	PF	Yes	9/23/2015	9.9	1	3.50	
1.24	U	U	No	5/23/2013	8.0	0	NA	
1.24	U	U	No	6/13/2013	7.6	0	NA	
1.24	U	U	No	7/26/2013	8.1	1	0.50	
1.24	U	U	No	9/20/2013	8.3	0	NA	
1.24	U	U	No	5/19/2014	6.8	0	NA	
1.24	U	U	No	7/7/2014	6.4	0	NA	
1.24	U	U	No	9/24/2014	6.8	0	NA	
1.24	U	U	No	7/22/2015	8.7	0		
1.24	U	U	No	9/23/2015	9.9	0		
1.25	C	C	No	5/23/2013	8.0	1	NA	
1.25	C	C	No	6/13/2013	7.6	1	NA	
1.25	C	C	No	7/26/2013	8.1	1	2.00	
1.25	C	C	No	9/20/2013	8.3	1	2.50	
1.25	C	C	No	5/19/2014	6.8	1	3.00	
1.25	C	C	No	7/7/2014	6.4	1	3.50	
1.25	C	C	No	9/24/2014	6.8	1	4.00	
1.25	C	C	No	7/22/2015	8.7	1	4.25	
1.25	C	C	No	9/23/2015	9.9	1	4.25	
1.26	U	U	No	5/23/2013	8.0	0	NA	
1.26	U	U	No	6/13/2013	7.6	0	NA	
1.26	U	U	No	7/26/2013	8.1	1	2.00	
1.26	U	U	No	9/20/2013	8.3	0	NA	
1.26	U	U	No	5/19/2014	6.8	0	NA	
1.26	U	U	No	7/7/2014	6.4	0	NA	
1.26	U	U	No	9/24/2014	6.8	0	NA	
1.26	U	U	No	7/22/2015	8.7	0		
1.26	U	U	No	9/23/2015	9.9	0		
1.27	C	CF	Yes	5/23/2013	8.0	1	NA	
1.27	C	CF	Yes	6/13/2013	7.6	1	NA	
1.27	C	CF	Yes	7/26/2013	8.1	1	3.00	
1.27	C	CF	Yes	9/20/2013	8.3	1	2.50	
1.27	C	CF	Yes	5/19/2014	6.8	1	3.00	
1.27	C	CF	Yes	7/7/2014	6.4	1	3.00	

Plot ID	Stock Type	Stock Type / Fabric	Fabric	Date	Water Table (ft)	Survival	Height (ft)	Comments
1.27	C	CF	Yes	9/24/2014	6.8	1	4.00	
1.27	C	CF	Yes	7/22/2015	8.7	1	4.00	
1.27	C	CF	Yes	9/23/2015	9.9	1	4.00	
1.28	P	P	No	5/23/2013	8.0	1	NA	
1.28	P	P	No	6/13/2013	7.6	1	NA	
1.28	P	P	No	7/26/2013	8.1	1	3.00	
1.28	P	P	No	9/20/2013	8.3	1	4.00	
1.28	P	P	No	5/19/2014	6.8	1	3.50	
1.28	P	P	No	7/7/2014	6.4	1	3.75	
1.28	P	P	No	9/24/2014	6.8	1	4.25	
1.28	P	P	No	7/22/2015	8.7	1	3.00	07/2015 dead top
1.28	P	P	No	9/23/2015	9.9	1	2.75	
1.29	U	UF	Yes	5/23/2013	8.0	0	NA	
1.29	U	UF	Yes	6/13/2013	7.6	0	NA	
1.29	U	UF	Yes	7/26/2013	8.1	0	NA	
1.29	U	UF	Yes	9/20/2013	8.3	0	NA	
1.29	U	UF	Yes	5/19/2014	6.8	0	NA	
1.29	U	UF	Yes	7/7/2014	6.4	0	NA	
1.29	U	UF	Yes	9/24/2014	6.8	0	NA	
1.29	U	UF	Yes	7/22/2015	8.7	0		
1.29	U	UF	Yes	9/23/2015	9.9	0		
1.30	P	PF	Yes	5/23/2013	8.0	1	NA	
1.30	P	PF	Yes	6/13/2013	7.6	1	NA	
1.30	P	PF	Yes	7/26/2013	8.1	1	4.50	
1.30	P	PF	Yes	9/20/2013	8.3	1	4.50	
1.30	P	PF	Yes	5/19/2014	6.8	0	NA	
1.30	P	PF	Yes	7/7/2014	6.4	0	NA	
1.30	P	PF	Yes	9/24/2014	6.8	0	NA	
1.30	P	PF	Yes	7/22/2015	8.7	0		
1.30	P	PF	Yes	9/23/2015	9.9	0		
1.31	P	PF	Yes	5/23/2013	8.0	1	NA	
1.31	P	PF	Yes	6/13/2013	7.6	1	NA	
1.31	P	PF	Yes	7/26/2013	8.1	1	4.00	
1.31	P	PF	Yes	9/20/2013	8.3	1	4.00	
1.31	P	PF	Yes	5/19/2014	6.8	1	3.50	
1.31	P	PF	Yes	7/7/2014	6.4	1	2.50	
1.31	P	PF	Yes	9/24/2014	6.8	1	3.25	
1.31	P	PF	Yes	7/22/2015	8.7	0		07/2015 3.5' dead
1.31	P	PF	Yes	9/23/2015	9.9	0		
1.32	C	CF	Yes	5/23/2013	8.0	1	NA	
1.32	C	CF	Yes	6/13/2013	7.6	1	NA	
1.32	C	CF	Yes	7/26/2013	8.1	1	3.00	
1.32	C	CF	Yes	9/20/2013	8.3	1	2.50	
1.32	C	CF	Yes	5/19/2014	6.8	1	2.00	
1.32	C	CF	Yes	7/7/2014	6.4	1	2.50	
1.32	C	CF	Yes	9/24/2014	6.8	1	2.25	
1.32	C	CF	Yes	7/22/2015	8.7	1	1.00	barely alive
1.32	C	CF	Yes	9/23/2015	9.9	0		
1.33	P	P	No	5/23/2013	8.0	1	NA	
1.33	P	P	No	6/13/2013	7.6	1	NA	
1.33	P	P	No	7/26/2013	8.1	1	4.50	
1.33	P	P	No	9/20/2013	8.3	1	4.50	
1.33	P	P	No	5/19/2014	6.8	1	4.00	
1.33	P	P	No	7/7/2014	6.4	0	NA	
1.33	P	P	No	9/24/2014	6.8	1	3.00	
1.33	P	P	No	7/22/2015	8.7	0		07/2015 4' dead
1.33	P	P	No	9/23/2015	9.9	0		
1.34	U	UF	Yes	5/23/2013	8.0	0	NA	
1.34	U	UF	Yes	6/13/2013	7.6	0	NA	
1.34	U	UF	Yes	7/26/2013	8.1	1	0.50	

Plot ID	Stock Type	Stock Type / Fabric	Fabric	Date	Water Table (ft)	Survival	Height (ft)	Comments
1.34	U	UF	Yes	9/20/2013	8.3	0	NA	
1.34	U	UF	Yes	5/19/2014	6.8	0	NA	
1.34	U	UF	Yes	7/7/2014	6.4	0	NA	
1.34	U	UF	Yes	9/24/2014	6.8	0	NA	
1.34	U	UF	Yes	7/22/2015	8.7	0		
1.34	U	UF	Yes	9/23/2015	9.9	0		
1.35	U	U	No	5/23/2013	8.0	1	NA	
1.35	U	U	No	6/13/2013	7.6	1	NA	
1.35	U	U	No	7/26/2013	8.1	0	NA	
1.35	U	U	No	9/20/2013	8.3	0	NA	
1.35	U	U	No	5/19/2014	6.8	0	NA	
1.35	U	U	No	7/7/2014	6.4	0	NA	
1.35	U	U	No	9/24/2014	6.8	0	NA	
1.35	U	U	No	7/22/2015	8.7	0		
1.35	U	U	No	9/23/2015	9.9	0		
1.36	C	C	No	5/23/2013	8.0	1	NA	
1.36	C	C	No	6/13/2013	7.6	1	NA	
1.36	C	C	No	7/26/2013	8.1	1	3.00	
1.36	C	C	No	9/20/2013	8.3	1	2.50	
1.36	C	C	No	5/19/2014	6.8	1	2.00	
1.36	C	C	No	7/7/2014	6.4	1	2.75	
1.36	C	C	No	9/24/2014	6.8	1	3.00	
1.36	C	C	No	7/22/2015	8.7	1	2.75	
1.36	C	C	No	9/23/2015	9.9	1	1.50	
2.1	P	P	No	5/23/2013	10.1	1	NA	
2.1	P	P	No	6/13/2013	11.5	1	NA	
2.1	P	P	No	7/26/2013	11.5	1	4.50	
2.1	P	P	No	9/20/2013	11.5	1	4.50	
2.1	P	P	No	5/19/2014	10.0	1	4.00	
2.1	P	P	No	7/7/2014	9.5	1	4.25	
2.1	P	P	No	9/24/2014	11.5	1	2.50	
2.1	P	P	No	7/22/2015	9.9	1	2.00	07/2015 dead top
2.1	P	P	No	9/23/2015	12.0	1	2.00	
2.2	U	U	Yes	5/23/2013	10.1	0	NA	
2.2	U	U	Yes	6/13/2013	11.5	1	NA	
2.2	U	U	Yes	7/26/2013	11.5	0	NA	
2.2	U	U	Yes	9/20/2013	11.5	0	NA	
2.2	U	U	Yes	5/19/2014	10.0	0	NA	
2.2	U	U	Yes	7/7/2014	9.5	0	NA	
2.2	U	U	Yes	9/24/2014	11.5	0	NA	
2.2	U	U	Yes	7/22/2015	9.9	0		
2.2	U	U	Yes	9/23/2015	12.0	0		
2.3	C	CF	Yes	5/23/2013	10.1	1	NA	
2.3	C	CF	Yes	6/13/2013	11.5	1	NA	
2.3	C	CF	Yes	7/26/2013	11.5	1	3.00	
2.3	C	CF	Yes	9/20/2013	11.5	1	2.50	
2.3	C	CF	Yes	5/19/2014	10.0	1	2.00	
2.3	C	CF	Yes	7/7/2014	9.5	1	2.50	
2.3	C	CF	Yes	9/24/2014	11.5	0	NA	
2.3	C	CF	Yes	7/22/2015	9.9	0		
2.3	C	CF	Yes	9/23/2015	12.0	0		
2.4	U	UF	Yes	5/23/2013	10.1	0	NA	
2.4	U	UF	Yes	6/13/2013	11.5	0	NA	
2.4	U	UF	Yes	7/26/2013	11.5	0	NA	
2.4	U	UF	Yes	9/20/2013	11.5	0	NA	
2.4	U	UF	Yes	5/19/2014	10.0	0	NA	
2.4	U	UF	Yes	7/7/2014	9.5	0	NA	
2.4	U	UF	Yes	9/24/2014	11.5	1	2.00	
2.4	U	UF	Yes	7/22/2015	9.9	0		
2.4	U	UF	Yes	9/23/2015	12.0	0		

Plot ID	Stock Type	Stock Type / Fabric	Fabric	Date	Water Table (ft)	Survival	Height (ft)	Comments
2.5	C	C	No	5/23/2013	10.1	1	NA	
2.5	C	C	No	6/13/2013	11.5	1	NA	
2.5	C	C	No	7/26/2013	11.5	1	3.00	
2.5	C	C	No	9/20/2013	11.5	0	NA	
2.5	C	C	No	5/19/2014	10.0	1	2.00	
2.5	C	C	No	7/7/2014	9.5	0	NA	
2.5	C	C	No	9/24/2014	11.5	0	NA	
2.5	C	C	No	7/22/2015	9.9	0		
2.5	C	C	No	9/23/2015	12.0	0		
2.6	P	PF	Yes	5/23/2013	10.1	1	NA	
2.6	P	PF	Yes	6/13/2013	11.5	1	NA	
2.6	P	PF	Yes	7/26/2013	11.5	1	4.00	
2.6	P	PF	Yes	9/20/2013	11.5	1	4.00	
2.6	P	PF	Yes	5/19/2014	10.0	1	4.00	
2.6	P	PF	Yes	7/7/2014	9.5	1	1.75	
2.6	P	PF	Yes	9/24/2014	11.5	1	4.00	
2.6	P	PF	Yes	7/22/2015	9.9	1	2.50	
2.6	P	PF	Yes	9/23/2015	12.0	1	3.00	
2.7	C	CF	Yes	5/23/2013	10.1	1	NA	
2.7	C	CF	Yes	6/13/2013	11.5	1	NA	
2.7	C	CF	Yes	7/26/2013	11.5	1	2.00	
2.7	C	CF	Yes	9/20/2013	11.5	1	2.50	
2.7	C	CF	Yes	5/19/2014	10.0	1	2.00	
2.7	C	CF	Yes	7/7/2014	9.5	1	3.50	
2.7	C	CF	Yes	9/24/2014	11.5	1	4.00	
2.7	C	CF	Yes	7/22/2015	9.9	1	4.00	
2.7	C	CF	Yes	9/23/2015	12.0	1	4.00	
2.8	U	U	Yes	5/23/2013	10.1	0	NA	
2.8	U	U	Yes	6/13/2013	11.5	0	NA	
2.8	U	U	Yes	7/26/2013	11.5	0	NA	
2.8	U	U	Yes	9/20/2013	11.5	0	NA	
2.8	U	U	Yes	5/19/2014	10.0	0	NA	
2.8	U	U	Yes	7/7/2014	9.5	0	NA	
2.8	U	U	Yes	9/24/2014	11.5	0	NA	
2.8	U	U	Yes	7/22/2015	9.9	0		
2.8	U	U	Yes	9/23/2015	12.0	0		
2.9	U	UF	Yes	5/23/2013	10.1	0	NA	
2.9	U	UF	Yes	6/13/2013	11.5	0	NA	
2.9	U	UF	Yes	7/26/2013	11.5	1	0.50	
2.9	U	UF	Yes	9/20/2013	11.5	0	NA	
2.9	U	UF	Yes	5/19/2014	10.0	0	NA	
2.9	U	UF	Yes	7/7/2014	9.5	0	NA	
2.9	U	UF	Yes	9/24/2014	11.5	1	1.00	
2.9	U	UF	Yes	7/22/2015	9.9	0		
2.9	U	UF	Yes	9/23/2015	12.0	0		
2.10	C	C	No	5/23/2013	10.1	1	NA	
2.10	C	C	No	6/13/2013	11.5	1	NA	
2.10	C	C	No	7/26/2013	11.5	1	3.00	
2.10	C	C	No	9/20/2013	11.5	1	2.50	
2.10	C	C	No	5/19/2014	10.0	1	2.50	
2.10	C	C	No	7/7/2014	9.5	1	3.25	
2.10	C	C	No	9/24/2014	11.5	1	3.50	
2.10	C	C	No	7/22/2015	9.9	1	4.00	
2.10	C	C	No	9/23/2015	12.0	1	4.00	
2.11	P	PF	Yes	5/23/2013	10.1	1	NA	
2.11	P	PF	Yes	6/13/2013	11.5	1	NA	
2.11	P	PF	Yes	7/26/2013	11.5	1	4.00	
2.11	P	PF	Yes	9/20/2013	11.5	1	4.50	
2.11	P	PF	Yes	5/19/2014	10.0	1	4.00	
2.11	P	PF	Yes	7/7/2014	9.5	1	4.50	

Plot ID	Stock Type	Stock Type / Fabric	Fabric	Date	Water Table (ft)	Survival	Height (ft)	Comments
2.11	P	PF	Yes	9/24/2014	11.5	1	4.50	
2.11	P	PF	Yes	7/22/2015	9.9	1	4.00	
2.11	P	PF	Yes	9/23/2015	12.0	0		
2.12	P	P	No	5/23/2013	10.1	1	NA	
2.12	P	P	No	6/13/2013	11.5	1	NA	
2.12	P	P	No	7/26/2013	11.5	1	4.00	
2.12	P	P	No	9/20/2013	11.5	1	4.00	
2.12	P	P	No	5/19/2014	10.0	1	4.00	
2.12	P	P	No	7/7/2014	9.5	1	4.50	
2.12	P	P	No	9/24/2014	11.5	1	4.25	
2.12	P	P	No	7/22/2015	9.9	1	5.00	07/2015 dead top
2.12	P	P	No	9/23/2015	12.0	0		
2.13	U	U	Yes	5/23/2013	10.1	0	NA	
2.13	U	U	Yes	6/13/2013	11.5	0	NA	
2.13	U	U	Yes	7/26/2013	11.5	1	0.50	
2.13	U	U	Yes	9/20/2013	11.5	0	NA	
2.13	U	U	Yes	5/19/2014	10.0	0	NA	
2.13	U	U	Yes	7/7/2014	9.5	0	NA	
2.13	U	U	Yes	9/24/2014	11.5	0	NA	
2.13	U	U	Yes	7/22/2015	9.9	0		
2.13	U	U	Yes	9/23/2015	12.0	0		
2.14	P	P	No	5/23/2013	10.1	1	NA	
2.14	P	P	No	6/13/2013	11.5	1	NA	
2.14	P	P	No	7/26/2013	11.5	1	4.00	
2.14	P	P	No	9/20/2013	11.5	1	4.00	
2.14	P	P	No	5/19/2014	10.0	1	4.00	
2.14	P	P	No	7/7/2014	9.5	1	4.25	
2.14	P	P	No	9/24/2014	11.5	1	4.50	
2.14	P	P	No	7/22/2015	9.9	0		07/2015 4' dead
2.14	P	P	No	9/23/2015	12.0	0		
2.15	C	CF	Yes	5/23/2013	10.1	1	NA	
2.15	C	CF	Yes	6/13/2013	11.5	1	NA	
2.15	C	CF	Yes	7/26/2013	11.5	1	4.00	
2.15	C	CF	Yes	9/20/2013	11.5	1	4.00	
2.15	C	CF	Yes	5/19/2014	10.0	1	4.00	
2.15	C	CF	Yes	7/7/2014	9.5	1	4.00	
2.15	C	CF	Yes	9/24/2014	11.5	1	4.00	
2.15	C	CF	Yes	7/22/2015	9.9	1	4.25	
2.15	C	CF	Yes	9/23/2015	12.0	1	4.50	
2.16	U	UF	Yes	5/23/2013	10.1	0	NA	
2.16	U	UF	Yes	6/13/2013	11.5	0	NA	
2.16	U	UF	Yes	7/26/2013	11.5	1	0.50	
2.16	U	UF	Yes	9/20/2013	11.5	0	NA	
2.16	U	UF	Yes	5/19/2014	10.0	0	NA	
2.16	U	UF	Yes	7/7/2014	9.5	0	NA	
2.16	U	UF	Yes	9/24/2014	11.5	0	NA	
2.16	U	UF	Yes	7/22/2015	9.9	0		
2.16	U	UF	Yes	9/23/2015	12.0	0		
2.17	C	C	No	5/23/2013	10.1	1	NA	
2.17	C	C	No	6/13/2013	11.5	1	NA	
2.17	C	C	No	7/26/2013	11.5	1	3.00	
2.17	C	C	No	9/20/2013	11.5	1	3.00	
2.17	C	C	No	5/19/2014	10.0	1	3.00	
2.17	C	C	No	7/7/2014	9.5	1	3.75	
2.17	C	C	No	9/24/2014	11.5	1	4.00	
2.17	C	C	No	7/22/2015	9.9	1	4.25	
2.17	C	C	No	9/23/2015	12.0	1	4.50	
2.18	P	PF	Yes	5/23/2013	10.1	1	NA	
2.18	P	PF	Yes	6/13/2013	11.5	1	NA	
2.18	P	PF	Yes	7/26/2013	11.5	1	4.00	

Plot ID	Stock Type	Stock Type / Fabric	Fabric	Date	Water Table (ft)	Survival	Height (ft)	Comments
2.18	P	PF	Yes	9/20/2013	11.5	1	5.00	
2.18	P	PF	Yes	5/19/2014	10.0	1	4.50	
2.18	P	PF	Yes	7/7/2014	9.5	1	4.25	
2.18	P	PF	Yes	9/24/2014	11.5	1	5.25	
2.18	P	PF	Yes	7/22/2015	9.9	1	4.50	
2.18	P	PF	Yes	9/23/2015	12.0	1	4.50	
2.19	U	UF	Yes	5/23/2013	10.1	0	NA	
2.19	U	UF	Yes	6/13/2013	11.5	1	NA	
2.19	U	UF	Yes	7/26/2013	11.5	1	0.50	
2.19	U	UF	Yes	9/20/2013	11.5	1	2.00	
2.19	U	UF	Yes	5/19/2014	10.0	0	NA	
2.19	U	UF	Yes	7/7/2014	9.5	0	NA	
2.19	U	UF	Yes	9/24/2014	11.5	0	NA	
2.19	U	UF	Yes	7/22/2015	9.9	0		
2.19	U	UF	Yes	9/23/2015	12.0	0		
2.20	U	U	Yes	5/23/2013	10.1	0	NA	
2.20	U	U	Yes	6/13/2013	11.5	0	NA	
2.20	U	U	Yes	7/26/2013	11.5	1	2.00	
2.20	U	U	Yes	9/20/2013	11.5	0	NA	
2.20	U	U	Yes	5/19/2014	10.0	1	2.00	
2.20	U	U	Yes	7/7/2014	9.5	0	NA	
2.20	U	U	Yes	9/24/2014	11.5	0	NA	
2.20	U	U	Yes	7/22/2015	9.9	0		
2.20	U	U	Yes	9/23/2015	12.0	0		
2.21	P	PF	Yes	5/23/2013	10.1	1	NA	
2.21	P	PF	Yes	6/13/2013	11.5	1	NA	
2.21	P	PF	Yes	7/26/2013	11.5	1	4.50	
2.21	P	PF	Yes	9/20/2013	11.5	1	5.00	
2.21	P	PF	Yes	5/19/2014	10.0	1	4.00	
2.21	P	PF	Yes	7/7/2014	9.5	0	NA	
2.21	P	PF	Yes	9/24/2014	11.5	0	NA	
2.21	P	PF	Yes	7/22/2015	9.9	1	0.25	
2.21	P	PF	Yes	9/23/2015	12.0	1	0.25	
2.22	P	P	No	5/23/2013	10.1	1	NA	
2.22	P	P	No	6/13/2013	11.5	1	NA	
2.22	P	P	No	7/26/2013	11.5	1	4.50	
2.22	P	P	No	9/20/2013	11.5	1	5.00	
2.22	P	P	No	5/19/2014	10.0	1	4.00	
2.22	P	P	No	7/7/2014	9.5	1	4.50	
2.22	P	P	No	9/24/2014	11.5	1	4.50	
2.22	P	P	No	7/22/2015	9.9	1	5.00	
2.22	P	P	No	9/23/2015	12.0	1	5.25	
2.23	C	CF	Yes	5/23/2013	10.1	1	NA	
2.23	C	CF	Yes	6/13/2013	11.5	1	NA	
2.23	C	CF	Yes	7/26/2013	11.5	1	2.00	
2.23	C	CF	Yes	9/20/2013	11.5	1	3.00	
2.23	C	CF	Yes	5/19/2014	10.0	1	3.00	
2.23	C	CF	Yes	7/7/2014	9.5	1	3.75	
2.23	C	CF	Yes	9/24/2014	11.5	1	4.00	
2.23	C	CF	Yes	7/22/2015	9.9	1	2.75	
2.23	C	CF	Yes	9/23/2015	12.0	1	2.75	
2.24	C	C	No	5/23/2013	10.1	1	NA	
2.24	C	C	No	6/13/2013	11.5	1	NA	
2.24	C	C	No	7/26/2013	11.5	1	3.00	
2.24	C	C	No	9/20/2013	11.5	1	3.50	
2.24	C	C	No	5/19/2014	10.0	1	3.50	
2.24	C	C	No	7/7/2014	9.5	1	4.00	
2.24	C	C	No	9/24/2014	11.5	1	4.00	
2.24	C	C	No	7/22/2015	9.9	1	2.50	07/2015 dead top
2.24	C	C	No	9/23/2015	12.0	1	2.50	

Plot ID	Stock Type	Stock Type / Fabric	Fabric	Date	Water Table (ft)	Survival	Height (ft)	Comments
2.25	U	UF	Yes	5/23/2013	10.1	1	NA	
2.25	U	UF	Yes	6/13/2013	11.5	1	NA	
2.25	U	UF	Yes	7/26/2013	11.5	1	3.00	
2.25	U	UF	Yes	9/20/2013	11.5	1	3.00	
2.25	U	UF	Yes	5/19/2014	10.0	1	2.50	
2.25	U	UF	Yes	7/7/2014	9.5	1	2.75	
2.25	U	UF	Yes	9/24/2014	11.5	1	3.00	
2.25	U	UF	Yes	7/22/2015	9.9	0		
2.25	U	UF	Yes	9/23/2015	12.0	0		
2.26	P	P	No	5/23/2013	10.1	1	NA	
2.26	P	P	No	6/13/2013	11.5	1	NA	
2.26	P	P	No	7/26/2013	11.5	1	4.50	
2.26	P	P	No	9/20/2013	11.5	1	4.50	
2.26	P	P	No	5/19/2014	10.0	1	4.00	
2.26	P	P	No	7/7/2014	9.5	1	4.00	
2.26	P	P	No	9/24/2014	11.5	1	4.00	
2.26	P	P	No	7/22/2015	9.9	1	4.00	
2.26	P	P	No	9/23/2015	12.0	1	3.50	
2.27	U	U	Yes	5/23/2013	10.1	0	NA	
2.27	U	U	Yes	6/13/2013	11.5	1	NA	
2.27	U	U	Yes	7/26/2013	11.5	1	1.00	
2.27	U	U	Yes	9/20/2013	11.5	0	NA	
2.27	U	U	Yes	5/19/2014	10.0	0	NA	
2.27	U	U	Yes	7/7/2014	9.5	0	NA	
2.27	U	U	Yes	9/24/2014	11.5	0	NA	
2.27	U	U	Yes	7/22/2015	9.9	0		
2.27	U	U	Yes	9/23/2015	12.0	0		
2.28	P	PF	Yes	5/23/2013	10.1	1	NA	
2.28	P	PF	Yes	6/13/2013	11.5	1	NA	
2.28	P	PF	Yes	7/26/2013	11.5	1	4.50	
2.28	P	PF	Yes	9/20/2013	11.5	1	5.00	
2.28	P	PF	Yes	5/19/2014	10.0	1	4.00	
2.28	P	PF	Yes	7/7/2014	9.5	1	4.25	
2.28	P	PF	Yes	9/24/2014	11.5	1	4.75	
2.28	P	PF	Yes	7/22/2015	9.9	1	1.5	07/2015 dead top
2.28	P	PF	Yes	9/23/2015	12.0	0		
2.29	C	CF	Yes	5/23/2013	10.1	1	NA	
2.29	C	CF	Yes	6/13/2013	11.5	1	NA	
2.29	C	CF	Yes	7/26/2013	11.5	1	4.00	
2.29	C	CF	Yes	9/20/2013	11.5	1	4.50	
2.29	C	CF	Yes	5/19/2014	10.0	1	4.00	
2.29	C	CF	Yes	7/7/2014	9.5	1	4.50	
2.29	C	CF	Yes	9/24/2014	11.5	1	4.75	
2.29	C	CF	Yes	7/22/2015	9.9	0		07/2015 4.5 dead
2.29	C	CF	Yes	9/23/2015	12.0	0		
2.30	C	C	No	5/23/2013	10.1	1	NA	
2.30	C	C	No	6/13/2013	11.5	1	NA	
2.30	C	C	No	7/26/2013	11.5	1	3.00	
2.30	C	C	No	9/20/2013	11.5	1	3.50	
2.30	C	C	No	5/19/2014	10.0	1	3.00	
2.30	C	C	No	7/7/2014	9.5	1	4.00	
2.30	C	C	No	9/24/2014	11.5	1	4.00	
2.30	C	C	No	7/22/2015	9.9	1	4.00	
2.30	C	C	No	9/23/2015	12.0	1	4.00	
2.31	U	U	Yes	5/23/2013	10.1	0	NA	
2.31	U	U	Yes	6/13/2013	11.5	0	NA	
2.31	U	U	Yes	7/26/2013	11.5	1	0.50	
2.31	U	U	Yes	9/20/2013	11.5	0	NA	
2.31	U	U	Yes	5/19/2014	10.0	0	NA	
2.31	U	U	Yes	7/7/2014	9.5	0	NA	

Plot ID	Stock Type	Stock Type / Fabric	Fabric	Date	Water Table (ft)	Survival	Height (ft)	Comments
2.31	U	U	Yes	9/24/2014	11.5	0	NA	
2.31	U	U	Yes	7/22/2015	9.9	0		
2.31	U	U	Yes	9/23/2015	12.0	0		
2.32	P	P	No	5/23/2013	10.1	1	NA	
2.32	P	P	No	6/13/2013	11.5	1	NA	
2.32	P	P	No	7/26/2013	11.5	1	4.00	
2.32	P	P	No	9/20/2013	11.5	1	4.50	
2.32	P	P	No	5/19/2014	10.0	1	4.00	
2.32	P	P	No	7/7/2014	9.5	1	4.00	
2.32	P	P	No	9/24/2014	11.5	1	4.25	
2.32	P	P	No	7/22/2015	9.9	1	4.25	
2.32	P	P	No	9/23/2015	12.0	1	3.00	
2.33	P	PF	Yes	5/23/2013	10.1	1	NA	
2.33	P	PF	Yes	6/13/2013	11.5	1	NA	
2.33	P	PF	Yes	7/26/2013	11.5	1	4.00	
2.33	P	PF	Yes	9/20/2013	11.5	1	4.00	
2.33	P	PF	Yes	5/19/2014	10.0	1	4.00	
2.33	P	PF	Yes	7/7/2014	9.5	1	4.50	
2.33	P	PF	Yes	9/24/2014	11.5	1	4.50	
2.33	P	PF	Yes	7/22/2015	9.9	0		07/2015 4.5 dead
2.33	P	PF	Yes	9/23/2015	12.0	0		
2.34	C	CF	Yes	5/23/2013	10.1	1	NA	
2.34	C	CF	Yes	6/13/2013	11.5	1	NA	
2.34	C	CF	Yes	7/26/2013	11.5	1	4.00	
2.34	C	CF	Yes	9/20/2013	11.5	1	4.50	
2.34	C	CF	Yes	5/19/2014	10.0	1	4.00	
2.34	C	CF	Yes	7/7/2014	9.5	1	4.25	
2.34	C	CF	Yes	9/24/2014	11.5	1	4.25	
2.34	C	CF	Yes	7/22/2015	9.9	0		07/2015 4.25 dead
2.34	C	CF	Yes	9/23/2015	12.0	0		
2.35	C	C	No	5/23/2013	10.1	1	NA	
2.35	C	C	No	6/13/2013	11.5	1	NA	
2.35	C	C	No	7/26/2013	11.5	1	3.00	
2.35	C	C	No	9/20/2013	11.5	1	3.00	
2.35	C	C	No	5/19/2014	10.0	1	2.50	
2.35	C	C	No	7/7/2014	9.5	1	3.75	
2.35	C	C	No	9/24/2014	11.5	1	3.75	
2.35	C	C	No	7/22/2015	9.9	1	4.00	
2.35	C	C	No	9/23/2015	12.0	1	4.00	
2.36	U	UF	Yes	5/23/2013	10.1	0	NA	
2.36	U	UF	Yes	6/13/2013	11.5	1	NA	
2.36	U	UF	Yes	7/26/2013	11.5	0	NA	
2.36	U	UF	Yes	9/20/2013	11.5	0	NA	
2.36	U	UF	Yes	5/19/2014	10.0	0	NA	
2.36	U	UF	Yes	7/7/2014	9.5	0	NA	
2.36	U	UF	Yes	9/24/2014	11.5	0	NA	
2.36	U	UF	Yes	7/22/2015	9.9	0		
2.36	U	UF	Yes	9/23/2015	12.0	0		
3.1	C	CF	Yes	5/23/2013	8.2	1	NA	
3.1	C	CF	Yes	6/13/2013	8.5	1	NA	
3.1	C	CF	Yes	7/26/2013	9.1	1	3.00	
3.1	C	CF	Yes	9/20/2013	9.5	1	2.50	
3.1	C	CF	Yes	5/19/2014	7.6	1	3.00	
3.1	C	CF	Yes	7/7/2014	7.3	0	NA	
3.1	C	CF	Yes	9/24/2014	6.7	0	NA	
3.1	C	CF	Yes	7/22/2015	7.7	0		
3.1	C	CF	Yes	9/23/2015	11.0	0		
3.2	U	UF	No	5/23/2013	8.2	0	NA	
3.2	U	UF	No	6/13/2013	8.5	0	NA	
3.2	U	UF	No	7/26/2013	9.1	0	NA	

Plot ID	Stock Type	Stock Type / Fabric	Fabric	Date	Water Table (ft)	Survival	Height (ft)	Comments
3.2	U	UF	No	9/20/2013	9.5	0	NA	
3.2	U	UF	No	5/19/2014	7.6	0	NA	
3.2	U	UF	No	7/7/2014	7.3	0	NA	
3.2	U	UF	No	9/24/2014	6.7	0	NA	
3.2	U	UF	No	7/22/2015	7.7	0		
3.2	U	UF	No	9/23/2015	11.0	0		
3.3	U	U	No	5/23/2013	8.2	0	NA	
3.3	U	U	No	6/13/2013	8.5	0	NA	
3.3	U	U	No	7/26/2013	9.1	1	1.00	
3.3	U	U	No	9/20/2013	9.5	1	1.50	
3.3	U	U	No	5/19/2014	7.6	0	NA	
3.3	U	U	No	7/7/2014	7.3	0	NA	
3.3	U	U	No	9/24/2014	6.7	0	NA	
3.3	U	U	No	7/22/2015	7.7	0		
3.3	U	U	No	9/23/2015	11.0	0		
3.4	C	C	No	5/23/2013	8.2	1	NA	
3.4	C	C	No	6/13/2013	8.5	1	NA	
3.4	C	C	No	7/26/2013	9.1	1	3.00	
3.4	C	C	No	9/20/2013	9.5	1	3.50	
3.4	C	C	No	5/19/2014	7.6	1	3.50	
3.4	C	C	No	7/7/2014	7.3	1	4.25	
3.4	C	C	No	9/24/2014	6.7	1	4.50	
3.4	C	C	No	7/22/2015	7.7	1	3.00	07/2015 resprout from base
3.4	C	C	No	9/23/2015	11.0	1	3.00	
3.5	P	PF	Yes	5/23/2013	8.2	1	NA	
3.5	P	PF	Yes	6/13/2013	8.5	1	NA	
3.5	P	PF	Yes	7/26/2013	9.1	1	4.50	
3.5	P	PF	Yes	9/20/2013	9.5	1	5.00	
3.5	P	PF	Yes	5/19/2014	7.6	1	4.50	
3.5	P	PF	Yes	7/7/2014	7.3	1	4.50	
3.5	P	PF	Yes	9/24/2014	6.7	1	5.00	
3.5	P	PF	Yes	7/22/2015	7.7	1	2.50	07/2015 resprout from base
3.5	P	PF	Yes	9/23/2015	11.0	1	2.75	
3.6	P	P	No	5/23/2013	8.2	1	NA	
3.6	P	P	No	6/13/2013	8.5	1	NA	
3.6	P	P	No	7/26/2013	9.1	1	3.00	
3.6	P	P	No	9/20/2013	9.5	1	4.50	
3.6	P	P	No	5/19/2014	7.6	1	4.00	
3.6	P	P	No	7/7/2014	7.3	1	4.50	
3.6	P	P	No	9/24/2014	6.7	1	5.00	
3.6	P	P	No	7/22/2015	7.7	0		
3.6	P	P	No	9/23/2015	11.0	0		
3.7	P	PF	Yes	5/23/2013	8.2	1	NA	
3.7	P	PF	Yes	6/13/2013	8.5	1	NA	
3.7	P	PF	Yes	7/26/2013	9.1	1	4.50	
3.7	P	PF	Yes	9/20/2013	9.5	1	5.50	
3.7	P	PF	Yes	5/19/2014	7.6	1	5.00	
3.7	P	PF	Yes	7/7/2014	7.3	1	5.00	
3.7	P	PF	Yes	9/24/2014	6.7	1	7.25	
3.7	P	PF	Yes	7/22/2015	7.7	1	8.00	
3.7	P	PF	Yes	9/23/2015	11.0	1	8.50	
3.8	P	P	No	5/23/2013	8.2	1	NA	
3.8	P	P	No	6/13/2013	8.5	1	NA	
3.8	P	P	No	7/26/2013	9.1	1	4.50	
3.8	P	P	No	9/20/2013	9.5	1	5.50	
3.8	P	P	No	5/19/2014	7.6	1	5.00	
3.8	P	P	No	7/7/2014	7.3	1	4.50	
3.8	P	P	No	9/24/2014	6.7	0	NA	
3.8	P	P	No	7/22/2015	7.7	0		Deer broke stake 07/07/2014
3.8	P	P	No	9/23/2015	11.0	0		

Plot ID	Stock Type	Stock Type / Fabric	Fabric	Date	Water Table (ft)	Survival	Height (ft)	Comments
3.9	C	CF	Yes	5/23/2013	8.2	1	NA	
3.9	C	CF	Yes	6/13/2013	8.5	1	NA	
3.9	C	CF	Yes	7/26/2013	9.1	1	3.00	
3.9	C	CF	Yes	9/20/2013	9.5	1	3.00	
3.9	C	CF	Yes	5/19/2014	7.6	1	3.00	
3.9	C	CF	Yes	7/7/2014	7.3	1	4.25	
3.9	C	CF	Yes	9/24/2014	6.7	1	4.50	
3.9	C	CF	Yes	7/22/2015	7.7	1	4.50	
3.9	C	CF	Yes	9/23/2015	11.0	1	4.25	
3.10	U	UF	Yes	5/23/2013	8.2	1	NA	
3.10	U	UF	Yes	6/13/2013	8.5	1	NA	
3.10	U	UF	Yes	7/26/2013	9.1	1	2.00	
3.10	U	UF	Yes	9/20/2013	9.5	0	NA	
3.10	U	UF	Yes	5/19/2014	7.6	0	NA	
3.10	U	UF	Yes	7/7/2014	7.3	0	NA	
3.10	U	UF	Yes	9/24/2014	6.7	0	NA	
3.10	U	UF	Yes	7/22/2015	7.7	0		
3.10	U	UF	Yes	9/23/2015	11.0	0		
3.11	U	U	No	5/23/2013	8.2	0	NA	
3.11	U	U	No	6/13/2013	8.5	0	NA	
3.11	U	U	No	7/26/2013	9.1	1	1.00	
3.11	U	U	No	9/20/2013	9.5	0	NA	
3.11	U	U	No	5/19/2014	7.6	1	3.00	
3.11	U	U	No	7/7/2014	7.3	0	NA	
3.11	U	U	No	9/24/2014	6.7	0	NA	
3.11	U	U	No	7/22/2015	7.7	0		
3.11	U	U	No	9/23/2015	11.0	0		
3.12	C	C	No	5/23/2013	8.2	1	NA	
3.12	C	C	No	6/13/2013	8.5	1	NA	
3.12	C	C	No	7/26/2013	9.1	1	3.00	
3.12	C	C	No	9/20/2013	9.5	1	3.50	
3.12	C	C	No	5/19/2014	7.6	1	3.00	
3.12	C	C	No	7/7/2014	7.3	1	4.00	
3.12	C	C	No	9/24/2014	6.7	1	4.00	
3.12	C	C	No	7/22/2015	7.7	1	4.00	07/2015 resprout from base
3.12	C	C	No	9/23/2015	11.0	1	4.00	
3.13	U	U	No	5/23/2013	8.2	0	NA	
3.13	U	U	No	6/13/2013	8.5	0	NA	
3.13	U	U	No	7/26/2013	9.1	1	1.00	
3.13	U	U	No	9/20/2013	9.5	0	NA	
3.13	U	U	No	5/19/2014	7.6	0	NA	
3.13	U	U	No	7/7/2014	7.3	0	NA	
3.13	U	U	No	9/24/2014	6.7	0	NA	
3.13	U	U	No	7/22/2015	7.7	0		
3.13	U	U	No	9/23/2015	11.0	0		
3.14	P	P	No	5/23/2013	8.2	1	NA	
3.14	P	P	No	6/13/2013	8.5	1	NA	
3.14	P	P	No	7/26/2013	9.1	1	4.50	
3.14	P	P	No	9/20/2013	9.5	1	5.00	
3.14	P	P	No	5/19/2014	7.6	1	4.50	
3.14	P	P	No	7/7/2014	7.3	1	6.50	
3.14	P	P	No	9/24/2014	6.7	1	7.75	
3.14	P	P	No	7/22/2015	7.7	1	8.50	
3.14	P	P	No	9/23/2015	11.0	1	9.00	
3.15	C	C	No	5/23/2013	8.2	1	NA	
3.15	C	C	No	6/13/2013	8.5	1	NA	
3.15	C	C	No	7/26/2013	9.1	1	3.00	
3.15	C	C	No	9/20/2013	9.5	1	3.50	
3.15	C	C	No	5/19/2014	7.6	1	3.00	
3.15	C	C	No	7/7/2014	7.3	1	4.25	

Plot ID	Stock Type	Stock Type / Fabric	Fabric	Date	Water Table (ft)	Survival	Height (ft)	Comments
3.15	C	C	No	9/24/2014	6.7	1	5.25	
3.15	C	C	No	7/22/2015	7.7	1	4.25	
3.15	C	C	No	9/23/2015	11.0	1	4.50	
3.16	P	PF	Yes	5/23/2013	8.2	1	NA	
3.16	P	PF	Yes	6/13/2013	8.5	1	NA	
3.16	P	PF	Yes	7/26/2013	9.1	1	4.50	
3.16	P	PF	Yes	9/20/2013	9.5	1	4.50	
3.16	P	PF	Yes	5/19/2014	7.6	1	4.00	
3.16	P	PF	Yes	7/7/2014	7.3	0	NA	
3.16	P	PF	Yes	9/24/2014	6.7	0	NA	
3.16	P	PF	Yes	7/22/2015	7.7	0		07/2015 4' dead
3.16	P	PF	Yes	9/23/2015	11.0	0		
3.17	C	CF	Yes	5/23/2013	8.2	1	NA	
3.17	C	CF	Yes	6/13/2013	8.5	1	NA	
3.17	C	CF	Yes	7/26/2013	9.1	1	4.50	
3.17	C	CF	Yes	9/20/2013	9.5	1	4.50	
3.17	C	CF	Yes	5/19/2014	7.6	1	4.00	
3.17	C	CF	Yes	7/7/2014	7.3	1	3.50	
3.17	C	CF	Yes	9/24/2014	6.7	1	4.25	
3.17	C	CF	Yes	7/22/2015	7.7	1	4.50	
3.17	C	CF	Yes	9/23/2015	11.0	1	4.25	
3.18	U	UF	No	5/23/2013	8.2	0	NA	
3.18	U	UF	No	6/13/2013	8.5	0	NA	
3.18	U	UF	No	7/26/2013	9.1	1	0.25	
3.18	U	UF	No	9/20/2013	9.5	0	NA	
3.18	U	UF	No	5/19/2014	7.6	0	NA	
3.18	U	UF	No	7/7/2014	7.3	0	NA	
3.18	U	UF	No	9/24/2014	6.7	0	NA	
3.18	U	UF	No	7/22/2015	7.7	0		
3.18	U	UF	No	9/23/2015	11.0	0		
3.19	C	CF	Yes	5/23/2013	8.2	1	NA	
3.19	C	CF	Yes	6/13/2013	8.5	1	NA	
3.19	C	CF	Yes	7/26/2013	9.1	1	4.50	
3.19	C	CF	Yes	9/20/2013	9.5	1	4.50	
3.19	C	CF	Yes	5/19/2014	7.6	1	4.50	
3.19	C	CF	Yes	7/7/2014	7.3	1	5.50	
3.19	C	CF	Yes	9/24/2014	6.7	1	6.75	
3.19	C	CF	Yes	7/22/2015	7.7	1	7.50	
3.19	C	CF	Yes	9/23/2015	11.0	1	8.00	
3.20	P	P	No	5/23/2013	8.2	1	NA	
3.20	P	P	No	6/13/2013	8.5	1	NA	
3.20	P	P	No	7/26/2013	9.1	1	4.50	
3.20	P	P	No	9/20/2013	9.5	1	4.50	
3.20	P	P	No	5/19/2014	7.6	1	4.00	
3.20	P	P	No	7/7/2014	7.3	1	4.75	
3.20	P	P	No	9/24/2014	6.7	1	6.25	
3.20	P	P	No	7/22/2015	7.7	0		07/2015 6' dead
3.20	P	P	No	9/23/2015	11.0	0		
3.21	C	C	No	5/23/2013	8.2	1	NA	
3.21	C	C	No	6/13/2013	8.5	1	NA	
3.21	C	C	No	7/26/2013	9.1	1	4.00	
3.21	C	C	No	9/20/2013	9.5	1	3.50	
3.21	C	C	No	5/19/2014	7.6	1	3.50	
3.21	C	C	No	7/7/2014	7.3	1	5.00	
3.21	C	C	No	9/24/2014	6.7	1	5.00	
3.21	C	C	No	7/22/2015	7.7	1	5.00	
3.21	C	C	No	9/23/2015	11.0	1	4.25	
3.22	P	PF	Yes	5/23/2013	8.2	1	NA	
3.22	P	PF	Yes	6/13/2013	8.5	1	NA	
3.22	P	PF	Yes	7/26/2013	9.1	1	4.50	

Plot ID	Stock Type	Stock Type / Fabric	Fabric	Date	Water Table (ft)	Survival	Height (ft)	Comments
3.22	P	PF	Yes	9/20/2013	9.5	1	5.00	
3.22	P	PF	Yes	5/19/2014	7.6	1	4.50	
3.22	P	PF	Yes	7/7/2014	7.3	1	6.00	
3.22	P	PF	Yes	9/24/2014	6.7	1	7.00	
3.22	P	PF	Yes	7/22/2015	7.7	1	8.25	
3.22	P	PF	Yes	9/23/2015	11.0	1	9.00	
3.23	U	UF	No	5/23/2013	8.2	0	NA	
3.23	U	UF	No	6/13/2013	8.5	0	NA	
3.23	U	UF	No	7/26/2013	9.1	1	1.00	
3.23	U	UF	No	9/20/2013	9.5	0	NA	
3.23	U	UF	No	5/19/2014	7.6	0	NA	
3.23	U	UF	No	7/7/2014	7.3	0	NA	
3.23	U	UF	No	9/24/2014	6.7	0	NA	
3.23	U	UF	No	7/22/2015	7.7	0		
3.23	U	UF	No	9/23/2015	11.0	0		
3.24	U	U	No	5/23/2013	8.2	0	NA	
3.24	U	U	No	6/13/2013	8.5	0	NA	
3.24	U	U	No	7/26/2013	9.1	1	2.00	
3.24	U	U	No	9/20/2013	9.5	1	3.50	
3.24	U	U	No	5/19/2014	7.6	1	3.00	
3.24	U	U	No	7/7/2014	7.3	1	4.00	
3.24	U	U	No	9/24/2014	6.7	1	4.50	
3.24	U	U	No	7/22/2015	7.7	1	4.50	
3.24	U	U	No	9/23/2015	11.0	1	4.50	
3.25	U	UF	No	5/23/2013	8.2	0	NA	
3.25	U	UF	No	6/13/2013	8.5	0	NA	
3.25	U	UF	No	7/26/2013	9.1	1	1.00	
3.25	U	UF	No	9/20/2013	9.5	0	NA	
3.25	U	UF	No	5/19/2014	7.6	0	NA	
3.25	U	UF	No	7/7/2014	7.3	0	NA	
3.25	U	UF	No	9/24/2014	6.7	0	NA	
3.25	U	UF	No	7/22/2015	7.7	0		
3.25	U	UF	No	9/23/2015	11.0	0		
3.26	P	P	No	5/23/2013	8.2	1	NA	
3.26	P	P	No	6/13/2013	8.5	1	NA	
3.26	P	P	No	7/26/2013	9.1	1	4.50	
3.26	P	P	No	9/20/2013	9.5	1	4.50	
3.26	P	P	No	5/19/2014	7.6	1	4.00	
3.26	P	P	No	7/7/2014	7.3	1	4.00	
3.26	P	P	No	9/24/2014	6.7	1	5.00	
3.26	P	P	No	7/22/2015	7.7	1	4.50	
3.26	P	P	No	9/23/2015	11.0	1	5.00	
3.27	C	CF	Yes	5/23/2013	8.2	1	NA	
3.27	C	CF	Yes	6/13/2013	8.5	1	NA	
3.27	C	CF	Yes	7/26/2013	9.1	1	4.50	
3.27	C	CF	Yes	9/20/2013	9.5	1	4.50	
3.27	C	CF	Yes	5/19/2014	7.6	1	4.00	
3.27	C	CF	Yes	7/7/2014	7.3	1	5.50	
3.27	C	CF	Yes	9/24/2014	6.7	1	7.00	
3.27	C	CF	Yes	7/22/2015	7.7	1	1.00	
3.27	C	CF	Yes	9/23/2015	11.0	1	0.75	
3.28	P	PF	Yes	5/23/2013	8.2	1	NA	
3.28	P	PF	Yes	6/13/2013	8.5	1	NA	
3.28	P	PF	Yes	7/26/2013	9.1	1	2.00	
3.28	P	PF	Yes	9/20/2013	9.5	1	1.50	
3.28	P	PF	Yes	5/19/2014	7.6	0	NA	
3.28	P	PF	Yes	7/7/2014	7.3	0	NA	
3.28	P	PF	Yes	9/24/2014	6.7	0	NA	
3.28	P	PF	Yes	7/22/2015	7.7	0		
3.28	P	PF	Yes	9/23/2015	11.0	0		

Plot ID	Stock Type	Stock Type / Fabric	Fabric	Date	Water Table (ft)	Survival	Height (ft)	Comments
3.29	U	U	No	5/23/2013	8.2	0	NA	
3.29	U	U	No	6/13/2013	8.5	1	NA	
3.29	U	U	No	7/26/2013	9.1	0	NA	
3.29	U	U	No	9/20/2013	9.5	0	NA	
3.29	U	U	No	5/19/2014	7.6	0	NA	
3.29	U	U	No	7/7/2014	7.3	0	NA	
3.29	U	U	No	9/24/2014	6.7	0	NA	
3.29	U	U	No	7/22/2015	7.7	0		
3.29	U	U	No	9/23/2015	11.0	0		
3.30	C	C	No	5/23/2013	8.2	1	NA	
3.30	C	C	No	6/13/2013	8.5	1	NA	
3.30	C	C	No	7/26/2013	9.1	1	3.00	
3.30	C	C	No	9/20/2013	9.5	0	NA	
3.30	C	C	No	5/19/2014	7.6	1	3.50	
3.30	C	C	No	7/7/2014	7.3	0	NA	
3.30	C	C	No	9/24/2014	6.7	0	NA	
3.30	C	C	No	7/22/2015	7.7	0		
3.30	C	C	No	9/23/2015	11.0	0		
3.31	C	C	No	5/23/2013	8.2	1	NA	
3.31	C	C	No	6/13/2013	8.5	1	NA	
3.31	C	C	No	7/26/2013	9.1	1	3.00	
3.31	C	C	No	9/20/2013	9.5	1	4.00	
3.31	C	C	No	5/19/2014	7.6	1	4.00	
3.31	C	C	No	7/7/2014	7.3	1	4.25	
3.31	C	C	No	9/24/2014	6.7	1	4.25	
3.31	C	C	No	7/22/2015	7.7	1	3.75	about dead
3.31	C	C	No	9/23/2015	11.0	0		
3.32	P	P	No	5/23/2013	8.2	1	NA	
3.32	P	P	No	6/13/2013	8.5	1	NA	
3.32	P	P	No	7/26/2013	9.1	1	4.50	
3.32	P	P	No	9/20/2013	9.5	1	4.50	
3.32	P	P	No	5/19/2014	7.6	1	4.00	
3.32	P	P	No	7/7/2014	7.3	1	4.00	
3.32	P	P	No	9/24/2014	6.7	1	4.50	
3.32	P	P	No	7/22/2015	7.7	1	4.00	about dead
3.32	P	P	No	9/23/2015	11.0	1	4.00	
3.33	U	U	No	5/23/2013	8.2	0	NA	
3.33	U	U	No	6/13/2013	8.5	0	NA	
3.33	U	U	No	7/26/2013	9.1	0	NA	
3.33	U	U	No	9/20/2013	9.5	0	NA	
3.33	U	U	No	5/19/2014	7.6	0	NA	
3.33	U	U	No	7/7/2014	7.3	0	NA	
3.33	U	U	No	9/24/2014	6.7	0	NA	
3.33	U	U	No	7/22/2015	7.7	0		
3.33	U	U	No	9/23/2015	11.0	0		
3.34	P	PF	Yes	5/23/2013	8.2	1	NA	
3.34	P	PF	Yes	6/13/2013	8.5	1	NA	
3.34	P	PF	Yes	7/26/2013	9.1	1	4.50	
3.34	P	PF	Yes	9/20/2013	9.5	1	5.00	
3.34	P	PF	Yes	5/19/2014	7.6	1	5.00	
3.34	P	PF	Yes	7/7/2014	7.3	1	3.75	
3.34	P	PF	Yes	9/24/2014	6.7	1	6.25	
3.34	P	PF	Yes	7/22/2015	7.7	1	4.25	07/2015 resprout from base
3.34	P	PF	Yes	9/23/2015	11.0	1	4.50	
3.35	C	CF	Yes	5/23/2013	8.2	1	NA	
3.35	C	CF	Yes	6/13/2013	8.5	1	NA	
3.35	C	CF	Yes	7/26/2013	9.1	1	4.50	
3.35	C	CF	Yes	9/20/2013	9.5	1	4.50	
3.35	C	CF	Yes	5/19/2014	7.6	1	4.00	
3.35	C	CF	Yes	7/7/2014	7.3	1	4.00	

Plot ID	Stock Type	Stock Type / Fabric	Fabric	Date	Water Table (ft)	Survival	Height (ft)	Comments
3.35	C	CF	Yes	9/24/2014	6.7	1	5.25	
3.35	C	CF	Yes	7/22/2015	7.7	1	5.00	
3.35	C	CF	Yes	9/23/2015	11.0	1	5.25	
3.36	U	U	No	5/23/2013	8.2	1	NA	
3.36	U	U	No	6/13/2013	8.5	1	NA	
3.36	U	U	No	7/26/2013	9.1	1	0.50	
3.36	U	U	No	9/20/2013	9.5	0	NA	
3.36	U	U	No	5/19/2014	7.6	0	NA	
3.36	U	U	No	7/7/2014	7.3	0	NA	
3.36	U	U	No	9/24/2014	6.7	0	NA	
3.36	U	U	No	7/22/2015	7.7	0		
3.36	U	U	No	9/23/2015	11.0	0		
4.1	P	P	No	5/23/2013	10.0	1	NA	
4.1	P	P	No	6/13/2013	12.0	1	NA	
4.1	P	P	No	7/26/2013	12.0	1	4.50	
4.1	P	P	No	9/20/2013	12.0	1	4.50	
4.1	P	P	No	5/19/2014	10.3	1	4.00	
4.1	P	P	No	7/7/2014	10.0	1	4.50	
4.1	P	P	No	9/24/2014	11.0	1	4.50	
4.1	P	P	No	7/22/2015	11.3	1	5.00	
4.1	P	P	No	9/23/2015	12.0	1	5.00	
4.2	C	CF	Yes	5/23/2013	10.0	1	NA	
4.2	C	CF	Yes	6/13/2013	12.0	1	NA	
4.2	C	CF	Yes	7/26/2013	12.0	1	4.50	
4.2	C	CF	Yes	9/20/2013	12.0	1	4.50	
4.2	C	CF	Yes	5/19/2014	10.3	1	4.50	
4.2	C	CF	Yes	7/7/2014	10.0	1	4.75	
4.2	C	CF	Yes	9/24/2014	11.0	1	4.50	
4.2	C	CF	Yes	7/22/2015	11.3	0		07/2015 4' dead
4.2	C	CF	Yes	9/23/2015	12.0	0		
4.3	C	C	No	5/23/2013	10.0	1	NA	
4.3	C	C	No	6/13/2013	12.0	1	NA	
4.3	C	C	No	7/26/2013	12.0	1	4.50	
4.3	C	C	No	9/20/2013	12.0	1	4.00	
4.3	C	C	No	5/19/2014	10.3	1	4.00	
4.3	C	C	No	7/7/2014	10.0	1	4.25	
4.3	C	C	No	9/24/2014	11.0	1	4.00	
4.3	C	C	No	7/22/2015	11.3	1	3.50	07/2015 resprout from base
4.3	C	C	No	9/23/2015	12.0	1	4.25	
4.4	U	U	No	5/23/2013	10.0	0	NA	
4.4	U	U	No	6/13/2013	12.0	0	NA	
4.4	U	U	No	7/26/2013	12.0	0	NA	
4.4	U	U	No	9/20/2013	12.0	0	NA	
4.4	U	U	No	5/19/2014	10.3	0	NA	
4.4	U	U	No	7/7/2014	10.0	0	NA	
4.4	U	U	No	9/24/2014	11.0	0	NA	
4.4	U	U	No	7/22/2015	11.3	1		
4.4	U	U	No	9/23/2015	12.0	0		
4.5	P	PF	Yes	5/23/2013	10.0	1	NA	
4.5	P	PF	Yes	6/13/2013	12.0	1	NA	
4.5	P	PF	Yes	7/26/2013	12.0	1	4.50	
4.5	P	PF	Yes	9/20/2013	12.0	1	4.50	
4.5	P	PF	Yes	5/19/2014	10.3	1	4.50	
4.5	P	PF	Yes	7/7/2014	10.0	0	NA	
4.5	P	PF	Yes	9/24/2014	11.0	0	NA	
4.5	P	PF	Yes	7/22/2015	11.3	0		0 at 4.5' 9/24/2014
4.5	P	PF	Yes	9/23/2015	12.0	0		
4.6	U	UF	Yes	5/23/2013	10.0	0	NA	
4.6	U	UF	Yes	6/13/2013	12.0	0	NA	
4.6	U	UF	Yes	7/26/2013	12.0	0	NA	

Plot ID	Stock Type	Stock Type / Fabric	Fabric	Date	Water Table (ft)	Survival	Height (ft)	Comments
4.6	U	UF	Yes	9/20/2013	12.0	0		
4.6	U	UF	Yes	5/19/2014	10.3	0	NA	
4.6	U	UF	Yes	7/7/2014	10.0	0	NA	
4.6	U	UF	Yes	9/24/2014	11.0	0	NA	
4.6	U	UF	Yes	7/22/2015	11.3	0		
4.6	U	UF	Yes	9/23/2015	12.0	0		
4.7	P	PF	Yes	5/23/2013	10.0	1	NA	
4.7	P	PF	Yes	6/13/2013	12.0	1	NA	
4.7	P	PF	Yes	7/26/2013	12.0	1	4.50	
4.7	P	PF	Yes	9/20/2013	12.0	1	5.50	
4.7	P	PF	Yes	5/19/2014	10.3	1	4.00	
4.7	P	PF	Yes	7/7/2014	10.0	0	NA	
4.7	P	PF	Yes	9/24/2014	11.0	0	NA	
4.7	P	PF	Yes	7/22/2015	11.3	0		
4.7	P	PF	Yes	9/23/2015	12.0	0		
4.8	P	P	No	5/23/2013	10.0	1	NA	
4.8	P	P	No	6/13/2013	12.0	1	NA	
4.8	P	P	No	7/26/2013	12.0	1	4.50	
4.8	P	P	No	9/20/2013	12.0	1	4.50	
4.8	P	P	No	5/19/2014	10.3	1	4.00	
4.8	P	P	No	7/7/2014	10.0	1	4.00	
4.8	P	P	No	9/24/2014	11.0	1	4.50	
4.8	P	P	No	7/22/2015	11.3	1	5.00	
4.8	P	P	No	9/23/2015	12.0	1	5.25	
4.9	U	U	No	5/23/2013	10.0	1	NA	
4.9	U	U	No	6/13/2013	12.0	1	NA	
4.9	U	U	No	7/26/2013	12.0	0	NA	
4.9	U	U	No	9/20/2013	12.0	0	NA	
4.9	U	U	No	5/19/2014	10.3	0	NA	
4.9	U	U	No	7/7/2014	10.0	0	NA	
4.9	U	U	No	9/24/2014	11.0	0	NA	
4.9	U	U	No	7/22/2015	11.3	0		
4.9	U	U	No	9/23/2015	12.0	0		
4.10	C	CF	Yes	5/23/2013	10.0	1	NA	
4.10	C	CF	Yes	6/13/2013	12.0	1	NA	
4.10	C	CF	Yes	7/26/2013	12.0	1	4.50	
4.10	C	CF	Yes	9/20/2013	12.0	1	4.50	
4.10	C	CF	Yes	5/19/2014	10.3	1	4.00	
4.10	C	CF	Yes	7/7/2014	10.0	1	4.25	
4.10	C	CF	Yes	9/24/2014	11.0	1	5.00	
4.10	C	CF	Yes	7/22/2015	11.3	1	7.00	
4.10	C	CF	Yes	9/23/2015	12.0	1	7.50	
4.11	U	UF	Yes	5/23/2013	10.0	0	NA	
4.11	U	UF	Yes	6/13/2013	12.0	0	NA	
4.11	U	UF	Yes	7/26/2013	12.0	0	NA	
4.11	U	UF	Yes	9/20/2013	12.0	0	NA	
4.11	U	UF	Yes	5/19/2014	10.3	0	NA	
4.11	U	UF	Yes	7/7/2014	10.0	0	NA	
4.11	U	UF	Yes	9/24/2014	11.0	0	NA	
4.11	U	UF	Yes	7/22/2015	11.3	0		
4.11	U	UF	Yes	9/23/2015	12.0	0		
4.12	C	C	No	5/23/2013	10.0	1	NA	
4.12	C	C	No	6/13/2013	12.0	1	NA	
4.12	C	C	No	7/26/2013	12.0	1	3.00	
4.12	C	C	No	9/20/2013	12.0	1	3.50	
4.12	C	C	No	5/19/2014	10.3	1	3.00	
4.12	C	C	No	7/7/2014	10.0	1	4.00	
4.12	C	C	No	9/24/2014	11.0	1	4.00	
4.12	C	C	No	7/22/2015	11.3	1	5.00	
4.12	C	C	No	9/23/2015	12.0	1	5.00	

Plot ID	Stock Type	Stock Type / Fabric	Fabric	Date	Water Table (ft)	Survival	Height (ft)	Comments
4.13	U	U	No	5/23/2013	10.0	0	NA	
4.13	U	U	No	6/13/2013	12.0	0	NA	
4.13	U	U	No	7/26/2013	12.0	1	0.50	
4.13	U	U	No	9/20/2013	12.0	0	NA	
4.13	U	U	No	5/19/2014	10.3	0	NA	
4.13	U	U	No	7/7/2014	10.0	0	NA	
4.13	U	U	No	9/24/2014	11.0	0	NA	
4.13	U	U	No	7/22/2015	11.3	0		
4.13	U	U	No	9/23/2015	12.0	0		
4.14	P	PF	Yes	5/23/2013	10.0	1	NA	
4.14	P	PF	Yes	6/13/2013	12.0	1	NA	
4.14	P	PF	Yes	7/26/2013	12.0	1	4.50	
4.14	P	PF	Yes	9/20/2013	12.0	1	5.00	
4.14	P	PF	Yes	5/19/2014	10.3	1	4.50	
4.14	P	PF	Yes	7/7/2014	10.0	0	NA	
4.14	P	PF	Yes	9/24/2014	11.0	0	NA	
4.14	P	PF	Yes	7/22/2015	11.3	0		0 at 5' 9/24/2014
4.14	P	PF	Yes	9/23/2015	12.0	0		
4.15	C	CF	Yes	5/23/2013	10.0	1	NA	
4.15	C	CF	Yes	6/13/2013	12.0	1	NA	
4.15	C	CF	Yes	7/26/2013	12.0	1	4.50	
4.15	C	CF	Yes	9/20/2013	12.0	1	4.50	
4.15	C	CF	Yes	5/19/2014	10.3	1	4.00	
4.15	C	CF	Yes	7/7/2014	10.0	1	4.00	
4.15	C	CF	Yes	9/24/2014	11.0	1	4.50	
4.15	C	CF	Yes	7/22/2015	11.3	1	5.50	
4.15	C	CF	Yes	9/23/2015	12.0	1	7.00	
4.16	P	P	No	5/23/2013	10.0	1	NA	
4.16	P	P	No	6/13/2013	12.0	1	NA	
4.16	P	P	No	7/26/2013	12.0	1	4.50	
4.16	P	P	No	9/20/2013	12.0	1	4.50	
4.16	P	P	No	5/19/2014	10.3	1	4.00	
4.16	P	P	No	7/7/2014	10.0	1	4.50	
4.16	P	P	No	9/24/2014	11.0	1	4.50	
4.16	P	P	No	7/22/2015	11.3	1	5.00	
4.16	P	P	No	9/23/2015	12.0	1	4.75	
4.17	C	C	No	5/23/2013	10.0	1	NA	
4.17	C	C	No	6/13/2013	12.0	1	NA	
4.17	C	C	No	7/26/2013	12.0	1	3.00	
4.17	C	C	No	9/20/2013	12.0	1	3.50	
4.17	C	C	No	5/19/2014	10.3	1	3.50	
4.17	C	C	No	7/7/2014	10.0	1	4.50	
4.17	C	C	No	9/24/2014	11.0	1	4.50	
4.17	C	C	No	7/22/2015	11.3	1	4.50	
4.17	C	C	No	9/23/2015	12.0	1	4.75	
4.18	U	UF	Yes	5/23/2013	10.0	0	NA	
4.18	U	UF	Yes	6/13/2013	12.0	0	NA	
4.18	U	UF	Yes	7/26/2013	12.0	1	1.00	
4.18	U	UF	Yes	9/20/2013	12.0	1	3.50	
4.18	U	UF	Yes	5/19/2014	10.3	1	3.50	
4.18	U	UF	Yes	7/7/2014	10.0	1	4.25	
4.18	U	UF	Yes	9/24/2014	11.0	1	4.25	
4.18	U	UF	Yes	7/22/2015	11.3	1	5.25	
4.18	U	UF	Yes	9/23/2015	12.0	1	5.75	
4.19	U	U	No	5/23/2013	10.0	0	NA	
4.19	U	U	No	6/13/2013	12.0	1	NA	
4.19	U	U	No	7/26/2013	12.0	0	NA	
4.19	U	U	No	9/20/2013	12.0	0	NA	
4.19	U	U	No	5/19/2014	10.3	0	NA	
4.19	U	U	No	7/7/2014	10.0	0	NA	

Plot ID	Stock Type	Stock Type / Fabric	Fabric	Date	Water Table (ft)	Survival	Height (ft)	Comments
4.19	U	U	No	9/24/2014	11.0	0	NA	
4.19	U	U	No	7/22/2015	11.3	0		
4.19	U	U	No	9/23/2015	12.0	0		
4.20	C	CF	Yes	5/23/2013	10.0	1	NA	
4.20	C	CF	Yes	6/13/2013	12.0	1	NA	
4.20	C	CF	Yes	7/26/2013	12.0	1	3.00	
4.20	C	CF	Yes	9/20/2013	12.0	1	5.00	
4.20	C	CF	Yes	5/19/2014	10.3	1	5.00	
4.20	C	CF	Yes	7/7/2014	10.0	1	4.00	
4.20	C	CF	Yes	9/24/2014	11.0	1	5.00	
4.20	C	CF	Yes	7/22/2015	11.3	1	4.75	
4.20	C	CF	Yes	9/23/2015	12.0	1	5.25	
4.21	P	PF	Yes	5/23/2013	10.0	1	NA	
4.21	P	PF	Yes	6/13/2013	12.0	1	NA	
4.21	P	PF	Yes	7/26/2013	12.0	1	4.50	
4.21	P	PF	Yes	9/20/2013	12.0	1	6.00	
4.21	P	PF	Yes	5/19/2014	10.3	1	5.00	
4.21	P	PF	Yes	7/7/2014	10.0	1	0.75	
4.21	P	PF	Yes	9/24/2014	11.0	0	NA	
4.21	P	PF	Yes	7/22/2015	11.3	0		0 at 5' 9/24/2014
4.21	P	PF	Yes	9/23/2015	12.0	0		
4.22	U	UF	Yes	5/23/2013	10.0	1	NA	
4.22	U	UF	Yes	6/13/2013	12.0	1	NA	
4.22	U	UF	Yes	7/26/2013	12.0	1	4.50	
4.22	U	UF	Yes	9/20/2013	12.0	1	4.50	
4.22	U	UF	Yes	5/19/2014	10.3	1	4.00	
4.22	U	UF	Yes	7/7/2014	10.0	1	4.75	
4.22	U	UF	Yes	9/24/2014	11.0	1	4.75	
4.22	U	UF	Yes	7/22/2015	11.3	1	6.25	reprint after dieback 07/07/2014
4.22	U	UF	Yes	9/23/2015	12.0	1	6.75	
4.23	P	P	No	5/23/2013	10.0	1	NA	
4.23	P	P	No	6/13/2013	12.0	1	NA	
4.23	P	P	No	7/26/2013	12.0	1	4.50	
4.23	P	P	No	9/20/2013	12.0	1	4.50	
4.23	P	P	No	5/19/2014	10.3	1	4.00	
4.23	P	P	No	7/7/2014	10.0	1	4.50	
4.23	P	P	No	9/24/2014	11.0	1	4.50	
4.23	P	P	No	7/22/2015	11.3	1	5.00	
4.23	P	P	No	9/23/2015	12.0	1	4.75	
4.24	C	C	No	5/23/2013	10.0	1	NA	
4.24	C	C	No	6/13/2013	12.0	1	NA	
4.24	C	C	No	7/26/2013	12.0	1	4.00	
4.24	C	C	No	9/20/2013	12.0	1	4.00	
4.24	C	C	No	5/19/2014	10.3	1	4.00	
4.24	C	C	No	7/7/2014	10.0	1	4.00	
4.24	C	C	No	9/24/2014	11.0	1	4.25	
4.24	C	C	No	7/22/2015	11.3	1	4.50	
4.24	C	C	No	9/23/2015	12.0	1	4.75	
4.25	P	PF	Yes	5/23/2013	10.0	1	NA	
4.25	P	PF	Yes	6/13/2013	12.0	1	NA	
4.25	P	PF	Yes	7/26/2013	12.0	1	4.50	
4.25	P	PF	Yes	9/20/2013	12.0	1	6.00	
4.25	P	PF	Yes	5/19/2014	10.3	1	5.00	
4.25	P	PF	Yes	7/7/2014	10.0	1	4.00	
4.25	P	PF	Yes	9/24/2014	11.0	1	4.25	
4.25	P	PF	Yes	7/22/2015	11.3	0		07/2015 4' dead
4.25	P	PF	Yes	9/23/2015	12.0	1	5.00	
4.26	C	C	No	5/23/2013	10.0	1	NA	
4.26	C	C	No	6/13/2013	12.0	1	NA	
4.26	C	C	No	7/26/2013	12.0	1	3.00	

Plot ID	Stock Type	Stock Type / Fabric	Fabric	Date	Water Table (ft)	Survival	Height (ft)	Comments
4.26	C	C	No	9/20/2013	12.0	1	4.00	
4.26	C	C	No	5/19/2014	10.3	1	4.00	
4.26	C	C	No	7/7/2014	10.0	1	4.25	
4.26	C	C	No	9/24/2014	11.0	1	4.00	
4.26	C	C	No	7/22/2015	11.3	1	4.75	
4.26	C	C	No	9/23/2015	12.0	0		
4.27	C	CF	Yes	5/23/2013	10.0	1	NA	
4.27	C	CF	Yes	6/13/2013	12.0	1	NA	
4.27	C	CF	Yes	7/26/2013	12.0	1	4.50	
4.27	C	CF	Yes	9/20/2013	12.0	1	6.00	
4.27	C	CF	Yes	5/19/2014	10.3	1	5.50	
4.27	C	CF	Yes	7/7/2014	10.0	1	4.50	
4.27	C	CF	Yes	9/24/2014	11.0	1	4.50	
4.27	C	CF	Yes	7/22/2015	11.3	0		
4.27	C	CF	Yes	9/23/2015	12.0	0		
4.28	U	UF	Yes	5/23/2013	10.0	0	NA	
4.28	U	UF	Yes	6/13/2013	12.0	0	NA	
4.28	U	UF	Yes	7/26/2013	12.0	1	1.50	
4.28	U	UF	Yes	9/20/2013	12.0	1	3.00	
4.28	U	UF	Yes	5/19/2014	10.3	1	3.00	
4.28	U	UF	Yes	7/7/2014	10.0	1	4.25	
4.28	U	UF	Yes	9/24/2014	11.0	1	4.50	
4.28	U	UF	Yes	7/22/2015	11.3	0		07/2015 4' dead
4.28	U	UF	Yes	9/23/2015	12.0	0		
4.29	U	U	No	5/23/2013	10.0	0	NA	
4.29	U	U	No	6/13/2013	12.0	0	NA	
4.29	U	U	No	7/26/2013	12.0	0	NA	
4.29	U	U	No	9/20/2013	12.0	0	NA	
4.29	U	U	No	5/19/2014	10.3	0	NA	
4.29	U	U	No	7/7/2014	10.0	0	NA	
4.29	U	U	No	9/24/2014	11.0	0	NA	
4.29	U	U	No	7/22/2015	11.3	0		07/2015 5' dead
4.29	U	U	No	9/23/2015	12.0	0		
4.30	P	P	No	5/23/2013	10.0	1	NA	
4.30	P	P	No	6/13/2013	12.0	1	NA	
4.30	P	P	No	7/26/2013	12.0	1	4.00	
4.30	P	P	No	9/20/2013	12.0	1	4.00	
4.30	P	P	No	5/19/2014	10.3	1	4.00	
4.30	P	P	No	7/7/2014	10.0	1	4.25	
4.30	P	P	No	9/24/2014	11.0	1	4.00	
4.30	P	P	No	7/22/2015	11.3	1	4.25	
4.30	P	P	No	9/23/2015	12.0	1	4.25	
4.31	U	U	No	5/23/2013	10.0	0	NA	
4.31	U	U	No	6/13/2013	12.0	0	NA	
4.31	U	U	No	7/26/2013	12.0	1	1.00	
4.31	U	U	No	9/20/2013	12.0	1	1.00	
4.31	U	U	No	5/19/2014	10.3	1	1.00	
4.31	U	U	No	7/7/2014	10.0	0	NA	
4.31	U	U	No	9/24/2014	11.0	0	NA	
4.31	U	U	No	7/22/2015	11.3	0		
4.31	U	U	No	9/23/2015	12.0	0		
4.32	P	P	No	5/23/2013	10.0	1	NA	
4.32	P	P	No	6/13/2013	12.0	1	NA	
4.32	P	P	No	7/26/2013	12.0	1	4.50	
4.32	P	P	No	9/20/2013	12.0	1	4.50	
4.32	P	P	No	5/19/2014	10.3	1	4.00	
4.32	P	P	No	7/7/2014	10.0	1	4.50	
4.32	P	P	No	9/24/2014	11.0	1	4.25	
4.32	P	P	No	7/22/2015	11.3	1	4.50	
4.32	P	P	No	9/23/2015	12.0	1	5.00	

Plot ID	Stock Type	Stock Type / Fabric	Fabric	Date	Water Table (ft)	Survival	Height (ft)	Comments
4.33	P	PF	Yes	5/23/2013	10.0	1	NA	
4.33	P	PF	Yes	6/13/2013	12.0	1	NA	
4.33	P	PF	Yes	7/26/2013	12.0	1	4.50	
4.33	P	PF	Yes	9/20/2013	12.0	1	6.00	
4.33	P	PF	Yes	5/19/2014	10.3	1	6.00	
4.33	P	PF	Yes	7/7/2014	10.0	1	5.00	
4.33	P	PF	Yes	9/24/2014	11.0	1	5.25	
4.33	P	PF	Yes	7/22/2015	11.3	1	5.00	
4.33	P	PF	Yes	9/23/2015	12.0	1	6.75	
4.34	C	CF	Yes	5/23/2013	10.0	1	NA	
4.34	C	CF	Yes	6/13/2013	12.0	1	NA	
4.34	C	CF	Yes	7/26/2013	12.0	1	4.00	
4.34	C	CF	Yes	9/20/2013	12.0	1	4.50	
4.34	C	CF	Yes	5/19/2014	10.3	1	4.00	
4.34	C	CF	Yes	7/7/2014	10.0	1	4.25	
4.34	C	CF	Yes	9/24/2014	11.0	1	4.25	
4.34	C	CF	Yes	7/22/2015	11.3	1	5.00	
4.34	C	CF	Yes	9/23/2015	12.0	1	5.75	
4.35	U	UF	Yes	5/23/2013	10.0	0	NA	
4.35	U	UF	Yes	6/13/2013	12.0	0	NA	
4.35	U	UF	Yes	7/26/2013	12.0	1	6.00	
4.35	U	UF	Yes	9/20/2013	12.0	0	NA	
4.35	U	UF	Yes	5/19/2014	10.3	0	NA	
4.35	U	UF	Yes	7/7/2014	10.0	0	NA	
4.35	U	UF	Yes	9/24/2014	11.0	0	NA	
4.35	U	UF	Yes	7/22/2015	11.3	0		
4.35	U	UF	Yes	9/23/2015	12.0	0		
4.36	C	C	No	5/23/2013	10.0	1	NA	
4.36	C	C	No	6/13/2013	12.0	1	NA	
4.36	C	C	No	7/26/2013	12.0	1	3.00	
4.36	C	C	No	9/20/2013	12.0	1	3.00	
4.36	C	C	No	5/19/2014	10.3	1	3.00	
4.36	C	C	No	7/7/2014	10.0	1	4.00	
4.36	C	C	No	9/24/2014	11.0	1	4.00	
4.36	C	C	No	7/22/2015	11.3	1	4.50	
4.36	C	C	No	9/23/2015	12.0	1	4.50	
5.1	C	C	No	5/23/2013	Not planted in 2013			
5.1	C	C	No	6/13/2013	Not planted in 2013			
5.1	C	C	No	7/26/2013	Not planted in 2013			
5.1	C	C	No	9/20/2013	Not planted in 2013			
5.1	C	C	No	5/19/2014	Not planted in 2013			
5.1	C	C	No	7/7/2014	5.8	1	1.50	
5.1	C	C	No	9/24/2014	6.4	1	3.00	
5.1	C	C	No	7/22/2015	8.1	0	2.75	
5.1	C	C	No	9/23/2015	8.1	1	4.00	
5.2	U	U	No	5/23/2013	Not planted in 2013			
5.2	U	U	No	6/13/2013	Not planted in 2013			
5.2	U	U	No	7/26/2013	Not planted in 2013			
5.2	U	U	No	9/20/2013	Not planted in 2013			
5.2	U	U	No	5/19/2014	Not planted in 2013			
5.2	U	U	No	7/7/2014	5.8	1	0.75	
5.2	U	U	No	9/24/2014	6.4	1	2.00	
5.2	U	U	No	7/22/2015	8.1	1	4.00	
5.2	U	U	No	9/23/2015	8.1	1	4.50	
5.3	U	UF	Yes	5/23/2013	Not planted in 2013			
5.3	U	UF	Yes	6/13/2013	Not planted in 2013			
5.3	U	UF	Yes	7/26/2013	Not planted in 2013			
5.3	U	UF	Yes	9/20/2013	Not planted in 2013			
5.3	U	UF	Yes	5/19/2014	Not planted in 2013			
5.3	U	UF	Yes	7/7/2014	5.8	1	3.25	

Plot ID	Stock Type	Stock Type / Fabric	Fabric	Date	Water Table (ft)	Survival	Height (ft)	Comments
5.3	U	UF	Yes	9/24/2014	6.4	1	4.00	
5.3	U	UF	Yes	7/22/2015	8.1	1	3.50	07/2015 dead top
5.3	U	UF	Yes	9/23/2015	8.1	1	4.00	
5.4	P	P	No	5/23/2013	Not planted in 2013			
5.4	P	P	No	6/13/2013	Not planted in 2013			
5.4	P	P	No	7/26/2013	Not planted in 2013			
5.4	P	P	No	9/20/2013	Not planted in 2013			
5.4	P	P	No	5/19/2014	Not planted in 2013			
5.4	P	P	No	7/7/2014	5.8	1	2.25	
5.4	P	P	No	9/24/2014	6.4	1	4.00	
5.4	P	P	No	7/22/2015	8.1	1	4.25	
5.4	P	P	No	9/23/2015	8.1	1	4.50	
5.5	P	PF	Yes	5/23/2013	Not planted in 2013			
5.5	P	PF	Yes	6/13/2013	Not planted in 2013			
5.5	P	PF	Yes	7/26/2013	Not planted in 2013			
5.5	P	PF	Yes	9/20/2013	Not planted in 2013			
5.5	P	PF	Yes	5/19/2014	Not planted in 2013			
5.5	P	PF	Yes	7/7/2014	5.8	1	1.50	
5.5	P	PF	Yes	9/24/2014	6.4	1	2.25	
5.5	P	PF	Yes	7/22/2015	8.1	1	4.00	
5.5	P	PF	Yes	9/23/2015	8.1	1	4.50	
5.6	C	CF	Yes	5/23/2013	Not planted in 2013			
5.6	C	CF	Yes	6/13/2013	Not planted in 2013			
5.6	C	CF	Yes	7/26/2013	Not planted in 2013			
5.6	C	CF	Yes	9/20/2013	Not planted in 2013			
5.6	C	CF	Yes	5/19/2014	Not planted in 2013			
5.6	C	CF	Yes	7/7/2014	5.8	1	1.25	
5.6	C	CF	Yes	9/24/2014	6.4	1	1.75	
5.6	C	CF	Yes	7/22/2015	8.1	1	2.50	
5.6	C	CF	Yes	9/23/2015	8.1	1	4.50	
5.7	U	UF	Yes	5/23/2013	Not planted in 2013			
5.7	U	UF	Yes	6/13/2013	Not planted in 2013			
5.7	U	UF	Yes	7/26/2013	Not planted in 2013			
5.7	U	UF	Yes	9/20/2013	Not planted in 2013			
5.7	U	UF	Yes	5/19/2014	Not planted in 2013			
5.7	U	UF	Yes	7/7/2014	5.8	1	2.00	
5.7	U	UF	Yes	9/24/2014	6.4	1	4.25	
5.7	U	UF	Yes	7/22/2015	8.1	1	4.25	
5.7	U	UF	Yes	9/23/2015	8.1	0		
5.8	C	C	No	5/23/2013	Not planted in 2013			
5.8	C	C	No	6/13/2013	Not planted in 2013			
5.8	C	C	No	7/26/2013	Not planted in 2013			
5.8	C	C	No	9/20/2013	Not planted in 2013			
5.8	C	C	No	5/19/2014	Not planted in 2013			
5.8	C	C	No	7/7/2014	5.8	0	NA	
5.8	C	C	No	9/24/2014	6.4	0	NA	
5.8	C	C	No	7/22/2015	8.1	0		
5.8	C	C	No	9/23/2015	8.1	0		
5.9	C	CF	Yes	5/23/2013	Not planted in 2013			
5.9	C	CF	Yes	6/13/2013	Not planted in 2013			
5.9	C	CF	Yes	7/26/2013	Not planted in 2013			
5.9	C	CF	Yes	9/20/2013	Not planted in 2013			
5.9	C	CF	Yes	5/19/2014	Not planted in 2013			
5.9	C	CF	Yes	7/7/2014	5.8	1	2.25	
5.9	C	CF	Yes	9/24/2014	6.4	1	2.25	
5.9	C	CF	Yes	7/22/2015	8.1	1	3.00	
5.9	C	CF	Yes	9/23/2015	8.1	1	4.00	
5.10	P	PF	Yes	5/23/2013	Not planted in 2013			
5.10	P	PF	Yes	6/13/2013	Not planted in 2013			
5.10	P	PF	Yes	7/26/2013	Not planted in 2013			

Plot ID	Stock Type	Stock Type / Fabric	Fabric	Date	Water Table (ft)	Survival	Height (ft)	Comments
5.10	P	PF	Yes	9/20/2013	Not planted in 2013			
5.10	P	PF	Yes	5/19/2014	Not planted in 2013			
5.10	P	PF	Yes	7/7/2014	5.8	1	2.25	
5.10	P	PF	Yes	9/24/2014	6.4	1	2.50	
5.10	P	PF	Yes	7/22/2015	8.1	1	4.00	
5.10	P	PF	Yes	9/23/2015	8.1	1	4.25	
5.11	U	U	No	5/23/2013	Not planted in 2013			
5.11	U	U	No	6/13/2013	Not planted in 2013			
5.11	U	U	No	7/26/2013	Not planted in 2013			
5.11	U	U	No	9/20/2013	Not planted in 2013			
5.11	U	U	No	5/19/2014	Not planted in 2013			
5.11	U	U	No	7/7/2014	5.8	1	1.50	
5.11	U	U	No	9/24/2014	6.4	0	NA	
5.11	U	U	No	7/22/2015	8.1	0		
5.11	U	U	No	9/23/2015	8.1	0		
5.12	P	P	No	5/23/2013	Not planted in 2013			
5.12	P	P	No	6/13/2013	Not planted in 2013			
5.12	P	P	No	7/26/2013	Not planted in 2013			
5.12	P	P	No	9/20/2013	Not planted in 2013			
5.12	P	P	No	5/19/2014	Not planted in 2013			
5.12	P	P	No	7/7/2014	5.8	1	1.50	
5.12	P	P	No	9/24/2014	6.4	1	1.50	
5.12	P	P	No	7/22/2015	8.1	0		
5.12	P	P	No	9/23/2015	8.1	0		
5.13	U	UF	Yes	5/23/2013	Not planted in 2013			
5.13	U	UF	Yes	6/13/2013	Not planted in 2013			
5.13	U	UF	Yes	7/26/2013	Not planted in 2013			
5.13	U	UF	Yes	9/20/2013	Not planted in 2013			
5.13	U	UF	Yes	5/19/2014	Not planted in 2013			
5.13	U	UF	Yes	7/7/2014	5.8	1	2.25	
5.13	U	UF	Yes	9/24/2014	6.4	1	3.00	
5.13	U	UF	Yes	7/22/2015	8.1	0		07/2015 3' dead
5.13	U	UF	Yes	9/23/2015	8.1	0		
5.14	C	C	No	5/23/2013	Not planted in 2013			
5.14	C	C	No	6/13/2013	Not planted in 2013			
5.14	C	C	No	7/26/2013	Not planted in 2013			
5.14	C	C	No	9/20/2013	Not planted in 2013			
5.14	C	C	No	5/19/2014	Not planted in 2013			
5.14	C	C	No	7/7/2014	5.8	1	1.75	
5.14	C	C	No	9/24/2014	6.4	0	NA	
5.14	C	C	No	7/22/2015	8.1	0		
5.14	C	C	No	9/23/2015	8.1	0		
5.15	C	CF	Yes	5/23/2013	Not planted in 2013			
5.15	C	CF	Yes	6/13/2013	Not planted in 2013			
5.15	C	CF	Yes	7/26/2013	Not planted in 2013			
5.15	C	CF	Yes	9/20/2013	Not planted in 2013			
5.15	C	CF	Yes	5/19/2014	Not planted in 2013			
5.15	C	CF	Yes	7/7/2014	5.8	1	0.50	
5.15	C	CF	Yes	9/24/2014	6.4	0	NA	
5.15	C	CF	Yes	7/22/2015	8.1	0		
5.15	C	CF	Yes	9/23/2015	8.1	0		
5.16	P	PF	Yes	5/23/2013	Not planted in 2013			
5.16	P	PF	Yes	6/13/2013	Not planted in 2013			
5.16	P	PF	Yes	7/26/2013	Not planted in 2013			
5.16	P	PF	Yes	9/20/2013	Not planted in 2013			
5.16	P	PF	Yes	5/19/2014	Not planted in 2013			
5.16	P	PF	Yes	7/7/2014	5.8	1	1.50	
5.16	P	PF	Yes	9/24/2014	6.4	0	NA	
5.16	P	PF	Yes	7/22/2015	8.1	1	4.00	
5.16	P	PF	Yes	9/23/2015	8.1	1	4.50	

Plot ID	Stock Type	Stock Type / Fabric	Fabric	Date	Water Table (ft)	Survival	Height (ft)	Comments
5.17	U	U	No	5/23/2013	Not planted in 2013			
5.17	U	U	No	6/13/2013	Not planted in 2013			
5.17	U	U	No	7/26/2013	Not planted in 2013			
5.17	U	U	No	9/20/2013	Not planted in 2013			
5.17	U	U	No	5/19/2014	Not planted in 2013			
5.17	U	U	No	7/7/2014	5.8	1	2.50	
5.17	U	U	No	9/24/2014	6.4	1	4.00	
5.17	U	U	No	7/22/2015	8.1	1	4.00	
5.17	U	U	No	9/23/2015	8.1	1	4.50	
5.18	P	P	No	5/23/2013	Not planted in 2013			
5.18	P	P	No	6/13/2013	Not planted in 2013			
5.18	P	P	No	7/26/2013	Not planted in 2013			
5.18	P	P	No	9/20/2013	Not planted in 2013			
5.18	P	P	No	5/19/2014	Not planted in 2013			
5.18	P	P	No	7/7/2014	5.8	1	2.00	
5.18	P	P	No	9/24/2014	6.4	1	4.00	
5.18	P	P	No	7/22/2015	8.1	1	4.25	
5.18	P	P	No	9/23/2015	8.1	1	4.50	
5.19	P	P	No	5/23/2013	Not planted in 2013			
5.19	P	P	No	6/13/2013	Not planted in 2013			
5.19	P	P	No	7/26/2013	Not planted in 2013			
5.19	P	P	No	9/20/2013	Not planted in 2013			
5.19	P	P	No	5/19/2014	Not planted in 2013			
5.19	P	P	No	7/7/2014	5.8	1	1.50	
5.19	P	P	No	9/24/2014	6.4	1	3.00	
5.19	P	P	No	7/22/2015	8.1	1	4.00	
5.19	P	P	No	9/23/2015	8.1	1	3.50	
5.20	U	UF	Yes	5/23/2013	Not planted in 2013			
5.20	U	UF	Yes	6/13/2013	Not planted in 2013			
5.20	U	UF	Yes	7/26/2013	Not planted in 2013			
5.20	U	UF	Yes	9/20/2013	Not planted in 2013			
5.20	U	UF	Yes	5/19/2014	Not planted in 2013			
5.20	U	UF	Yes	7/7/2014	5.8	1	1.00	
5.20	U	UF	Yes	9/24/2014	6.4	1	2.75	
5.20	U	UF	Yes	7/22/2015	8.1	1	4.25	
5.20	U	UF	Yes	9/23/2015	8.1	1	4.75	
5.21	C	CF	Yes	5/23/2013	Not planted in 2013			
5.21	C	CF	Yes	6/13/2013	Not planted in 2013			
5.21	C	CF	Yes	7/26/2013	Not planted in 2013			
5.21	C	CF	Yes	9/20/2013	Not planted in 2013			
5.21	C	CF	Yes	5/19/2014	Not planted in 2013			
5.21	C	CF	Yes	7/7/2014	5.8	1	2.75	
5.21	C	CF	Yes	9/24/2014	6.4	1	3.00	
5.21	C	CF	Yes	7/22/2015	8.1	1	4.00	
5.21	C	CF	Yes	9/23/2015	8.1	1	4.00	
5.22	C	C	No	5/23/2013	Not planted in 2013			
5.22	C	C	No	6/13/2013	Not planted in 2013			
5.22	C	C	No	7/26/2013	Not planted in 2013			
5.22	C	C	No	9/20/2013	Not planted in 2013			
5.22	C	C	No	5/19/2014	Not planted in 2013			
5.22	C	C	No	7/7/2014	5.8	1	2.50	
5.22	C	C	No	9/24/2014	6.4	1	3.75	
5.22	C	C	No	7/22/2015	8.1	1	4.25	
5.22	C	C	No	9/23/2015	8.1	1	4.50	
5.23	P	PF	Yes	5/23/2013	Not planted in 2013			
5.23	P	PF	Yes	6/13/2013	Not planted in 2013			
5.23	P	PF	Yes	7/26/2013	Not planted in 2013			
5.23	P	PF	Yes	9/20/2013	Not planted in 2013			
5.23	P	PF	Yes	5/19/2014	Not planted in 2013			
5.23	P	PF	Yes	7/7/2014	5.8	1	2.25	

Plot ID	Stock Type	Stock Type / Fabric	Fabric	Date	Water Table (ft)	Survival	Height (ft)	Comments
5.23	P	PF	Yes	9/24/2014	6.4	1	2.75	
5.23	P	PF	Yes	7/22/2015	8.1	1	4.00	
5.23	P	PF	Yes	9/23/2015	8.1	1	4.50	
5.24	U	U	No	5/23/2013	Not planted in 2013			
5.24	U	U	No	6/13/2013	Not planted in 2013			
5.24	U	U	No	7/26/2013	Not planted in 2013			
5.24	U	U	No	9/20/2013	Not planted in 2013			
5.24	U	U	No	5/19/2014	Not planted in 2013			
5.24	U	U	No	7/7/2014	5.8	1	1.75	
5.24	U	U	No	9/24/2014	6.4	1	2.75	
5.24	U	U	No	7/22/2015	8.1	1	4.50	
5.24	U	U	No	9/23/2015	8.1	1	4.00	
5.25	P	P	No	5/23/2013	Not planted in 2013			
5.25	P	P	No	6/13/2013	Not planted in 2013			
5.25	P	P	No	7/26/2013	Not planted in 2013			
5.25	P	P	No	9/20/2013	Not planted in 2013			
5.25	P	P	No	5/19/2014	Not planted in 2013			
5.25	P	P	No	7/7/2014	5.8	1	2.00	
5.25	P	P	No	9/24/2014	6.4	1	3.50	
5.25	P	P	No	7/22/2015	8.1	1	4.00	
5.25	P	P	No	9/23/2015	8.1	1	4.50	
5.26	U	U	No	5/23/2013	Not planted in 2013			
5.26	U	U	No	6/13/2013	Not planted in 2013			
5.26	U	U	No	7/26/2013	Not planted in 2013			
5.26	U	U	No	9/20/2013	Not planted in 2013			
5.26	U	U	No	5/19/2014	Not planted in 2013			
5.26	U	U	No	7/7/2014	5.8	1	1.50	
5.26	U	U	No	9/24/2014	6.4	1	2.75	
5.26	U	U	No	7/22/2015	8.1	1	4.00	
5.26	U	U	No	9/23/2015	8.1	1	4.50	
5.27	P	PF	Yes	5/23/2013	Not planted in 2013			
5.27	P	PF	Yes	6/13/2013	Not planted in 2013			
5.27	P	PF	Yes	7/26/2013	Not planted in 2013			
5.27	P	PF	Yes	9/20/2013	Not planted in 2013			
5.27	P	PF	Yes	5/19/2014	Not planted in 2013			
5.27	P	PF	Yes	7/7/2014	5.8	1	1.75	
5.27	P	PF	Yes	9/24/2014	6.4	1	2.50	
5.27	P	PF	Yes	7/22/2015	8.1	1	4.25	
5.27	P	PF	Yes	9/23/2015	8.1	1	4.50	
5.28	UF not planted			5/23/2013	Not planted in 2013			
5.28	UF not planted			6/13/2013	Not planted in 2013			
5.28	UF not planted			7/26/2013	Not planted in 2013			
5.28	UF not planted			9/20/2013	Not planted in 2013			
5.28	UF not planted			5/19/2014	Not planted in 2013			
5.28	UF not planted			7/7/2014	5.8			
5.28	UF not planted			9/24/2014	6.4			
5.28	UF not planted			7/22/2015	8.1			Unrooted cutting mistakenly not planted
5.28	UF not planted			9/23/2015	8.1	0		
5.29	C	C	No	5/23/2013	Not planted in 2013			
5.29	C	C	No	6/13/2013	Not planted in 2013			
5.29	C	C	No	7/26/2013	Not planted in 2013			
5.29	C	C	No	9/20/2013	Not planted in 2013			
5.29	C	C	No	5/19/2014	Not planted in 2013			
5.29	C	C	No	7/7/2014	5.8	0	NA	
5.29	C	C	No	9/24/2014	6.4	0	NA	
5.29	C	C	No	7/22/2015	8.1	0		
5.29	C	C	No	9/23/2015	8.1	0		
5.30	C	CF	Yes	5/23/2013	Not planted in 2013			
5.30	C	CF	Yes	6/13/2013	Not planted in 2013			
5.30	C	CF	Yes	7/26/2013	Not planted in 2013			

Plot ID	Stock Type	Stock Type / Fabric	Fabric	Date	Water Table (ft)	Survival	Height (ft)	Comments
5.30	C	CF	Yes	9/20/2013	Not planted in 2013			
5.30	C	CF	Yes	5/19/2014	Not planted in 2013			
5.30	C	CF	Yes	7/7/2014	5.8	1	1.00	
5.30	C	CF	Yes	9/24/2014	6.4	1	1.50	
5.30	C	CF	Yes	7/22/2015	8.1	1	2.25	
5.30	C	CF	Yes	9/23/2015	8.1	0		
5.31	P	PF	Yes	5/23/2013	Not planted in 2013			
5.31	P	PF	Yes	6/13/2013	Not planted in 2013			
5.31	P	PF	Yes	7/26/2013	Not planted in 2013			
5.31	P	PF	Yes	9/20/2013	Not planted in 2013			
5.31	P	PF	Yes	5/19/2014	Not planted in 2013			
5.31	P	PF	Yes	7/7/2014	5.8	1	3.50	
5.31	P	PF	Yes	9/24/2014	6.4	1	3.50	
5.31	P	PF	Yes	7/22/2015	8.1	1	4.25	
5.31	P	PF	Yes	9/23/2015	8.1	1	4.00	
5.32	U	UF	Yes	5/23/2013	Not planted in 2013			
5.32	U	UF	Yes	6/13/2013	Not planted in 2013			
5.32	U	UF	Yes	7/26/2013	Not planted in 2013			
5.32	U	UF	Yes	9/20/2013	Not planted in 2013			
5.32	U	UF	Yes	5/19/2014	Not planted in 2013			
5.32	U	UF	Yes	7/7/2014	5.8	1	2.25	
5.32	U	UF	Yes	9/24/2014	6.4	0	NA	
5.32	U	UF	Yes	7/22/2015	8.1	0		07/2015 2.5' dead
5.32	U	UF	Yes	9/23/2015	8.1	0		
5.33	C	CF	Yes	5/23/2013	Not planted in 2013			
5.33	C	CF	Yes	6/13/2013	Not planted in 2013			
5.33	C	CF	Yes	7/26/2013	Not planted in 2013			
5.33	C	CF	Yes	9/20/2013	Not planted in 2013			
5.33	C	CF	Yes	5/19/2014	Not planted in 2013			
5.33	C	CF	Yes	7/7/2014	5.8	0	NA	
5.33	C	CF	Yes	9/24/2014	6.4	0	NA	
5.33	C	CF	Yes	7/22/2015	8.1	0		07/2015 2.5' dead
5.33	C	CF	Yes	9/23/2015	8.1	0		
5.34	C	C	No	5/23/2013	Not planted in 2013			
5.34	C	C	No	6/13/2013	Not planted in 2013			
5.34	C	C	No	7/26/2013	Not planted in 2013			
5.34	C	C	No	9/20/2013	Not planted in 2013			
5.34	C	C	No	5/19/2014	Not planted in 2013			
5.34	C	C	No	7/7/2014	5.8	0	NA	
5.34	C	C	No	9/24/2014	6.4	0	NA	
5.34	C	C	No	7/22/2015	8.1	0		07/2015 2.5' dead
5.34	C	C	No	9/23/2015	8.1	0		
5.35	P	P	No	5/23/2013	Not planted in 2013			
5.35	P	P	No	6/13/2013	Not planted in 2013			
5.35	P	P	No	7/26/2013	Not planted in 2013			
5.35	P	P	No	9/20/2013	Not planted in 2013			
5.35	P	P	No	5/19/2014	Not planted in 2013			
5.35	P	P	No	7/7/2014	5.8	1	2.25	
5.35	P	P	No	9/24/2014	6.4	1	2.25	
5.35	P	P	No	7/22/2015	8.1	1	1.50	07/2015 dead top
5.35	P	P	No	9/23/2015	8.1	1	1.50	
5.36	U	U	No	5/23/2013	Not planted in 2013			
5.36	U	U	No	6/13/2013	Not planted in 2013			
5.36	U	U	No	7/26/2013	Not planted in 2013			
5.36	U	U	No	9/20/2013	Not planted in 2013			
5.36	U	U	No	5/19/2014	Not planted in 2013			
5.36	U	U	No	7/7/2014	5.8	1	1.50	
5.36	U	U	No	9/24/2014	6.4	1	3.00	
5.36	U	U	No	7/22/2015	8.1	1	4.25	
5.36	U	U	No	9/23/2015	8.1	1	4.50	

Plot ID	Stock Type	Stock Type / Fabric	Fabric	Date	Water Table (ft)	Survival	Height (ft)	Comments
6.1	P	P	No	5/23/2013	Not planted in 2013			
6.1	P	P	No	6/13/2013	Not planted in 2013			
6.1	P	P	No	7/26/2013	Not planted in 2013			
6.1	P	P	No	9/20/2013	Not planted in 2013			
6.1	P	P	No	5/19/2014	Not planted in 2013			
6.1	P	P	No	7/7/2014	5	1	2.00	
6.1	P	P	No	9/24/2014	6	1	2.50	
6.1	P	P	No	7/22/2015	8.3	1	4.25	
6.1	P	P	No	9/23/2015	8.1	1	4.50	
6.2	C	CF	Yes	5/23/2013	Not planted in 2013			
6.2	C	CF	Yes	6/13/2013	Not planted in 2013			
6.2	C	CF	Yes	7/26/2013	Not planted in 2013			
6.2	C	CF	Yes	9/20/2013	Not planted in 2013			
6.2	C	CF	Yes	5/19/2014	Not planted in 2013			
6.2	C	CF	Yes	7/7/2014	5.0	1	2.00	
6.2	C	CF	Yes	9/24/2014	6.0	1	3.25	
6.2	C	CF	Yes	7/22/2015	8.3	1	4.00	
6.2	C	CF	Yes	9/23/2015	8.1	1	4.00	
6.3	U	U	No	5/23/2013	Not planted in 2013			
6.3	U	U	No	6/13/2013	Not planted in 2013			
6.3	U	U	No	7/26/2013	Not planted in 2013			
6.3	U	U	No	9/20/2013	Not planted in 2013			
6.3	U	U	No	5/19/2014	Not planted in 2013			
6.3	U	U	No	7/7/2014	5	1	2.25	
6.3	U	U	No	9/24/2014	6	1	3.25	
6.3	U	U	No	7/22/2015	8.3	1	4.00	
6.3	U	U	No	9/23/2015	8.1	1	3.50	
6.4	P	PF	Yes	5/23/2013	Not planted in 2013			
6.4	P	PF	Yes	6/13/2013	Not planted in 2013			
6.4	P	PF	Yes	7/26/2013	Not planted in 2013			
6.4	P	PF	Yes	9/20/2013	Not planted in 2013			
6.4	P	PF	Yes	5/19/2014	Not planted in 2013			
6.4	P	PF	Yes	7/7/2014	5.0	1	1.50	
6.4	P	PF	Yes	9/24/2014	6.0	1	3.00	
6.4	P	PF	Yes	7/22/2015	8.3	1	4.50	
6.4	P	PF	Yes	9/23/2015	8.1	1	5.00	
6.5	U	UF	Yes	5/23/2013	Not planted in 2013			
6.5	U	UF	Yes	6/13/2013	Not planted in 2013			
6.5	U	UF	Yes	7/26/2013	Not planted in 2013			
6.5	U	UF	Yes	9/20/2013	Not planted in 2013			
6.5	U	UF	Yes	5/19/2014	Not planted in 2013			
6.5	U	UF	Yes	7/7/2014	5	1	2.75	
6.5	U	UF	Yes	9/24/2014	6	1	4.00	
6.5	U	UF	Yes	7/22/2015	8.3	1	4.25	
6.5	U	UF	Yes	9/23/2015	8.1	1	4.50	
6.6	C	C	No	5/23/2013	Not planted in 2013			
6.6	C	C	No	6/13/2013	Not planted in 2013			
6.6	C	C	No	7/26/2013	Not planted in 2013			
6.6	C	C	No	9/20/2013	Not planted in 2013			
6.6	C	C	No	5/19/2014	Not planted in 2013			
6.6	C	C	No	7/7/2014	5.0	1	1.50	
6.6	C	C	No	9/24/2014	6.0	1	2.00	
6.6	C	C	No	7/22/2015	8.3	0		
6.6	C	C	No	9/23/2015	8.1	0		
6.7	U	UF	Yes	5/23/2013	Not planted in 2013			
6.7	U	UF	Yes	6/13/2013	Not planted in 2013			
6.7	U	UF	Yes	7/26/2013	Not planted in 2013			
6.7	U	UF	Yes	9/20/2013	Not planted in 2013			
6.7	U	UF	Yes	5/19/2014	Not planted in 2013			
6.7	U	UF	Yes	7/7/2014	5	1	2.50	

Plot ID	Stock Type	Stock Type / Fabric	Fabric	Date	Water Table (ft)	Survival	Height (ft)	Comments
6.7	U	UF	Yes	9/24/2014	6	1	4.00	
6.7	U	UF	Yes	7/22/2015	8.3	1	4.50	
6.7	U	UF	Yes	9/23/2015	8.1	0		
6.8	U	U	No	5/23/2013	Not planted in 2013			
6.8	U	U	No	6/13/2013	Not planted in 2013			
6.8	U	U	No	7/26/2013	Not planted in 2013			
6.8	U	U	No	9/20/2013	Not planted in 2013			
6.8	U	U	No	5/19/2014	Not planted in 2013			
6.8	U	U	No	7/7/2014	5.0	1	4.50	
6.8	U	U	No	9/24/2014	6.0	1	4.25	
6.8	U	U	No	7/22/2015	8.3	0		07/2015 4.25' dead
6.8	U	U	No	9/23/2015	8.1	0		
6.9	P	PF	Yes	5/23/2013	Not planted in 2013			
6.9	P	PF	Yes	6/13/2013	Not planted in 2013			
6.9	P	PF	Yes	7/26/2013	Not planted in 2013			
6.9	P	PF	Yes	9/20/2013	Not planted in 2013			
6.9	P	PF	Yes	5/19/2014	Not planted in 2013			
6.9	P	PF	Yes	7/7/2014	5	1	2.50	
6.9	P	PF	Yes	9/24/2014	6	1	3.00	
6.9	P	PF	Yes	7/22/2015	8.3	1	3.50	
6.9	P	PF	Yes	9/23/2015	8.1	1	3.75	
6.10	C	CF	Yes	5/23/2013	Not planted in 2013			
6.10	C	CF	Yes	6/13/2013	Not planted in 2013			
6.10	C	CF	Yes	7/26/2013	Not planted in 2013			
6.10	C	CF	Yes	9/20/2013	Not planted in 2013			
6.10	C	CF	Yes	5/19/2014	Not planted in 2013			
6.10	C	CF	Yes	7/7/2014	5.0	1	1.50	
6.10	C	CF	Yes	9/24/2014	6.0	1	2.00	
6.10	C	CF	Yes	7/22/2015	8.3	1	3.50	
6.10	C	CF	Yes	9/23/2015	8.1	1	3.75	
6.11	C	C	No	5/23/2013	Not planted in 2013			
6.11	C	C	No	6/13/2013	Not planted in 2013			
6.11	C	C	No	7/26/2013	Not planted in 2013			
6.11	C	C	No	9/20/2013	Not planted in 2013			
6.11	C	C	No	5/19/2014	Not planted in 2013			
6.11	C	C	No	7/7/2014	5	1	0.50	
6.11	C	C	No	9/24/2014	6	1	1.25	
6.11	C	C	No	7/22/2015	8.3	1	2.50	
6.11	C	C	No	9/23/2015	8.1	1	2.00	
6.12	P	P	No	5/23/2013	Not planted in 2013			
6.12	P	P	No	6/13/2013	Not planted in 2013			
6.12	P	P	No	7/26/2013	Not planted in 2013			
6.12	P	P	No	9/20/2013	Not planted in 2013			
6.12	P	P	No	5/19/2014	Not planted in 2013			
6.12	P	P	No	7/7/2014	5.0	1	0.50	
6.12	P	P	No	9/24/2014	6.0	1	1.25	
6.12	P	P	No	7/22/2015	8.3	0		
6.12	P	P	No	9/23/2015	8.1	0		
6.13	P	P	No	5/23/2013	Not planted in 2013			
6.13	P	P	No	6/13/2013	Not planted in 2013			
6.13	P	P	No	7/26/2013	Not planted in 2013			
6.13	P	P	No	9/20/2013	Not planted in 2013			
6.13	P	P	No	5/19/2014	Not planted in 2013			
6.13	P	P	No	7/7/2014	5	1	1.50	
6.13	P	P	No	9/24/2014	6	1	1.50	
6.13	P	P	No	7/22/2015	8.3	0		
6.13	P	P	No	9/23/2015	8.1	0		
6.14	U	UF	Yes	5/23/2013	Not planted in 2013			
6.14	U	UF	Yes	6/13/2013	Not planted in 2013			
6.14	U	UF	Yes	7/26/2013	Not planted in 2013			

Plot ID	Stock Type	Stock Type / Fabric	Fabric	Date	Water Table (ft)	Survival	Height (ft)	Comments
6.14	U	UF	Yes	9/20/2013	Not planted in 2013			
6.14	U	UF	Yes	5/19/2014	Not planted in 2013			
6.14	U	UF	Yes	7/7/2014	5.0	1	2.25	
6.14	U	UF	Yes	9/24/2014	6.0	1	4.00	
6.14	U	UF	Yes	7/22/2015	8.3	1	2.75	
6.14	U	UF	Yes	9/23/2015	8.1	1	3.00	
6.15	P	PF	Yes	5/23/2013	Not planted in 2013			
6.15	P	PF	Yes	6/13/2013	Not planted in 2013			
6.15	P	PF	Yes	7/26/2013	Not planted in 2013			
6.15	P	PF	Yes	9/20/2013	Not planted in 2013			
6.15	P	PF	Yes	5/19/2014	Not planted in 2013			
6.15	P	PF	Yes	7/7/2014	5	1	1.75	
6.15	P	PF	Yes	9/24/2014	6	1	2.50	
6.15	P	PF	Yes	7/22/2015	8.3	1	3.75	
6.15	P	PF	Yes	9/23/2015	8.1	1	3.75	
6.16	U	U	No	5/23/2013	Not planted in 2013			
6.16	U	U	No	6/13/2013	Not planted in 2013			
6.16	U	U	No	7/26/2013	Not planted in 2013			
6.16	U	U	No	9/20/2013	Not planted in 2013			
6.16	U	U	No	5/19/2014	Not planted in 2013			
6.16	U	U	No	7/7/2014	5.0	1	3.50	
6.16	U	U	No	9/24/2014	6.0	1	4.00	
6.16	U	U	No	7/22/2015	8.3	1	4.25	
6.16	U	U	No	9/23/2015	8.1	0		
6.17	C	CF	Yes	5/23/2013	Not planted in 2013			
6.17	C	CF	Yes	6/13/2013	Not planted in 2013			
6.17	C	CF	Yes	7/26/2013	Not planted in 2013			
6.17	C	CF	Yes	9/20/2013	Not planted in 2013			
6.17	C	CF	Yes	5/19/2014	Not planted in 2013			
6.17	C	CF	Yes	7/7/2014	5	1	1.75	
6.17	C	CF	Yes	9/24/2014	6	1	4.00	
6.17	C	CF	Yes	7/22/2015	8.3	1	4.00	
6.17	C	CF	Yes	9/23/2015	8.1	1	4.00	
6.18	C	C	No	5/23/2013	Not planted in 2013			
6.18	C	C	No	6/13/2013	Not planted in 2013			
6.18	C	C	No	7/26/2013	Not planted in 2013			
6.18	C	C	No	9/20/2013	Not planted in 2013			
6.18	C	C	No	5/19/2014	Not planted in 2013			
6.18	C	C	No	7/7/2014	5.0	0	NA	
6.18	C	C	No	9/24/2014	6.0	0	NA	
6.18	C	C	No	7/22/2015	8.3	0		
6.18	C	C	No	9/23/2015	8.1	0		
6.19	U	U	No	5/23/2013	Not planted in 2013			
6.19	U	U	No	6/13/2013	Not planted in 2013			
6.19	U	U	No	7/26/2013	Not planted in 2013			
6.19	U	U	No	9/20/2013	Not planted in 2013			
6.19	U	U	No	5/19/2014	Not planted in 2013			
6.19	U	U	No	7/7/2014	5	1	1.50	
6.19	U	U	No	9/24/2014	6	1	2.00	
6.19	U	U	No	7/22/2015	8.3	1	3.75	
6.19	U	U	No	9/23/2015	8.1	1	3.50	
6.20	P	PF	Yes	5/23/2013	Not planted in 2013			
6.20	P	PF	Yes	6/13/2013	Not planted in 2013			
6.20	P	PF	Yes	7/26/2013	Not planted in 2013			
6.20	P	PF	Yes	9/20/2013	Not planted in 2013			
6.20	P	PF	Yes	5/19/2014	Not planted in 2013			
6.20	P	PF	Yes	7/7/2014	5.0	1	1.50	
6.20	P	PF	Yes	9/24/2014	6.0	1	2.00	
6.20	P	PF	Yes	7/22/2015	8.3	1	2.75	
6.20	P	PF	Yes	9/23/2015	8.1	1	2.75	

Plot ID	Stock Type	Stock Type / Fabric	Fabric	Date	Water Table (ft)	Survival	Height (ft)	Comments
6.21	U	UF	Yes	5/23/2013	Not planted in 2013			
6.21	U	UF	Yes	6/13/2013	Not planted in 2013			
6.21	U	UF	Yes	7/26/2013	Not planted in 2013			
6.21	U	UF	Yes	9/20/2013	Not planted in 2013			
6.21	U	UF	Yes	5/19/2014	Not planted in 2013			
6.21	U	UF	Yes	7/7/2014	5	1	1.75	
6.21	U	UF	Yes	9/24/2014	6	1	4.25	
6.21	U	UF	Yes	7/22/2015	8.3	1	4.00	
6.21	U	UF	Yes	9/23/2015	8.1	1	4.00	
6.22	P	P	No	5/23/2013	Not planted in 2013			
6.22	P	P	No	6/13/2013	Not planted in 2013			
6.22	P	P	No	7/26/2013	Not planted in 2013			
6.22	P	P	No	9/20/2013	Not planted in 2013			
6.22	P	P	No	5/19/2014	Not planted in 2013			
6.22	P	P	No	7/7/2014	5.0	1	1.50	
6.22	P	P	No	9/24/2014	6.0	1	2.25	
6.22	P	P	No	7/22/2015	8.3	1	3.25	
6.22	P	P	No	9/23/2015	8.1	1	3.50	
6.23	C	C	No	5/23/2013	Not planted in 2013			
6.23	C	C	No	6/13/2013	Not planted in 2013			
6.23	C	C	No	7/26/2013	Not planted in 2013			
6.23	C	C	No	9/20/2013	Not planted in 2013			
6.23	C	C	No	5/19/2014	Not planted in 2013			
6.23	C	C	No	7/7/2014	5	0	NA	
6.23	C	C	No	9/24/2014	6	0	NA	
6.23	C	C	No	7/22/2015	8.3	0		
6.23	C	C	No	9/23/2015	8.1	0		
6.24	C	CF	Yes	5/23/2013	Not planted in 2013			
6.24	C	CF	Yes	6/13/2013	Not planted in 2013			
6.24	C	CF	Yes	7/26/2013	Not planted in 2013			
6.24	C	CF	Yes	9/20/2013	Not planted in 2013			
6.24	C	CF	Yes	5/19/2014	Not planted in 2013			
6.24	C	CF	Yes	7/7/2014	5.0	1	1.00	
6.24	C	CF	Yes	9/24/2014	6.0	1	1.50	
6.24	C	CF	Yes	7/22/2015	8.3	0		
6.24	C	CF	Yes	9/23/2015	8.1	0		
6.25	P	PF	Yes	5/23/2013	Not planted in 2013			
6.25	P	PF	Yes	6/13/2013	Not planted in 2013			
6.25	P	PF	Yes	7/26/2013	Not planted in 2013			
6.25	P	PF	Yes	9/20/2013	Not planted in 2013			
6.25	P	PF	Yes	5/19/2014	Not planted in 2013			
6.25	P	PF	Yes	7/7/2014	5	1	2.00	
6.25	P	PF	Yes	9/24/2014	6	1	3.50	
6.25	P	PF	Yes	7/22/2015	8.3	1	4.00	
6.25	P	PF	Yes	9/23/2015	8.1	1	4.00	
6.26	U	UF	Yes	5/23/2013	Not planted in 2013			
6.26	U	UF	Yes	6/13/2013	Not planted in 2013			
6.26	U	UF	Yes	7/26/2013	Not planted in 2013			
6.26	U	UF	Yes	9/20/2013	Not planted in 2013			
6.26	U	UF	Yes	5/19/2014	Not planted in 2013			
6.26	U	UF	Yes	7/7/2014	5.0	1	2.25	
6.26	U	UF	Yes	9/24/2014	6.0	1	4.00	
6.26	U	UF	Yes	7/22/2015	8.3	1	4.25	
6.26	U	UF	Yes	9/23/2015	8.1	1	4.50	
6.27	U	U	No	5/23/2013	Not planted in 2013			
6.27	U	U	No	6/13/2013	Not planted in 2013			
6.27	U	U	No	7/26/2013	Not planted in 2013			
6.27	U	U	No	9/20/2013	Not planted in 2013			
6.27	U	U	No	5/19/2014	Not planted in 2013			
6.27	U	U	No	7/7/2014	5	1	1.25	

Plot ID	Stock Type	Stock Type / Fabric	Fabric	Date	Water Table (ft)	Survival	Height (ft)	Comments
6.27	U	U	No	9/24/2014	6	1	1.50	
6.27	U	U	No	7/22/2015	8.3	1	1.25	
6.27	U	U	No	9/23/2015	8.1	0		
6.28	C	CF	NA	5/23/2013	Not planted in 2013			
6.28	C	CF	NA	6/13/2013	Not planted in 2013			
6.28	C	CF	NA	7/26/2013	Not planted in 2013			
6.28	C	CF	NA	9/20/2013	Not planted in 2013			
6.28	C	CF	NA	5/19/2014	Not planted in 2013			
6.28	C	CF	NA	7/7/2014	5.0	1	1.50	
6.28	C	CF	NA	9/24/2014	6.0	1	1.75	
6.28	C	CF	NA	7/22/2015	8.3	0		
6.28	C	CF	NA	9/23/2015	8.1	0		
6.29	P	P	No	5/23/2013	Not planted in 2013			
6.29	P	P	No	6/13/2013	Not planted in 2013			
6.29	P	P	No	7/26/2013	Not planted in 2013			
6.29	P	P	No	9/20/2013	Not planted in 2013			
6.29	P	P	No	5/19/2014	Not planted in 2013			
6.29	P	P	No	7/7/2014	5	1	1.50	
6.29	P	P	No	9/24/2014	6	1	2.25	
6.29	P	P	No	7/22/2015	8.3	1	2.50	
6.29	P	P	No	9/23/2015	8.1	1	2.00	
6.30	C	C	No	5/23/2013	Not planted in 2013			
6.30	C	C	No	6/13/2013	Not planted in 2013			
6.30	C	C	No	7/26/2013	Not planted in 2013			
6.30	C	C	No	9/20/2013	Not planted in 2013			
6.30	C	C	No	5/19/2014	Not planted in 2013			
6.30	C	C	No	7/7/2014	5.0	1	2.50	
6.30	C	C	No	9/24/2014	6.0	1	2.50	
6.30	C	C	No	7/22/2015	8.3	1	3.75	
6.30	C	C	No	9/23/2015	8.1	1	3.75	
6.31	U	UF	Yes	5/23/2013	Not planted in 2013			
6.31	U	UF	Yes	6/13/2013	Not planted in 2013			
6.31	U	UF	Yes	7/26/2013	Not planted in 2013			
6.31	U	UF	Yes	9/20/2013	Not planted in 2013			
6.31	U	UF	Yes	5/19/2014	Not planted in 2013			
6.31	U	UF	Yes	7/7/2014	5	0	NA	
6.31	U	UF	Yes	9/24/2014	6	0	NA	
6.31	U	UF	Yes	7/22/2015	8.3	0		
6.31	U	UF	Yes	9/23/2015	8.1	0		
6.32	P	PF	Yes	5/23/2013	Not planted in 2013			
6.32	P	PF	Yes	6/13/2013	Not planted in 2013			
6.32	P	PF	Yes	7/26/2013	Not planted in 2013			
6.32	P	PF	Yes	9/20/2013	Not planted in 2013			
6.32	P	PF	Yes	5/19/2014	Not planted in 2013			
6.32	P	PF	Yes	7/7/2014	5.0	1	2.00	
6.32	P	PF	Yes	9/24/2014	6.0	1	2.75	
6.32	P	PF	Yes	7/22/2015	8.3	1	3.75	
6.32	P	PF	Yes	9/23/2015	8.1	1	3.50	
6.33	C	CF	Yes	5/23/2013	Not planted in 2013			
6.33	C	CF	Yes	6/13/2013	Not planted in 2013			
6.33	C	CF	Yes	7/26/2013	Not planted in 2013			
6.33	C	CF	Yes	9/20/2013	Not planted in 2013			
6.33	C	CF	Yes	5/19/2014	Not planted in 2013			
6.33	C	CF	Yes	7/7/2014	5	0	NA	
6.33	C	CF	Yes	9/24/2014	6	0	NA	
6.33	C	CF	Yes	7/22/2015	8.3	0		
6.33	C	CF	Yes	9/23/2015	8.1	0		
6.34	C	C	No	5/23/2013	Not planted in 2013			
6.34	C	C	No	6/13/2013	Not planted in 2013			
6.34	C	C	No	7/26/2013	Not planted in 2013			

Plot ID	Stock Type	Stock Type / Fabric	Fabric	Date	Water Table (ft)	Survival	Height (ft)	Comments
6.34	C	C	No	9/20/2013	Not planted in 2013			
6.34	C	C	No	5/19/2014	Not planted in 2013			
6.34	C	C	No	7/7/2014	5.0	0	NA	
6.34	C	C	No	9/24/2014	6.0	0	NA	
6.34	C	C	No	7/22/2015	8.3	0		
6.34	C	C	No	9/23/2015	8.1	0		
6.35	P	P	No	5/23/2013	Not planted in 2013			
6.35	P	P	No	6/13/2013	Not planted in 2013			
6.35	P	P	No	7/26/2013	Not planted in 2013			
6.35	P	P	No	9/20/2013	Not planted in 2013			
6.35	P	P	No	5/19/2014	Not planted in 2013			
6.35	P	P	No	7/7/2014	5	1	1.50	
6.35	P	P	No	9/24/2014	6	1	2.25	
6.35	P	P	No	7/22/2015	8.3	1	3.00	
6.35	P	P	No	9/23/2015	8.1	1	3.00	
6.36	U	U	No	5/23/2013	Not planted in 2013			
6.36	U	U	No	6/13/2013	Not planted in 2013			
6.36	U	U	No	7/26/2013	Not planted in 2013			
6.36	U	U	No	9/20/2013	Not planted in 2013			
6.36	U	U	No	5/19/2014	Not planted in 2013			
6.36	U	U	No	7/7/2014	5.0	1	2.25	
6.36	U	U	No	9/24/2014	6.0	1	3.25	
6.36	U	U	No	7/22/2015	8.3	1	3.25	
6.36	U	U	No	9/23/2015	8.1	1	3.50	
7.1	U	U	No	5/23/2013	Not planted in 2013			
7.1	U	U	No	6/13/2013	Not planted in 2013			
7.1	U	U	No	7/26/2013	Not planted in 2013			
7.1	U	U	No	9/20/2013	Not planted in 2013			
7.1	U	U	No	5/19/2014	Not planted in 2013			
7.1	U	U	No	7/7/2014	3	1	2.50	
7.1	U	U	No	9/24/2014	3.8	1	3.50	
7.1	U	U	No	7/22/2015	4.5	1	4.00	
7.1	U	U	No	9/23/2015	5.2	1	4.80	
7.2	C	C	No	5/23/2013	Not planted in 2013			
7.2	C	C	No	6/13/2013	Not planted in 2013			
7.2	C	C	No	7/26/2013	Not planted in 2013			
7.2	C	C	No	9/20/2013	Not planted in 2013			
7.2	C	C	No	5/19/2014	Not planted in 2013			
7.2	C	C	No	7/7/2014	3.0	0	NA	
7.2	C	C	No	9/24/2014	3.8	1	2.50	
7.2	C	C	No	7/22/2015	4.5	1	0.25	
7.2	C	C	No	9/23/2015	5.2	0		
7.3	U	UF	Yes	5/23/2013	Not planted in 2013			
7.3	U	UF	Yes	6/13/2013	Not planted in 2013			
7.3	U	UF	Yes	7/26/2013	Not planted in 2013			
7.3	U	UF	Yes	9/20/2013	Not planted in 2013			
7.3	U	UF	Yes	5/19/2014	Not planted in 2013			
7.3	U	UF	Yes	7/7/2014	3	1	3.50	
7.3	U	UF	Yes	9/24/2014	3.8	1	4.00	
7.3	U	UF	Yes	7/22/2015	4.5	1	4.75	
7.3	U	UF	Yes	9/23/2015	5.2	1	4.50	
7.4	P	PF	Yes	5/23/2013	Not planted in 2013			
7.4	P	PF	Yes	6/13/2013	Not planted in 2013			
7.4	P	PF	Yes	7/26/2013	Not planted in 2013			
7.4	P	PF	Yes	9/20/2013	Not planted in 2013			
7.4	P	PF	Yes	5/19/2014	Not planted in 2013			
7.4	P	PF	Yes	7/7/2014	3.0	1	3.00	
7.4	P	PF	Yes	9/24/2014	3.8	1	4.00	
7.4	P	PF	Yes	7/22/2015	4.5	1	4.25	
7.4	P	PF	Yes	9/23/2015	5.2	0		

Plot ID	Stock Type	Stock Type / Fabric	Fabric	Date	Water Table (ft)	Survival	Height (ft)	Comments
7.5	P	P	No	5/23/2013	Not planted in 2013			
7.5	P	P	No	6/13/2013	Not planted in 2013			
7.5	P	P	No	7/26/2013	Not planted in 2013			
7.5	P	P	No	9/20/2013	Not planted in 2013			
7.5	P	P	No	5/19/2014	Not planted in 2013			
7.5	P	P	No	7/7/2014	3	1	2.75	
7.5	P	P	No	9/24/2014	3.8	1	4.25	
7.5	P	P	No	7/22/2015	4.5	1	4.00	
7.5	P	P	No	9/23/2015	5.2	1	4.50	
7.6	C	CF	Yes	5/23/2013	Not planted in 2013			
7.6	C	CF	Yes	6/13/2013	Not planted in 2013			
7.6	C	CF	Yes	7/26/2013	Not planted in 2013			
7.6	C	CF	Yes	9/20/2013	Not planted in 2013			
7.6	C	CF	Yes	5/19/2014	Not planted in 2013			
7.6	C	CF	Yes	7/7/2014	3.0	1	1.25	
7.6	C	CF	Yes	9/24/2014	3.8	1	4.00	
7.6	C	CF	Yes	7/22/2015	4.5	1	1.50	
7.6	C	CF	Yes	9/23/2015	5.2	1	2.75	
7.7	C	CF	Yes	5/23/2013	Not planted in 2013			
7.7	C	CF	Yes	6/13/2013	Not planted in 2013			
7.7	C	CF	Yes	7/26/2013	Not planted in 2013			
7.7	C	CF	Yes	9/20/2013	Not planted in 2013			
7.7	C	CF	Yes	5/19/2014	Not planted in 2013			
7.7	C	CF	Yes	7/7/2014	3	1	2.25	
7.7	C	CF	Yes	9/24/2014	3.8	1	4.00	
7.7	C	CF	Yes	7/22/2015	4.5	1	4.25	
7.7	C	CF	Yes	9/23/2015	5.2	1	4.25	
7.8	P	P	No	5/23/2013	Not planted in 2013			
7.8	P	P	No	6/13/2013	Not planted in 2013			
7.8	P	P	No	7/26/2013	Not planted in 2013			
7.8	P	P	No	9/20/2013	Not planted in 2013			
7.8	P	P	No	5/19/2014	Not planted in 2013			
7.8	P	P	No	7/7/2014	3.0	1	2.00	
7.8	P	P	No	9/24/2014	3.8	1	4.00	
7.8	P	P	No	7/22/2015	4.5	1	4.50	
7.8	P	P	No	9/23/2015	5.2	1	4.50	
7.9	C	C	No	5/23/2013	Not planted in 2013			
7.9	C	C	No	6/13/2013	Not planted in 2013			
7.9	C	C	No	7/26/2013	Not planted in 2013			
7.9	C	C	No	9/20/2013	Not planted in 2013			
7.9	C	C	No	5/19/2014	Not planted in 2013			
7.9	C	C	No	7/7/2014	3	0	NA	
7.9	C	C	No	9/24/2014	3.8	0	NA	
7.9	C	C	No	7/22/2015	4.5	0		
7.9	C	C	No	9/23/2015	5.2	0		
7.10	U	UF	Yes	5/23/2013	Not planted in 2013			
7.10	U	UF	Yes	6/13/2013	Not planted in 2013			
7.10	U	UF	Yes	7/26/2013	Not planted in 2013			
7.10	U	UF	Yes	9/20/2013	Not planted in 2013			
7.10	U	UF	Yes	5/19/2014	Not planted in 2013			
7.10	U	UF	Yes	7/7/2014	3.0	1	2.50	
7.10	U	UF	Yes	9/24/2014	3.8	1	4.00	
7.10	U	UF	Yes	7/22/2015	4.5	1	4.50	
7.10	U	UF	Yes	9/23/2015	5.2	1	4.50	
7.11	P	PF	Yes	5/23/2013	Not planted in 2013			
7.11	P	PF	Yes	6/13/2013	Not planted in 2013			
7.11	P	PF	Yes	7/26/2013	Not planted in 2013			
7.11	P	PF	Yes	9/20/2013	Not planted in 2013			
7.11	P	PF	Yes	5/19/2014	Not planted in 2013			
7.11	P	PF	Yes	7/7/2014	3	1	1.50	

Plot ID	Stock Type	Stock Type / Fabric	Fabric	Date	Water Table (ft)	Survival	Height (ft)	Comments
7.11	P	PF	Yes	9/24/2014	3.8	1	4.00	
7.11	P	PF	Yes	7/22/2015	4.5	1	4.25	
7.11	P	PF	Yes	9/23/2015	5.2	1	4.50	
7.12	U	U	No	5/23/2013	Not planted in 2013			
7.12	U	U	No	6/13/2013	Not planted in 2013			
7.12	U	U	No	7/26/2013	Not planted in 2013			
7.12	U	U	No	9/20/2013	Not planted in 2013			
7.12	U	U	No	5/19/2014	Not planted in 2013			
7.12	U	U	No	7/7/2014	3.0	1	2.00	
7.12	U	U	No	9/24/2014	3.8	1	4.00	
7.12	U	U	No	7/22/2015	4.5	1	4.25	
7.12	U	U	No	9/23/2015	5.2	1	4.50	
7.13	P	PF	Yes	5/23/2013	Not planted in 2013			
7.13	P	PF	Yes	6/13/2013	Not planted in 2013			
7.13	P	PF	Yes	7/26/2013	Not planted in 2013			
7.13	P	PF	Yes	9/20/2013	Not planted in 2013			
7.13	P	PF	Yes	5/19/2014	Not planted in 2013			
7.13	P	PF	Yes	7/7/2014	3	1	0.50	
7.13	P	PF	Yes	9/24/2014	3.8	0	NA	
7.13	P	PF	Yes	7/22/2015	4.5	0		
7.13	P	PF	Yes	9/23/2015	5.2	0		
7.14	P	P	No	5/23/2013	Not planted in 2013			
7.14	P	P	No	6/13/2013	Not planted in 2013			
7.14	P	P	No	7/26/2013	Not planted in 2013			
7.14	P	P	No	9/20/2013	Not planted in 2013			
7.14	P	P	No	5/19/2014	Not planted in 2013			
7.14	P	P	No	7/7/2014	3.0	0	NA	
7.14	P	P	No	9/24/2014	3.8	0	NA	
7.14	P	P	No	7/22/2015	4.5	0		
7.14	P	P	No	9/23/2015	5.2	0		
7.15	C	C	No	5/23/2013	Not planted in 2013			
7.15	C	C	No	6/13/2013	Not planted in 2013			
7.15	C	C	No	7/26/2013	Not planted in 2013			
7.15	C	C	No	9/20/2013	Not planted in 2013			
7.15	C	C	No	5/19/2014	Not planted in 2013			
7.15	C	C	No	7/7/2014	3.0	0	NA	
7.15	C	C	No	9/24/2014	3.8	0	NA	
7.15	C	C	No	7/22/2015	4.5	0		
7.15	C	C	No	9/23/2015	5.2	0		
7.16	U	UF	Yes	5/23/2013	Not planted in 2013			
7.16	U	UF	Yes	6/13/2013	Not planted in 2013			
7.16	U	UF	Yes	7/26/2013	Not planted in 2013			
7.16	U	UF	Yes	9/20/2013	Not planted in 2013			
7.16	U	UF	Yes	5/19/2014	Not planted in 2013			
7.16	U	UF	Yes	7/7/2014	3.0	1	3.50	
7.16	U	UF	Yes	9/24/2014	3.8	1	4.25	
7.16	U	UF	Yes	7/22/2015	4.5	1	4.25	
7.16	U	UF	Yes	9/23/2015	5.2	1	4.50	
7.17	C	CF	Yes	5/23/2013	Not planted in 2013			
7.17	C	CF	Yes	6/13/2013	Not planted in 2013			
7.17	C	CF	Yes	7/26/2013	Not planted in 2013			
7.17	C	CF	Yes	9/20/2013	Not planted in 2013			
7.17	C	CF	Yes	5/19/2014	Not planted in 2013			
7.17	C	CF	Yes	7/7/2014	3.0	1	1.50	
7.17	C	CF	Yes	9/24/2014	3.8	1	4.00	
7.17	C	CF	Yes	7/22/2015	4.5	1	4.50	
7.17	C	CF	Yes	9/23/2015	5.2	1	4.75	
7.18	U	U	No	5/23/2013	Not planted in 2013			
7.18	U	U	No	6/13/2013	Not planted in 2013			
7.18	U	U	No	7/26/2013	Not planted in 2013			

Plot ID	Stock Type	Stock Type / Fabric	Fabric	Date	Water Table (ft)	Survival	Height (ft)	Comments
7.18	U	U	No	9/20/2013	Not planted in 2013			
7.18	U	U	No	5/19/2014	Not planted in 2013			
7.18	U	U	No	7/7/2014	3.0	1	1.50	
7.18	U	U	No	9/24/2014	3.8	1	4.00	
7.18	U	U	No	7/22/2015	4.5	1	4.50	
7.18	U	U	No	9/23/2015	5.2	1	4.75	
7.19	U	U	No	5/23/2013	Not planted in 2013			
7.19	U	U	No	6/13/2013	Not planted in 2013			
7.19	U	U	No	7/26/2013	Not planted in 2013			
7.19	U	U	No	9/20/2013	Not planted in 2013			
7.19	U	U	No	5/19/2014	Not planted in 2013			
7.19	U	U	No	7/7/2014	3.0	1	2.00	
7.19	U	U	No	9/24/2014	3.8	1	3.50	
7.19	U	U	No	7/22/2015	4.5	1	4.50	
7.19	U	U	No	9/23/2015	5.2	1	4.50	
7.20	C	C	No	5/23/2013	Not planted in 2013			
7.20	C	C	No	6/13/2013	Not planted in 2013			
7.20	C	C	No	7/26/2013	Not planted in 2013			
7.20	C	C	No	9/20/2013	Not planted in 2013			
7.20	C	C	No	5/19/2014	Not planted in 2013			
7.20	C	C	No	7/7/2014	3.0	1	1.00	
7.20	C	C	No	9/24/2014	3.8	1	1.75	
7.20	C	C	No	7/22/2015	4.5	1	4.00	
7.20	C	C	No	9/23/2015	5.2	1	4.50	
7.21	U	UF	Yes	5/23/2013	Not planted in 2013			
7.21	U	UF	Yes	6/13/2013	Not planted in 2013			
7.21	U	UF	Yes	7/26/2013	Not planted in 2013			
7.21	U	UF	Yes	9/20/2013	Not planted in 2013			
7.21	U	UF	Yes	5/19/2014	Not planted in 2013			
7.21	U	UF	Yes	7/7/2014	3.0	1	3.50	
7.21	U	UF	Yes	9/24/2014	3.8	1	4.00	
7.21	U	UF	Yes	7/22/2015	4.5	1	4.50	
7.21	U	UF	Yes	9/23/2015	5.2	1	4.50	
7.22	P	P	No	5/23/2013	Not planted in 2013			
7.22	P	P	No	6/13/2013	Not planted in 2013			
7.22	P	P	No	7/26/2013	Not planted in 2013			
7.22	P	P	No	9/20/2013	Not planted in 2013			
7.22	P	P	No	5/19/2014	Not planted in 2013			
7.22	P	P	No	7/7/2014	3.0	1	2.50	
7.22	P	P	No	9/24/2014	3.8	1	4.00	
7.22	P	P	No	7/22/2015	4.5	1	4.50	
7.22	P	P	No	9/23/2015	5.2	1	4.50	
7.23	C	CF	Yes	5/23/2013	Not planted in 2013			
7.23	C	CF	Yes	6/13/2013	Not planted in 2013			
7.23	C	CF	Yes	7/26/2013	Not planted in 2013			
7.23	C	CF	Yes	9/20/2013	Not planted in 2013			
7.23	C	CF	Yes	5/19/2014	Not planted in 2013			
7.23	C	CF	Yes	7/7/2014	3.0	1	2.00	
7.23	C	CF	Yes	9/24/2014	3.8	1	3.50	
7.23	C	CF	Yes	7/22/2015	4.5	1	2.25	
7.23	C	CF	Yes	9/23/2015	5.2	1	2.25	
7.24	P	PF	Yes	5/23/2013	Not planted in 2013			
7.24	P	PF	Yes	6/13/2013	Not planted in 2013			
7.24	P	PF	Yes	7/26/2013	Not planted in 2013			
7.24	P	PF	Yes	9/20/2013	Not planted in 2013			
7.24	P	PF	Yes	5/19/2014	Not planted in 2013			
7.24	P	PF	Yes	7/7/2014	3.0	1	2.50	
7.24	P	PF	Yes	9/24/2014	3.8	1	3.50	
7.24	P	PF	Yes	7/22/2015	4.5	1	4.25	
7.24	P	PF	Yes	9/23/2015	5.2	1	4.50	

Plot ID	Stock Type	Stock Type / Fabric	Fabric	Date	Water Table (ft)	Survival	Height (ft)	Comments
7.25	U	UF	Yes	5/23/2013	Not planted in 2013			
7.25	U	UF	Yes	6/13/2013	Not planted in 2013			
7.25	U	UF	Yes	7/26/2013	Not planted in 2013			
7.25	U	UF	Yes	9/20/2013	Not planted in 2013			
7.25	U	UF	Yes	5/19/2014	Not planted in 2013			
7.25	U	UF	Yes	7/7/2014	3.0	0	NA	
7.25	U	UF	Yes	9/24/2014	3.8	0	NA	
7.25	U	UF	Yes	7/22/2015	4.5	0		
7.25	U	UF	Yes	9/23/2015	5.2	0		
7.26	C	CF	Yes	5/23/2013	Not planted in 2013			
7.26	C	CF	Yes	6/13/2013	Not planted in 2013			
7.26	C	CF	Yes	7/26/2013	Not planted in 2013			
7.26	C	CF	Yes	9/20/2013	Not planted in 2013			
7.26	C	CF	Yes	5/19/2014	Not planted in 2013			
7.26	C	CF	Yes	7/7/2014	3.0	0	NA	
7.26	C	CF	Yes	9/24/2014	3.8	0	NA	
7.26	C	CF	Yes	7/22/2015	4.5	0		
7.26	C	CF	Yes	9/23/2015	5.2	0		
7.27	P	P	No	5/23/2013	Not planted in 2013			
7.27	P	P	No	6/13/2013	Not planted in 2013			
7.27	P	P	No	7/26/2013	Not planted in 2013			
7.27	P	P	No	9/20/2013	Not planted in 2013			
7.27	P	P	No	5/19/2014	Not planted in 2013			
7.27	P	P	No	7/7/2014	3.0	1	1.50	
7.27	P	P	No	9/24/2014	3.8	1	4.00	
7.27	P	P	No	7/22/2015	4.5	1	4.50	
7.27	P	P	No	9/23/2015	5.2	1	5.00	
7.28	U	U	No	5/23/2013	Not planted in 2013			
7.28	U	U	No	6/13/2013	Not planted in 2013			
7.28	U	U	No	7/26/2013	Not planted in 2013			
7.28	U	U	No	9/20/2013	Not planted in 2013			
7.28	U	U	No	5/19/2014	Not planted in 2013			
7.28	U	U	No	7/7/2014	3.0	1	2.50	
7.28	U	U	No	9/24/2014	3.8	1	2.50	
7.28	U	U	No	7/22/2015	4.5	0		
7.28	U	U	No	9/23/2015	5.2	0		
7.29	C	C	No	5/23/2013	Not planted in 2013			
7.29	C	C	No	6/13/2013	Not planted in 2013			
7.29	C	C	No	7/26/2013	Not planted in 2013			
7.29	C	C	No	9/20/2013	Not planted in 2013			
7.29	C	C	No	5/19/2014	Not planted in 2013			
7.29	C	C	No	7/7/2014	3.0	1	1.00	
7.29	C	C	No	9/24/2014	3.8	1	2.00	
7.29	C	C	No	7/22/2015	4.5	1	2.50	
7.29	C	C	No	9/23/2015	5.2	1	2.50	
7.30	P	PF	Yes	5/23/2013	Not planted in 2013			
7.30	P	PF	Yes	6/13/2013	Not planted in 2013			
7.30	P	PF	Yes	7/26/2013	Not planted in 2013			
7.30	P	PF	Yes	9/20/2013	Not planted in 2013			
7.30	P	PF	Yes	5/19/2014	Not planted in 2013			
7.30	P	PF	Yes	7/7/2014	3.0	1	1.50	
7.30	P	PF	Yes	9/24/2014	3.8	1	2.25	
7.30	P	PF	Yes	7/22/2015	4.5	1	2.50	
7.30	P	PF	Yes	9/23/2015	5.2	1	4.25	
7.31	U	UF	Yes	5/23/2013	Not planted in 2013			
7.31	U	UF	Yes	6/13/2013	Not planted in 2013			
7.31	U	UF	Yes	7/26/2013	Not planted in 2013			
7.31	U	UF	Yes	9/20/2013	Not planted in 2013			
7.31	U	UF	Yes	5/19/2014	Not planted in 2013			
7.31	U	UF	Yes	7/7/2014	3.0	1	2.50	

Plot ID	Stock Type	Stock Type / Fabric	Fabric	Date	Water Table (ft)	Survival	Height (ft)	Comments
7.31	U	UF	Yes	9/24/2014	3.8	1	4.00	
7.31	U	UF	Yes	7/22/2015	4.5	1	4.25	
7.31	U	UF	Yes	9/23/2015	5.2	1	4.25	
7.32	U	U	No	5/23/2013	Not planted in 2013			
7.32	U	U	No	6/13/2013	Not planted in 2013			
7.32	U	U	No	7/26/2013	Not planted in 2013			
7.32	U	U	No	9/20/2013	Not planted in 2013			
7.32	U	U	No	5/19/2014	Not planted in 2013			
7.32	U	U	No	7/7/2014	3.0	1	3.50	
7.32	U	U	No	9/24/2014	3.8	0	NA	
7.32	U	U	No	7/22/2015	4.5	1	4.00	3.5' 0 9/24/2014
7.32	U	U	No	9/23/2015	5.2	1	4.25	
7.33	P	P	No	5/23/2013	Not planted in 2013			
7.33	P	P	No	6/13/2013	Not planted in 2013			
7.33	P	P	No	7/26/2013	Not planted in 2013			
7.33	P	P	No	9/20/2013	Not planted in 2013			
7.33	P	P	No	5/19/2014	Not planted in 2013			
7.33	P	P	No	7/7/2014	3.0	0	NA	
7.33	P	P	No	9/24/2014	3.8	0	NA	
7.33	P	P	No	7/22/2015	4.5	0		
7.33	P	P	No	9/23/2015	5.2	0		
7.34	P	PF	Yes	5/23/2013	Not planted in 2013			
7.34	P	PF	Yes	6/13/2013	Not planted in 2013			
7.34	P	PF	Yes	7/26/2013	Not planted in 2013			
7.34	P	PF	Yes	9/20/2013	Not planted in 2013			
7.34	P	PF	Yes	5/19/2014	Not planted in 2013			
7.34	P	PF	Yes	7/7/2014	3.0	1	1.50	
7.34	P	PF	Yes	9/24/2014	3.8	1	3.00	
7.34	P	PF	Yes	7/22/2015	4.5	1	4.00	
7.34	P	PF	Yes	9/23/2015	5.2	1	4.00	
7.35	C	C	No	5/23/2013	Not planted in 2013			
7.35	C	C	No	6/13/2013	Not planted in 2013			
7.35	C	C	No	7/26/2013	Not planted in 2013			
7.35	C	C	No	9/20/2013	Not planted in 2013			
7.35	C	C	No	5/19/2014	Not planted in 2013			
7.35	C	C	No	7/7/2014	3.0	0	NA	
7.35	C	C	No	9/24/2014	3.8	0	NA	
7.35	C	C	No	7/22/2015	4.5	0		
7.35	C	C	No	9/23/2015	5.2	0		
7.36	C	CF	Yes	5/23/2013	Not planted in 2013			
7.36	C	CF	Yes	6/13/2013	Not planted in 2013			
7.36	C	CF	Yes	7/26/2013	Not planted in 2013			
7.36	C	CF	Yes	9/20/2013	Not planted in 2013			
7.36	C	CF	Yes	5/19/2014	Not planted in 2013			
7.36	C	CF	Yes	7/7/2014	3.0	0	NA	
7.36	C	CF	Yes	9/24/2014	3.8	0	NA	
7.36	C	CF	Yes	7/22/2015	4.5	0		
7.36	C	CF	Yes	9/23/2015	5.2	0		

Figure CR-1. Survival percent by Stock Type on four dates in 2013 and 2014, blocks 1-4, cottonwood restoration study

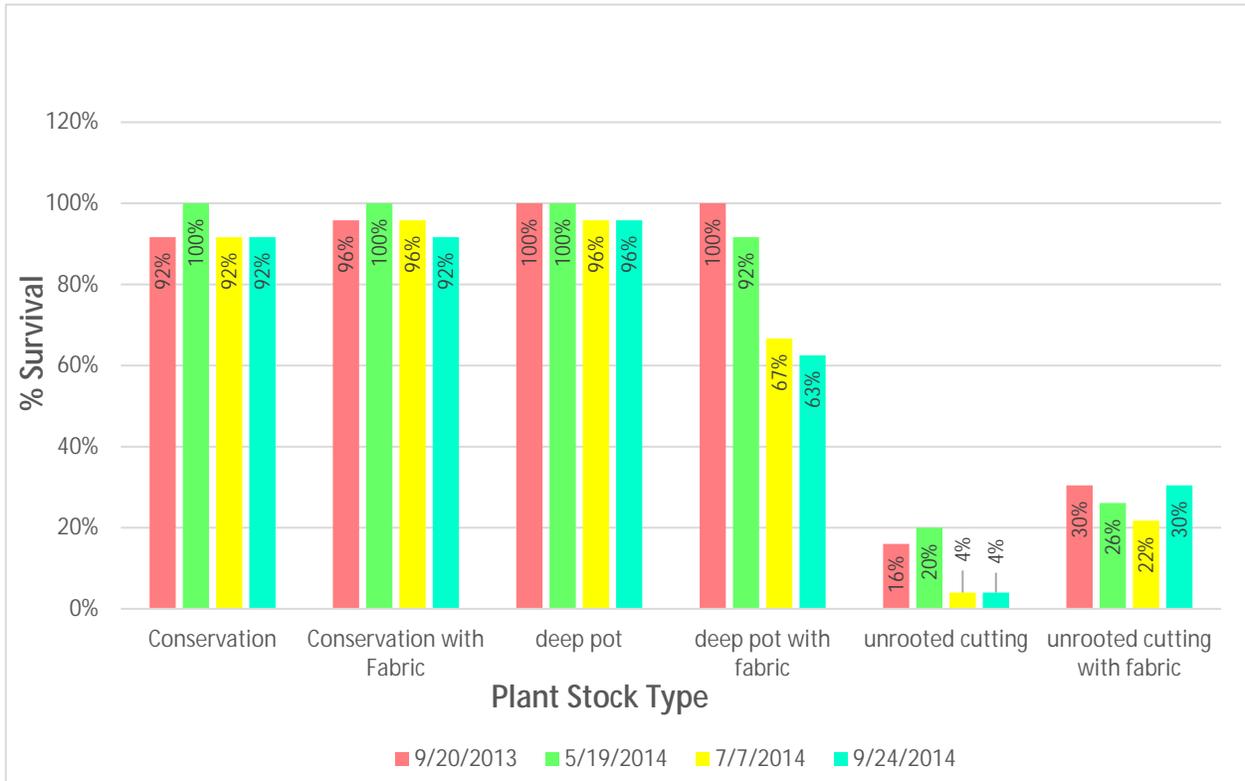


Figure CR-2. Average heights in blocks 1-4, by stock type, cottonwood restoration study

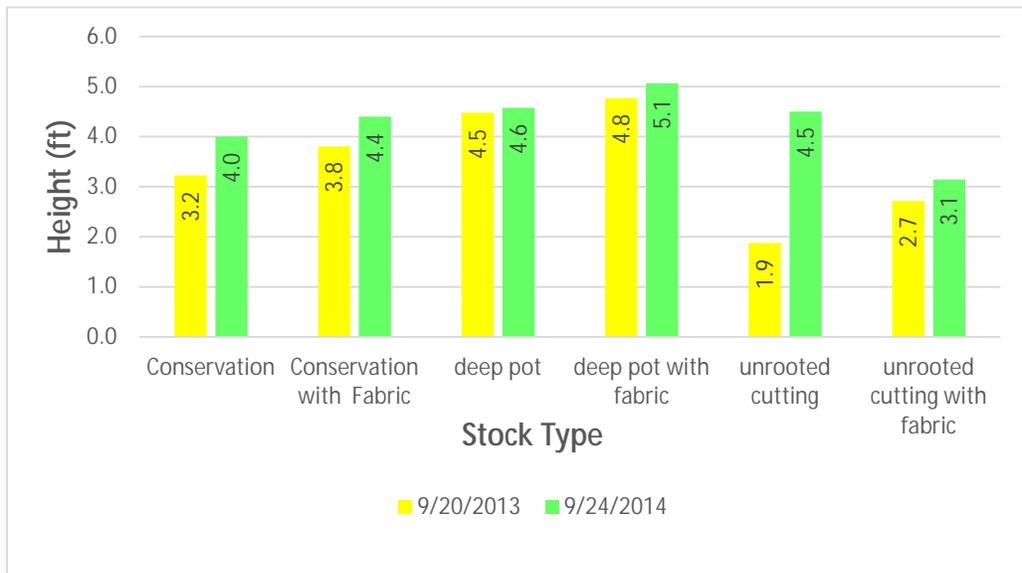


Figure CR-3. Average height and survival percent by plant stock types (blocks 1-4), September 2015, Cottonwood Restoration Study

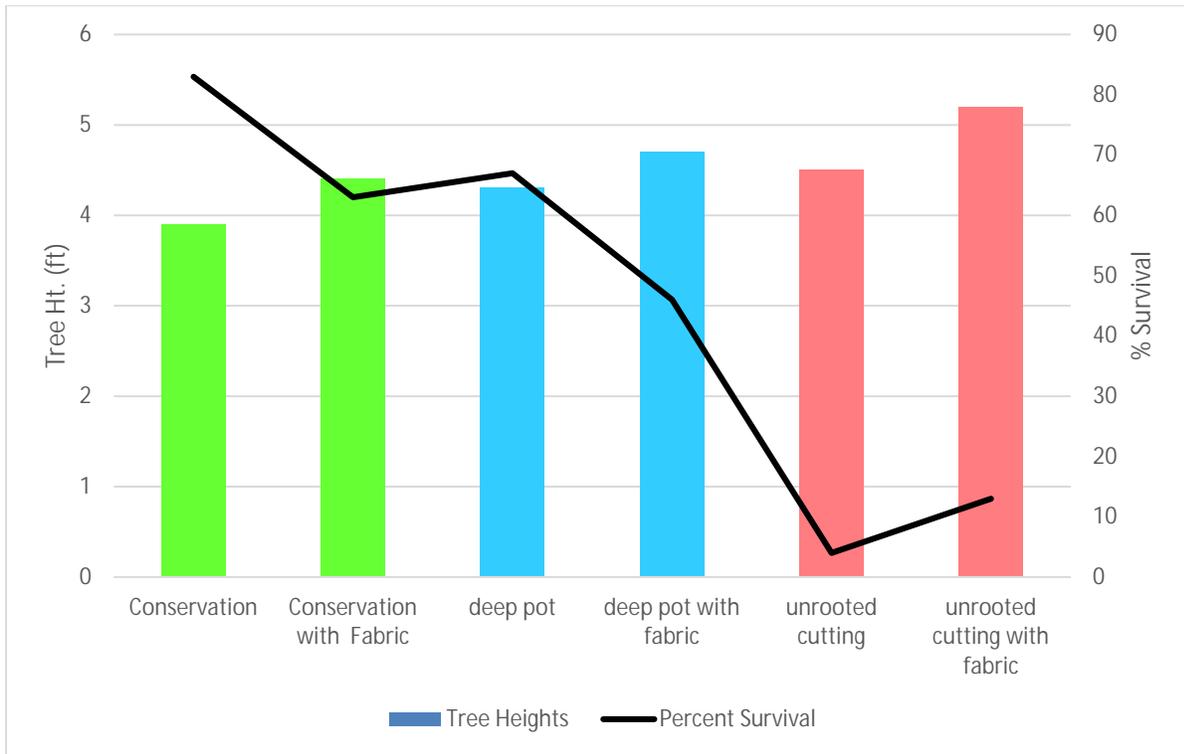


Figure CR-4. Survival percent by stock type in blocks 5-7, summer/fall 2014, cottonwood restoration study

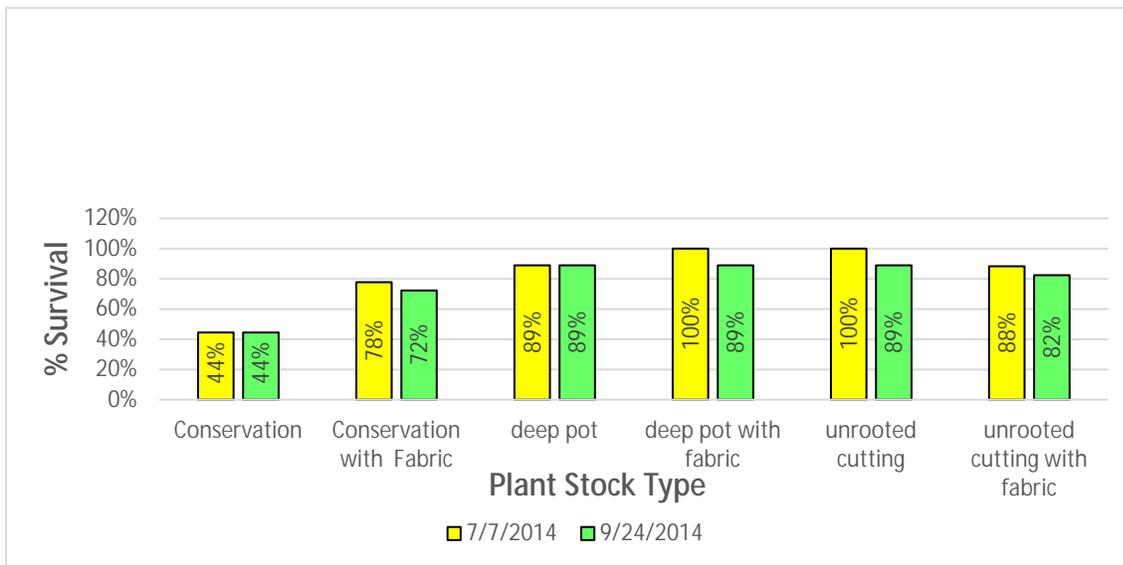


Figure CR-5. Average heights by stock type, blocks 5-7, September 24, 2014, cottonwood restoration study

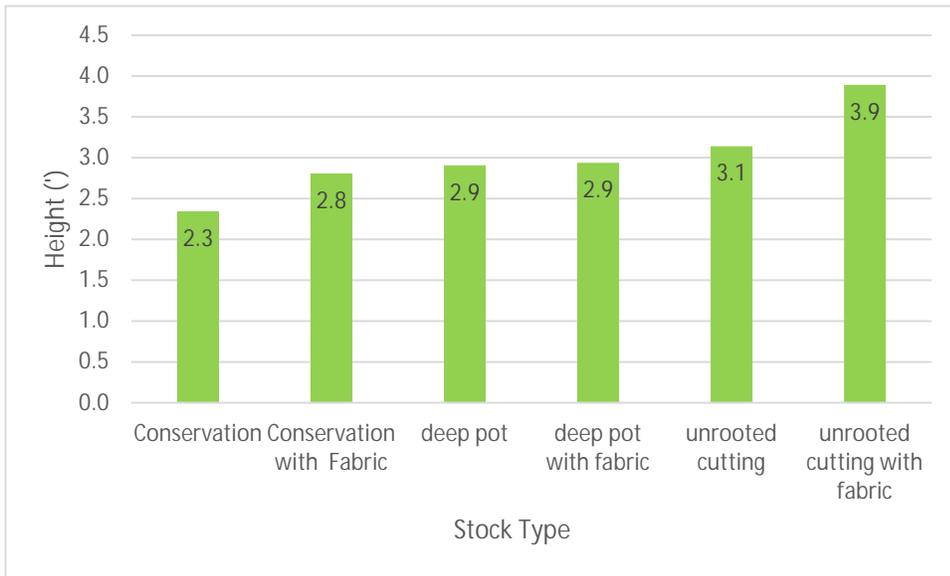
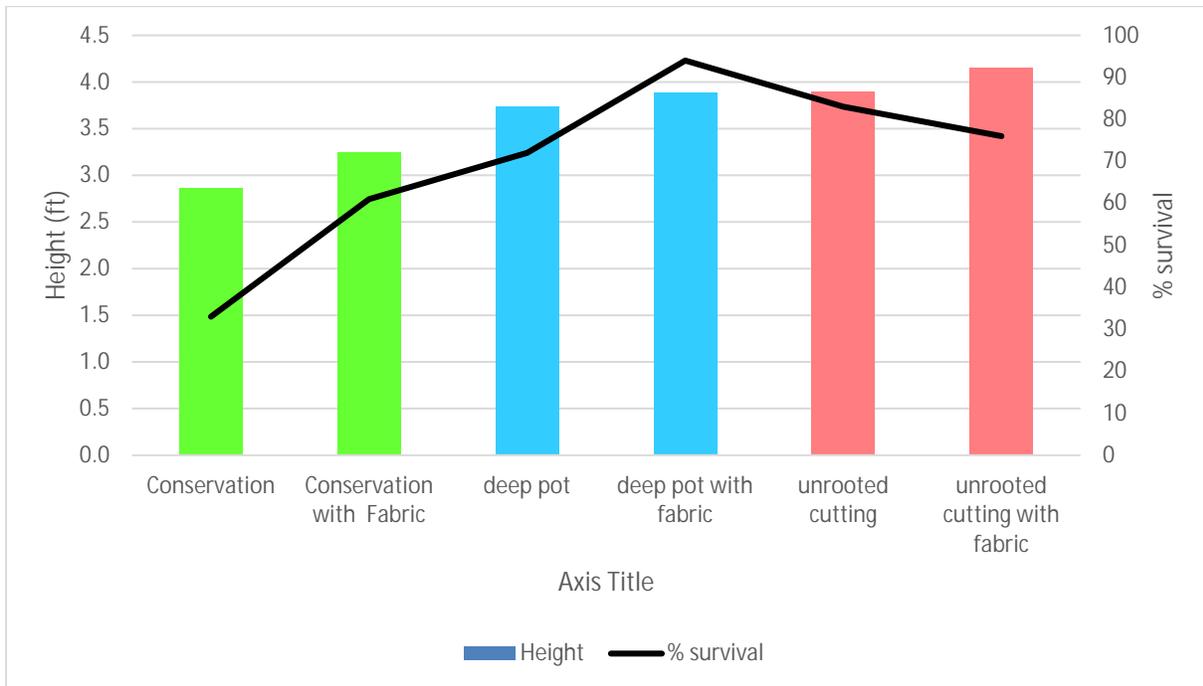


Figure CR-6. Height and survival percent by stock types, blocks 5-7, September 2015, cottonwood restoration study



TECHNOLOGY DEVELOPMENT: TECHNICAL REPORT – 2015

Study NDPMC-T-1402

Study Title: Hybrid Poplar Salinity Tolerance Evaluation

Introduction: Saline soil conditions affect all manner of growing plants. According to Bruce Seelig (2000) 1.9 million acres of North Dakota are affected by sodicity and 700,000 acres are affected by salinity. Too often building sites and roads are located on or adjacent to saline soils. This salinity limits or precludes the use of agroforestry practices (tree and/or shrub planting) to moderate winds, trap and manage snow distribution, and reduce energy demands for snow removal, livestock feed, and building space heating. For those locations where saline soils prevent woody plant survival and vigor, cooperators are often left fully exposed to the snows and winds of winter. Only a few species of trees and shrubs are currently adapted to saline soils. Most are shrubs. The lone salt tolerant tree is Russian olive *Eleagnus angustifolia* which has found much disfavor with many land managers due to its invasive characteristics.

Salinity in the field is difficult to measure. It varies between seasons and within a single season (Ulmer 2013). A short period of drought or wet weather can change salinity levels on any given site. Additionally, many saline sites will be affected by sodicity (Weiser 2013). Sodicity occurs when one of the salts causing the salinity is sodium chloride. The sodium causes a layer of nearly impervious soil to develop just above the saline salts. The impervious layer is caused by the sodium dispersing the soil particles so they fill many of the voids reducing the availability of soil oxygen and greatly reducing water infiltration rates. The sodium ion itself is also directly toxic to the plant.

The US Forest Service based in Rhinelander, Wisconsin, provided 7 clones of hybrid poplars that have exhibited saline tolerance to 9 mmhos (Zelesny 2013). Originally these clones were developed for biomass, bioenergy, and bioproducts. They were most recently tested and selected for use on bioremediation sites to uptake soil pollutants. If they were to perform satisfactorily at even half that salinity, it would be better than all but a few of the trees currently available for conservation planting in ND. These poplars were grown for differing lengths of time outdoors in the Rhinelander area, exhibiting adaptation to cold temperatures. Due to the Wisconsin location, salinity had to be created in a lab and applied to the trees through irrigation water. It was our intent to establish a field trial with these plants where local salinity is comprised of a wide assortment of minerals and most likely compounded by sodicity and wetness, a situation that is fairly common across the Northern Great Plains.

Objective: To determine salinity tolerance of the Rhinelander hybrid poplar clones in North Dakota field conditions.

Rationale: If these hybrid poplars perform well on very slightly saline, slightly saline and moderately saline soils, they will be a useful addition to our Field Office Technical Guide for agroforestry plantings in saline areas. Successful plantings could reduce salinization through reduced soil surface evaporation and greater transpiration. They would capture more snow which may further dilute surface salinity while providing protection to roads and building sites.

Study Design: Each salinity range, none to very slightly saline (0-3.9 mmhos), low end slightly saline (4-5.9 mmhos), and slightly to moderately saline (6-10 mmhos) contained seven plants of each of the seven saline tolerant hybrid poplars, seven plants of Robusta poplar and seven plants of Russian olive. Terminology does not match typical salinity discussions but irregularity of the site caused a different sort of salinity ranges. Also previous research indicated a natural break in plant tolerances at about 6 mmhos. It was also noted that few if any plants survived 16 mmhos but several grew at less than 10 mmhos. Irregularity of the site made it impossible to break the planting into blocks of uniform salinity. This prevented the study being laid out with three distinct reps. The “statistical reps” were determined by 3 individual drawings of plant accession numbers from a hat and marked on the map and planted on the site as described above.

Utilizing a Field Scout EC Meter manufactured by Spectrum Technologies Inc. and a soil scientist skilled in mapping saline soils, nearly 400 survey flags were initially located on a 10-foot x 10-foot grid covering the area most likely to include the desired salinity ranges. The salinity meter was calibrated using the solution provided by the manufacturer. Measurements were taken near each flag. (Note: Flags were all plastic, including the shaft, to ensure salinity measurements were not affected.) Measurements were recorded at 3-inch and 9-inch depths. The

readings were recorded on the flag and on paper. The 3-foot depth readings did not provide enough of the higher salinity spots, therefore initial design and plot layout was based on salinity readings from the 9-inch depth. Once the area had been gridded, each spot on the paper was colored as to one of the three salinity ranges. Beginning in the southeast corner of the test area 63 spots (plots) were assigned to each of the three salinity ranges. This process was repeated for each of the three replications. There were more of the lowest initial salinity ranges than the others so as plot assignments continued westward in the study area, there were skips where a tree was not planted on a very slightly saline spot. Three different colored flags, one color for each salinity range, were placed at each of the appropriate spots on the ground to ease planting efforts.

Individual plant locations for the 63 plants within each of the three blocks was determined by drawing accession numbers marked on metal washers from a hat. This was done for each of the three blocks. Drawn numbers were assigned positions beginning with the southeast corner of the study area and progressing east to west. Each north-south row numbering began from the south side. In other words, the individual tree plots were not numbered in a zigzag serpentine fashion from row to row.

Plant Stock (Material): All experimental planting stock, including hybrid poplar but excluding the Russian olive, was started from 6-8-inch unrooted cuttings in 16-inch³ cone-tainers and after 6-8-inch growth transplanted to 4-inch x 4-inch x 14-inch deep pots. The Russian olive was conservation grade stock ordered the spring of establishment. The Russian olive tree stock was very dry with few fine roots and rather “wimpy” when delivered.

Site Preparation: No weed control was applied prior to planting since removing vegetation through tillage or herbicide would increase surface salinity through increased evaporation and salt deposition. Vegetation at each plot was mowed short with a brush blade to facilitate fabric square installation.

Tree Planting: Planting depth to the bottom of the root ball was 12-13 inches. As expected, the soils of the sites were very sticky. A putty knife was used to scrape the goo off the shovel after each dig. In order to obtain good root soil contact, each planting hole was backfilled with Mandan silt loam brought to the site from the Plant Materials Center. All experts consulted felt that the in situ salinity would equalize across this added soil within one growing season.

Maintenance and Protection:

2014

The area is subject to very heavy deer browse and is grazed by cattle every other year. Five-foot tree shelters were installed by evening of the planting day to protect from deer. The area was not grazed in 2014. Corner posts and line posts with insulators were installed summer of 2014. A single strand electric wire and energizer will be installed spring of 2015 before cattle are released to the pasture.

Observations and Measurements:

The planting will be observed every two-four weeks with salinity, survival, tree height, temperature and moisture measured at each plot. Note that there are 73 plots where no trees and no fabric were planted or installed. These sites will be monitored to see how salinity changes over time without fabric. There may or may not be an impact on salinity caused by fabric and growing trees. At least one set of measurements should be taken in mid to late May to determine over winter survival and one set should be taken in mid-September to determine growing season survival. Other measurements throughout the season will give a more precise picture of salinity fluctuations and tree response. Measurements should include at a minimum: salinity, tree survival, tree height, and any unique observations.

2014

Individual aluminum identification tags were embossed with the accession number and plot number for each tree. These were attached with pop rivets to the PVC stake supporting the five-foot tree shelters. This should allow positive identification of each tree.

May 15: Initial salinity readings to determine plot locations.

June 10: Planted trees and installed tree shelters.

July 7: Recorded salinities at each plot.

July 15: Recorded salinity, height, survival, % moisture, and temperature at each plot.

July 16: Pulled 22 soil samples, from adjacent to trees, for analysis and to compare to salinity meter.

August 27: Recorded salinity, height, survival, % moisture, and temperature at each plot.

October 22: Recorded salinity, height, survival, % moisture, and temperature at each plot.

Measurements have not been statistically analyzed, but the following was observed:

- Across all plots the salinity readings at 9-inch depth generally decreased as the season progressed. If a site showed a substantial spike it may well have been a poor reading caused by the additional PMC soil, or bad contacts between the probe and the soil.
- A few trees were showing burned leaf margins by mid-July on the 'hotter' plots.
- In early July, 3 plants from accession 9094426 exhibited 50% top dieback. Interestingly, this same accession showed the same symptoms in the left over stock growing in our lath house.

Comparisons of the 22 soil samples to the probe readings at that site and time were inconclusive.

2015

Survival, heights, and soil salinity were measured July 8, 2015.

Survival and heights were measured on September 11, 2015. Salinity measurements were attempted but the soil was too hard.

On September 22, 2015, twenty-seven soil samples were taken from live trees, one from each initial salinity grouping for each accession. Also, 2-4 leaf samples were taken from mid-canopy from each tree at which the soil samples were collected (27 total). The soil sample will be analyzed at the USDA-ARS lab by Susan Samson-Liebig, NRCSS Soil Quality Specialist. The leaf samples were mailed to Ron Zalezney at Rhinelander, WI.

After two growing seasons there appears to be a difference between clones. See **Figure HP-1**. Clone 9019582 is Russian olive with a survival of 86% and an average height range, by salinity group of 5.3' to 3.4'. High survival rates and heights shorter than poplar are expected as Russian olive is known for salinity tolerance and it is a short to medium height tree.

Hybrid poplar clone, 9094424 exhibited only 52% survival with height range of 6.4 feet to 4.3 feet as initial site salinity increased.

Hybrid poplar clone, 9094425 exhibited only 62% survival with height range of 7.0 feet to 2.9 feet as initial site salinity increased.

Hybrid poplar clone, 9094423 exhibited 91% survival with height range of 7.7 feet to 4.8 feet as initial site salinity increased.

Please note that survival figures were the average survival of all the plants of each accession measured across all 3 initial salinity ranges. A more precise statistical analysis of each accession's response within each salinity range would be merited.

See **Table HP-1** for survival, heights, soil moisture and soil salinity data collected in 2014 and 2015.

Weather for 2015 was close to normal with wide fluctuations of high and low temperatures throughout the year. Precipitation equaled long time averages though late growing season rains were somewhat reduced. During the spring, many leaves on trees had achieved nearly $\frac{1}{3}$ to $\frac{1}{2}$ their growth and were killed off by a hard freeze requiring most trees to expend energy and releaf. Some weaker individuals were killed across the area. This phenomenon was observed in the Bismarck-Mandan area and it was presumed to also affect the trees in this study since they are close to town and located on a low-lying flood plain. In this study, only limited mortality was recorded at the July inventory. That may have been a factor of overwinter loss compounded by the late freeze. See **Table 1** on page 4 for temperature and precipitation information.

The September inventory showed 46 dead trees. Did they die from soil salinity? Did they die from winter stress? Did the tree shelters prevent hardening off making them more susceptible to winter mortality? Did the late spring freeze cause the mortality? Instead of answering questions, this study has created more questions. An estimated $\frac{1}{3}$ to $\frac{1}{2}$ the trees exhibited double or triple leaders originating from low in the tree shelter tubes. Most of these double leaders initiated below 2-foot height after the main stem had died. Possible reasons for multiple leader initiation are the same as for tree mortality described above. At this time it is unknown. Most of the plots with trees over 8 feet tall at the September 2015 inventory were single stemmed.

Future Efforts:

Long term

Before the Russian olive produce seed, they will be removed and the stumps treated. As trees die, fabric, tubes, and staples will be removed by Plant Materials staff. Stakes with identification labels should be left on site to ensure positive plot identification. Once the study has concluded, protective materials can be left or removed as deemed appropriate by the landowner.

Findings shall include the success or failure of various hybrid poplar clones to establish on saline sites typical of the upper Great Plains, as well as any other unique characteristics that become apparent as the study progresses. Specific clones tolerant of very slight to slight salinity conditions could be added to the Field Office Technical Guide. Research results will be provided to partners and peer groups as well as other PMCs and field offices throughout the Great Plains.

Plans for 2016

Continue regular measurements to monitor changes in salinity and impacts on tree growth.

Maintain contact with Zalezny to determine salt absorption differences by clones.

Remove shelters and fabric from fully dead trees, while leaving stake with identification tag.

Maintain fence and hook up charger depending on grazing scheme of livestock owner.

References:

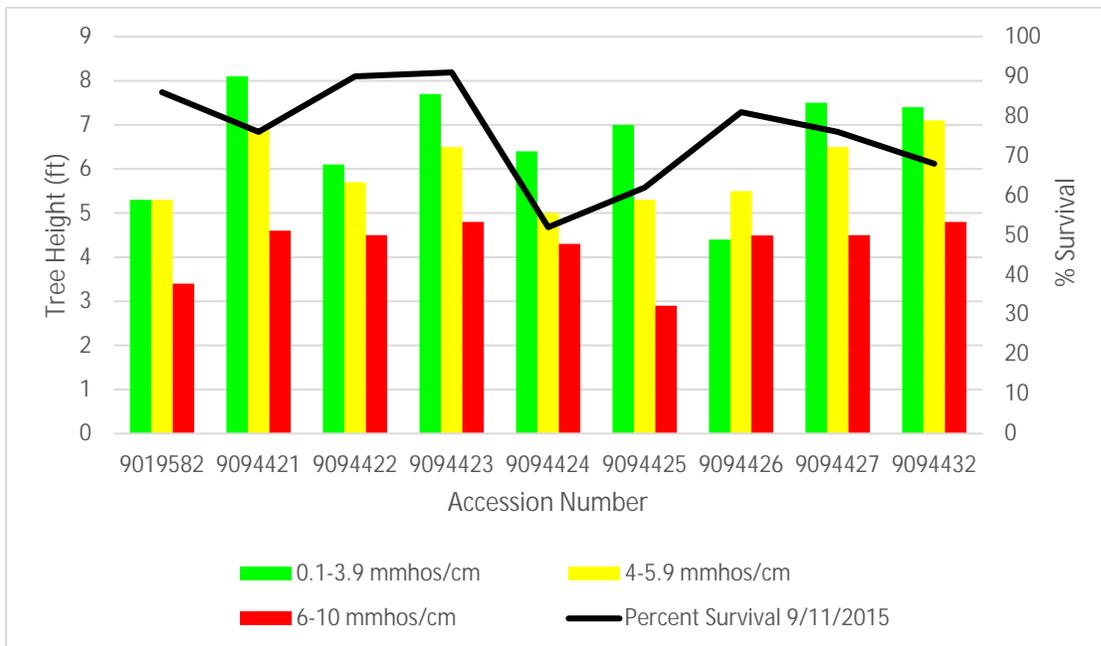
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Zelesny, R. 2013. Personal Communication. Research Geneticist, Northern Research Station, USFS, Rhinelander, WI.

Figure HP-1. Tree heights and average survival within each accession across all initial salinity ranges



Key to Table HP-1.

Salinity ratings: none: 0.1 to 3.9 mmhos; slight: 4.0 to 5.9 mmhos; moderate: 6.0 to 10.0 mmhos; strong: > 10 (no trees planted).

Soil moisture: measured as volumetric water content; 50-51% = saturated soil. If soil moisture was greater than 50%, all the pores were filled and the meter would not register a reading.

Height: measured in feet. X = plot is grass, has no trees planted and no fabric applied.

Table HP-1. Salinity, height, soil moisture, and soil temperature 2014 and 2015 data from hybrid poplar study

Plot #	Accession	Beginning Salinity Value	Date	Salinity (mmhos)	Height (ft)	Soil Moisture (%)	Soil Temp. (degrees F)	Notes
19	9019582	moderate	05/20/14	7.1				
19	9019582		07/03/14	5.7				
19	9019582		07/15/14	3.7	0.8	50	62	
19	9019582		08/27/14	4.9	1.5	saturated	62	
19	9019582		10/22/14	3.1	1.8	47		
19	9019582		07/08/15	4.1				1.5' before it died
19	9019582		09/11/15					dead - no tree present
20	9019582	none	05/20/14	1.1				
20	9019582		07/03/14	1.4				
20	9019582		07/15/14	1.0	1		64	
20	9019582		08/27/14	0.7	2.0	saturated	64	
20	9019582		10/22/14	0.9	2.5	42		
20	9019582		07/08/15	0.5	3.5	46		
20	9019582		09/11/15		4.75			
34	9019582	none	05/20/14	1.2				
34	9019582		07/03/14	1.1				
34	9019582		07/15/14	1.0	1	40	63	
34	9019582		08/27/14	1.0	2.0	saturated	64	
34	9019582		10/22/14	1.0	2.5	28		
34	9019582		07/08/15	0.8	3.0	51	67	
34	9019582		09/11/15		5.5			
44	9019582	none	05/20/14	2.2				
44	9019582		07/03/14	3.3				
44	9019582		07/15/14	2.5	1.6	42	65	
44	9019582		08/27/14	2.1	2.5	saturated	63	
44	9019582		10/22/14	1.2	3.0	38		
44	9019582		07/08/15	1.7	4.5	47.2		
44	9019582		09/11/15		6			
48	9019582	none	05/20/14	2.8				
48	9019582		07/03/14	2.6				
48	9019582		07/15/14	3	1.6		65	
48	9019582		08/27/14	2.3	3.0	saturated	63	
48	9019582		10/22/14	2.3	3.0	45		
48	9019582		07/08/15	2.8	4.5			
48	9019582		09/11/15		6.75			

Plot #	Accession	Beginning Salinity Value	Date	Salinity (mmhos)	Height (ft)	Soil Moisture (%)	Soil Temp. (degrees F)	Notes
53	9019582	slight	05/20/14	5.2				
53	9019582		07/03/14	4.8				
53	9019582		07/15/14	4.7	1.6	48	62	
53	9019582		08/27/14	3.7	2.0	saturated	62	
53	9019582		10/22/14	3.6	2.5			
53	9019582		07/08/15	4	2.0			sick looking Russian olive
53	9019582		09/11/15		2			
61	9019582	slight	05/20/14	4.0				
61	9019582		07/03/14	3.7				
61	9019582		07/15/14	3.4	1.6		62	
61	9019582		08/27/14	2.3	3.0	saturated	62	
61	9019582		10/22/14	2.3	3.5	34		
61	9019582		07/08/15	1.9	4.0			
61	9019582		09/11/15		6.5			
70	9019582	none	05/20/14	0.8				
70	9019582		07/03/14	1.1				
70	9019582		07/15/14	0.8	1	37	63	
70	9019582		08/27/14	0.7	2.0	saturated	63	
70	9019582		10/22/14	0.8	2.8	20		
70	9019582		07/08/15	0.8	4.0	40		
70	9019582		09/11/15		3.75			
84	9019582	none	05/20/14	1.7				
84	9019582		07/03/14	1.9				
84	9019582		07/15/14	1.7	0.8	52	63	
84	9019582		08/27/14	1.3	2.0	saturated	65	
84	9019582		10/22/14	1.4	2.8	38		
84	9019582		07/08/15	1.2	1.5			
84	9019582		09/11/15		2.75			
85	9019582	none	05/20/14	1.6				
85	9019582		07/03/14	1.3				
85	9019582		07/15/14	1.4	1.2	48	64	
85	9019582		08/27/14	1.1	3.0	saturated	65	
85	9019582		10/22/14	1.1	3.0	27		
85	9019582		07/08/15	1.2	5.0	48.6		
85	9019582		09/11/15		7.25			
88	9019582	moderate	05/20/14	6.3				
88	9019582		07/03/14	5.3				
88	9019582		07/15/14	5.4	1.8	12	63	
88	9019582		08/27/14	5.0	3.0	saturated	64	
88	9019582		10/22/14	4.2	3.3			
88	9019582		07/08/15	4.6	4.0			
88	9019582		09/11/15		5.5			
129	9019582	slight	05/20/14	5.4				
129	9019582		07/03/14	5.1				
129	9019582		07/15/14	5	1.2	46	64	
129	9019582		08/27/14	4.7	2.0	saturated	64	
129	9019582		10/22/14	4.2	2.5			
129	9019582		07/08/15	4.3				2.0' tall before it died
129	9019582		09/11/15					dead - no tree present

Plot #	Accession	Beginning Salinity Value	Date	Salinity (mmhos)	Height (ft)	Soil Moisture (%)	Soil Temp. (degrees F)	Notes
140	9019582	slight	05/20/14	5.0				
140	9019582		07/03/14	5.0				
140	9019582		07/15/14	4.7	1.6		63	
140	9019582		08/27/14	3.1	3.0	saturated	62	
140	9019582		10/22/14	1.6	3.0	43		
140	9019582		07/08/15	2.4	4.0			
140	9019582		09/11/15		6			
159	9019582	moderate	05/20/14	8.8				
159	9019582		07/03/14	6.8				
159	9019582		07/15/14	6.1	0.4	36	64	
159	9019582		08/27/14	5.1	2.0	saturated	63	
159	9019582		10/22/14	4.8	2.5			
159	9019582		07/08/15	4.9	1.25			
159	9019582		09/11/15		3.5			
174	9019582	moderate	05/20/14	9.7				
174	9019582		07/03/14	7.3				
174	9019582		07/15/14	6.7	1	36	64	
174	9019582		08/27/14	6.1	2.0	saturated	64	
174	9019582		10/22/14	5.5	1.5			unhealthy Russian olive
174	9019582		07/08/15	4.9	1.0			dead top, resprouts
174	9019582		09/11/15		1.75			
206	9019582	moderate	05/20/14	9.3				
206	9019582		07/03/14	5.7				
206	9019582		07/15/14	7.6	1.2		65	
206	9019582		08/27/14	7.1	2.5	saturated	64	
206	9019582		10/22/14	5.6	2.8			
206	9019582		07/08/15	6.8	3.5			
206	9019582		09/11/15		5.25			
210	9019582	slight	05/20/14	5.7				
210	9019582		07/03/14	4.9				
210	9019582		07/15/14	4.3	0		63	dead Russian olive
210	9019582		08/27/14	3.6	2.5	saturated	64	
210	9019582		10/22/14	3.6	2.8	32		
210	9019582		07/08/15	1.3	4.3			
210	9019582		09/11/15		7.25			
213	9019582	slight	05/20/14	5.4				
213	9019582		07/03/14	4.2				
213	9019582		07/15/14	3.6	1.2		65	
213	9019582		08/27/14	3.1	3.0	saturated	64	
213	9019582		10/22/14	3.2	3.0	36		
213	9019582		07/08/15	3.2	5.0			
213	9019582		09/11/15		6.75			
215	9019582	moderate	05/20/14	9.6				
215	9019582		07/03/14	7.6				
215	9019582		07/15/14	7.4	1.6		66	
215	9019582		08/27/14	6.0	2.5	saturated	64	
215	9019582		10/22/14	5.8	2.8			
215	9019582		07/08/15	6.3	0.5			Russian olive looks sick
215	9019582		09/11/15		0.75			

Plot #	Accession	Beginning Salinity Value	Date	Salinity (mmhos)	Height (ft)	Soil Moisture (%)	Soil Temp. (degrees F)	Notes
239	9019582	slight	05/20/14	5.6				
239	9019582		07/03/14	5.2				
239	9019582		07/15/14	5.3	1		65	
239	9019582		08/27/14	4.8	2.0	saturated	65	
239	9019582		10/22/14	3.0	2.8		54	
239	9019582		07/08/15	4.9	1.3			dead top, resprouts
239	9019582		09/11/15		3.25			
241	9019582	moderate	05/20/14	8.9				
241	9019582		07/03/14	8.3				
241	9019582		07/15/14	6.8	1		65	
241	9019582		08/27/14	6.2	1.5	saturated	65	
241	9019582		10/22/14	5.9	1.8		42	
241	9019582		07/08/15	5.7				1.5' tall before it died
241	9019582		09/11/15					dead - no tree present
2	9094421	moderate	05/20/14	7.3				
2	9094421		07/03/14	5.7				
2	9094421		07/15/14	3.4	4.6		31	64
2	9094421		08/27/14	4.4	5.5	saturated		62
2	9094421		10/22/14	2.1	5.3			54
2	9094421		07/08/15	2.5	5.0			
2	9094421		09/11/15		5.25			deer browse
4	9094421	slight	05/20/14	5.1				
4	9094421		07/03/14	8.4				
4	9094421		07/15/14	7.5	4.2			63
4	9094421		08/27/14	5.2	4.5	saturated		63
4	9094421		10/22/14	3.5	4.5			
4	9094421		07/08/15	5.7	3.5			dead top, resprouts
4	9094421		09/11/15					4.25' tall before it died
26	9094421	none	05/20/14	0.6				
26	9094421		07/03/14	0.6				
26	9094421		07/15/14	0.7	4		14	63
26	9094421		08/27/14	0.3	5.0	saturated		64
26	9094421		10/22/14	0.5	4.8		14	
26	9094421		07/08/15	0.5			45	dead
26	9094421		09/11/15		3.5			
39	9094421	moderate	05/20/14	6.7				
39	9094421		07/03/14	8.6				
39	9094421		07/15/14	6.6	5.2			65
39	9094421		08/27/14	4.8	5.5	saturated		63
39	9094421		10/22/14	2.3	5.3		30	
39	9094421		07/08/15	3.6	3.0			dead top, resprouts
39	9094421		09/11/15		5			
46	9094421	none	05/20/14	1.6				
46	9094421		07/03/14	2.8				
46	9094421		07/15/14	2.5	5			64
46	9094421		08/27/14	2.0	7.0	saturated		63
46	9094421		10/22/14	1.8	6.5		51	
46	9094421		07/08/15	1.2	5.5			dead top, resprouts
46	9094421		09/11/15		8.5			

Plot #	Accession	Beginning Salinity Value	Date	Salinity (mmhos)	Height (ft)	Soil Moisture (%)	Soil Temp. (degrees F)	Notes
50	9094421	none	05/20/14	1.8				
50	9094421		07/03/14	2.3				
50	9094421		07/15/14	2	4.6	47	64	
50	9094421		08/27/14	2.5	6.0	saturated	64	
50	9094421		10/22/14	2.1	6.0	47		
50	9094421		07/08/15	1.7	5.0			dead top, resprouts
50	9094421		09/11/15		6.5			
90	9094421	slight	05/20/14	6.4				
90	9094421		07/03/14	4.8				
90	9094421		07/15/14	4.7	4.6	50	64	
90	9094421		08/27/14	3.2	6.0	saturated	65	
90	9094421		10/22/14	1.4	6.0			
90	9094421		07/08/15	2.5	5.0			dead top, resprouts
90	9094421		09/11/15					6.0' tall before it died
91	9094421	none	05/20/14	3.7				
91	9094421		07/03/14	3.2				
91	9094421		07/15/14	2.6	4		64	
91	9094421		08/27/14	2.2	6.0	saturated	64	
91	9094421		10/22/14	1.9	6.0	43		
91	9094421		07/08/15	2.5	6.0			dead top, resprouts
91	9094421		09/11/15		9			
92	9094421	none	05/20/14	2.1				
92	9094421		07/03/14	1.7				
92	9094421		07/15/14	1.8	4.2	47	63	
92	9094421		08/27/14	1.4	6.6	saturated	64	
92	9094421		10/22/14	1.4	6.3	47		
92	9094421		07/08/15	1.3	7.0			dead top, resprouts
92	9094421		09/11/15		10			
96	9094421	slight	05/20/14	4.3				
96	9094421		07/03/14	3.7				
96	9094421		07/15/14	3.2	4.8		64	
96	9094421		08/27/14	2.2	7.0	saturated	64	
96	9094421		10/22/14	3.1	6.5	47		
96	9094421		07/08/15	0.7	7.0			double leader
96	9094421		09/11/15		9.5			
98	9094421	none	05/20/14	1.3				
98	9094421		07/03/14	1.4				
98	9094421		07/15/14	1.2	5.8	51	62	
98	9094421		08/27/14	1.0	7.0	saturated	65	
98	9094421		10/22/14	1.2	6.8	13		
98	9094421		07/08/15	0.7	8.0	47.9		
98	9094421		09/11/15		10			
108	9094421	none	05/20/14	3.1				
108	9094421		07/03/14	4.2				
108	9094421		07/15/14	2.6	5.2	50	64	
108	9094421		08/27/14	2.5	7.0	saturated	65	
108	9094421		10/22/14	2.3	7.0	43		
108	9094421		07/08/15	2.5	7.5			
108	9094421		09/11/15		9			

Plot #	Accession	Beginning Salinity Value	Date	Salinity (mmhos)	Height (ft)	Soil Moisture (%)	Soil Temp. (degrees F)	Notes
112	9094421	slight	05/20/14	5.7				
112	9094421		07/03/14	3.8				
112	9094421		07/15/14	3.9	4		63	
112	9094421		08/27/14	1.6	5.0	saturated	64	
112	9094421		10/22/14	1.9	5.5	46		
112	9094421		07/08/15	1.9	3.8			dead top, resprouts
112	9094421		09/11/15		6			
124	9094421	slight	05/20/14	5.0				
124	9094421		07/03/14	3.7				
124	9094421		07/15/14	3	4.6		64	
124	9094421		08/27/14	2.1	5.5	saturated	65	
124	9094421		10/22/14	1.8	5.6	24		
124	9094421		07/08/15	1.9	7.0			dead top, resprouts
124	9094421		09/11/15		8.5			
144	9094421	moderate	05/20/14	6.4				
144	9094421		07/03/14	3.7				
144	9094421		07/15/14	3.9	4.8		64	
144	9094421		08/27/14	3.6	6.0	saturated	64	
144	9094421		10/22/14	3.0	6.0	49		
144	9094421		07/08/15	3.1	5.0			dead top, resprouts
144	9094421		09/11/15					5.0' tall before it died
173	9094421	moderate	05/20/14	7.9				
173	9094421		07/03/14	5.7				
173	9094421		07/15/14	4.7	4.2	36	64	
173	9094421		08/27/14	3.6	5.0	saturated	63	burned leaf margin
173	9094421		10/22/14	5.3	4.5	49		dead?
173	9094421		07/08/15	3.1				4.5' tall before it died
173	9094421		09/11/15					4.5' tall before it died
189	9094421	moderate	05/20/14	7.7				
189	9094421		07/03/14	8.4				
189	9094421		07/15/14	6.8	5.2		68	
189	9094421		08/27/14	5.1	5.0	saturated	65	
189	9094421		10/22/14	5.3	5.0			
189	9094421		07/08/15	5.8	2.0			dead top, resprouts
189	9094421		09/11/15		3.5			
223	9094421	slight	05/20/14	4.5				
223	9094421		07/03/14	4.1				
223	9094421		07/15/14	0.8	5.4		67	
223	9094421		08/27/14	2.9	6.0	saturated	64	
223	9094421		10/22/14	2.8	6.0	22		
223	9094421		07/08/15	3	5.0			older growth torn by deer
223	9094421		09/11/15		5.75			
228	9094421	moderate	05/20/14	9.5				
228	9094421		07/03/14	7.3				
228	9094421		07/15/14	5.7	4.2		70	dead
228	9094421		08/27/14	4.9	2.0	saturated	65	small leaves
228	9094421		10/22/14	5.0	2.0			dead?
228	9094421		07/08/15	7.6				2.0' tall before it died
228	9094421		09/11/15					1.5' tall before it died

Plot #	Accession	Beginning Salinity Value	Date	Salinity (mmhos)	Height (ft)	Soil Moisture (%)	Soil Temp. (degrees F)	Notes
246	9094421	slight	05/20/14	4.8				
246	9094421		07/03/14	3.4				
246	9094421		07/15/14	2.6	4	41	66	
246	9094421		08/27/14	2.9	4.5	saturated	65	
246	9094421		10/22/14	2.6	4.5	27		
246	9094421		07/08/15	2.7	2.5			dead top, resprouts
246	9094421		09/11/15		5.5			
248	9094421	slight	05/20/14	4.5				
248	9094421		07/03/14	3.6				
248	9094421		07/15/14	2.9	4	51	66	
248	9094421		08/27/14	2.8	5.0	saturated	65	
248	9094421		10/22/14	2.6	5.0	32		
248	9094421		07/08/15	2	5.0			top chewed off at 5'
248	9094421		09/11/15		6.25			
8	9094422	none	05/20/14	0.7				
8	9094422		07/03/14	0.7				
8	9094422		07/15/14	0.8	5.2	18	63	
8	9094422		08/27/14	0.7	6.0	saturated	62	
8	9094422		10/22/14	0.3	6.3	20	55	
8	9094422		07/08/15	0.5	3.0	46		dead top, resprouts
8	9094422		09/11/15		6.5			
23	9094422	slight	05/20/14	5.6				
23	9094422		07/03/14	5.0				
23	9094422		07/15/14	5.2	4.2		63	
23	9094422		08/27/14	3.9	4.5	saturated	63	
23	9094422		10/22/14	3.0	4.8	49		
23	9094422		07/08/15	1.8				4.5' tall before it died
23	9094422		09/11/15					dead - no tree present
24	9094422	none	05/20/14	1.1				
24	9094422		07/03/14	1.2				
24	9094422		07/15/14	1.2	4.6	32	64	
24	9094422		08/27/14	1.1	6.0	saturated	63	
24	9094422		10/22/14	0.9	6.0	12		
24	9094422		07/08/15	1	3.5	50		dead top, resprouts
24	9094422		09/11/15		5			
25	9094422	none	05/20/14	0.8				
25	9094422		07/03/14	0.6				
25	9094422		07/15/14	0.7	4.6	13	65	
25	9094422		08/27/14	0.7	5.0	saturated	63	
25	9094422		10/22/14	0.6	5.3	18		
25	9094422		07/08/15	0.4	4.0	46		dead top, resprouts
25	9094422		09/11/15		6.5			
28	9094422	slight	05/20/14	5.2				
28	9094422		07/03/14	5.0				
28	9094422		07/15/14	4.4	4.8		64	
28	9094422		08/27/14	3.5	5.0	saturated	62	
28	9094422		10/22/14	2.5	5.3	42		
28	9094422		07/08/15	2.5	3.0			dead top, resprouts
28	9094422		09/11/15		5.5			

Plot #	Accession	Beginning Salinity Value	Date	Salinity (mmhos)	Height (ft)	Soil Moisture (%)	Soil Temp. (degrees F)	Notes
30	9094422	slight	05/20/14	4.0				
30	9094422		07/03/14	3.6				
30	9094422		07/15/14	3.1	5	35	65	
30	9094422		08/27/14	2.9	6.0	saturated	63	
30	9094422		10/22/14	2.5	6.0			
30	9094422		07/08/15	2.4	4.0			dead top, resprouts
30	9094422		09/11/15		6.75			
43	9094422	slight	05/20/14	5.5				
43	9094422		07/03/14	4.6				
43	9094422		07/15/14	3.3	3.6	51	65	
43	9094422		08/27/14	3.7	4.0	saturated	63	
43	9094422		10/22/14	2.7	4.0	31		
43	9094422		07/08/15	2.3	3.5			dead top, resprouts
43	9094422		09/11/15		6			
45	9094422	none	05/20/14	1.6				
45	9094422		07/03/14	1.5				
45	9094422		07/15/14	2	4.8	40	62	
45	9094422		08/27/14	1.3	6.0	saturated	63	
45	9094422		10/22/14	1.0	6.0	32		
45	9094422		07/08/15	1.1	1.5	45.6		dead top, resprouts
45	9094422		09/11/15		4.75			
58	9094422	moderate	05/20/14	7.1				
58	9094422		07/03/14	6.7				
58	9094422		07/15/14	6.5	4.3	51	65	
58	9094422		08/27/14	5.8	4.5	saturated	64	
58	9094422		10/22/14	4.9	5.0	43		
58	9094422		07/08/15	4.3	2.5			dead top, resprouts
58	9094422		09/11/15		4.75			
66	9094422	none	05/20/14	3.7				
66	9094422		07/03/14	3.1				
66	9094422		07/15/14	2.9	5.2		63	
66	9094422		08/27/14	2.4	6.0	saturated	63	
66	9094422		10/22/14	0.6	6.0	32		
66	9094422		07/08/15	2.7	4.5			dead top, resprouts
66	9094422		09/11/15		6.75			
72	9094422	none	05/20/14	1.5				
72	9094422		07/03/14	1.4				
72	9094422		07/15/14	1.2	4	43	63	
72	9094422		08/27/14	0.7	5.0	saturated	63	
72	9094422		10/22/14	0.1	5.5		56	
72	9094422		07/08/15	1	4.0	51.2		dead top, resprouts
72	9094422		09/11/15		6			
79	9094422	moderate	05/20/14	6.8				
79	9094422		07/03/14	5.8				
79	9094422		07/15/14	6	4.6		63	
79	9094422		08/27/14	5.2	5.0	saturated	63	
79	9094422		10/22/14	4.4	5.0			
79	9094422		07/08/15	3.8	2.5			dead top, resprouts
79	9094422		09/11/15		5.75			

Plot #	Accession	Beginning Salinity Value	Date	Salinity (mmhos)	Height (ft)	Soil Moisture (%)	Soil Temp. (degrees F)	Notes
81	9094422	none	05/20/14	1.1				
81	9094422		07/03/14	1.3				
81	9094422		07/15/14	1.2	5	46	64	
81	9094422		08/27/14	1.1	6.0	saturated	64	
81	9094422		10/22/14	0.8	5.8	33		
81	9094422		07/08/15	1	4.8			dead top, resprouts
81	9094422		09/11/15		7			
106	9094422	moderate	05/20/14	8.3				
106	9094422		07/03/14	7.3				
106	9094422		07/15/14	7	4.6		64	
106	9094422		08/27/14	4.8	5.0	saturated	64	
106	9094422		10/22/14	4.6	5			
106	9094422		07/08/15	4.3	2.5			dead top, resprouts
106	9094422		09/11/15		3.5			
121	9094422	moderate	05/20/14	6.3				
121	9094422		07/03/14	5.2				
121	9094422		07/15/14	5.1	4.6	49	62	
121	9094422		08/27/14	4.0	4.5	saturated	63	
121	9094422		10/22/14	2.3	5.0	33		
121	9094422		07/08/15	4.2	3.0			dead top, resprouts
121	9094422		09/11/15		4.5			
123	9094422	moderate	05/20/14	6.4				
123	9094422		07/03/14	3.6				
123	9094422		07/15/14	4.3	4.6		64	
123	9094422		08/27/14	2.3	5.0	saturated	63	
123	9094422		10/22/14	2.1	5.0	40		
123	9094422		07/08/15	2.5	2.5			dead top, resprouts
123	9094422		09/11/15		4.75			
160	9094422	moderate	05/20/14	9.3				
160	9094422		07/03/14	8.4				
160	9094422		07/15/14	7.1	3.2		64	
160	9094422		08/27/14	6.8	3.5	saturated	65	
160	9094422		10/22/14	5.3	4.0			
160	9094422		07/08/15	5.8	0.8			dead top, resprouts
160	9094422		09/11/15		1.5			
177	9094422	slight	05/20/14	5.6				
177	9094422		07/03/14	4.8				
177	9094422		07/15/14	3.7	3.4		65	
177	9094422		08/27/14	2.5	4.0	saturated	65	
177	9094422		10/22/14	1.2	4.5	49		
177	9094422		07/08/15	2.5	3.0			dead top, resprouts
177	9094422		09/11/15		4.5			
181	9094422	slight	05/20/14	5.3				
181	9094422		07/03/14	5.2				
181	9094422		07/15/14	2.8	4.6		63	
181	9094422		08/27/14	4.5	5.0	saturated	63	
181	9094422		10/22/14	3.5	5.0	40		
181	9094422		07/08/15	2.9	3.0			dead top, resprouts
181	9094422		09/11/15		5.5			

Plot #	Accession	Beginning Salinity Value	Date	Salinity (mmhos)	Height (ft)	Soil Moisture (%)	Soil Temp. (degrees F)	Notes
225	9094422	moderate	05/20/14	7.3				
225	9094422		07/03/14	6.5				
225	9094422		07/15/14	5.7	5.3		65	
225	9094422		08/27/14	5.2	5.5	saturated	65	
225	9094422		10/22/14	4.2		48		
225	9094422		07/08/15	5.5	5.5			dead top, resprouts
225	9094422		09/11/15		6.75			
259	9094422	slight	05/20/14	4.6				
259	9094422		07/03/14	2.7				
259	9094422		07/15/14	3.1	4.2	43	66	
259	9094422		08/27/14	2.4	4.5	saturated	65	
259	9094422		10/22/14	2.6		48		missed height??
259	9094422		07/08/15	3.6	5.5			
259	9094422		09/11/15					4.5' tall before it died
1	9094423	slight	05/20/14	4.1				
1	9094423		07/03/14	3.0				
1	9094423		07/15/14	2.3	4.8		63	
1	9094423		08/27/14	2.2	5.5	saturated	62	2.5 " rain in last 3 days.
1	9094423		10/22/14	1.8	5.5	43		
1	9094423		07/08/15	2.3	4.5		67	basal resprouts
1	9094423		09/11/15		6.75			
9	9094423	none	05/20/14	0.7				
9	9094423		07/03/14	0.7				
9	9094423		07/15/14	0.7	5.0	25	63	
9	9094423		08/27/14	0.6	5.5	saturated	65	
9	9094423		10/22/14	0.3	5.5	29		
9	9094423		07/08/15	0.4	4.8	43		just basal growth
9	9094423		09/11/15		8			
12	9094423	none	05/20/14	1.0				
12	9094423		07/03/14	0.7				
12	9094423		07/15/14	0.8	5.6	26	61	
12	9094423		08/27/14	0.7	6.5	saturated	63	
12	9094423		10/22/14	0.2	6.5	16		
12	9094423		07/08/15	0.4	5.0	45		dead top, resprouts
12	9094423		09/11/15		8.5			
15	9094423	moderate	05/20/14	7.6				
15	9094423		07/03/14	4.1				
15	9094423		07/15/14	2.4	4.6		61	
15	9094423		08/27/14	4.7	5.0	saturated	62	
15	9094423		10/22/14	2.2	4.5			
15	9094423		07/08/15	2.5	3.5			dead top, resprouts
15	9094423		09/11/15		5.5			
33	9094423	none	05/20/14	2.6				
33	9094423		07/03/14	3.0				
33	9094423		07/15/14	2.7	5.6	35	60	
33	9094423		08/27/14	1.9	6.0	saturated	63	
33	9094423		10/22/14	2.3	6.3			
33	9094423		07/08/15	1.8	6.5			dead top, resprouts
33	9094423		09/11/15		8.75			

Plot #	Accession	Beginning Salinity Value	Date	Salinity (mmhos)	Height (ft)	Soil Moisture (%)	Soil Temp. (degrees F)	Notes
62	9094423	none	05/20/14	2.5				
62	9094423		07/03/14	2.7				
62	9094423		07/15/14	1.8	3.6		64	
62	9094423		08/27/14	1.6	6.0	saturated	63	
62	9094423		10/22/14	2.0	6.0	35		
62	9094423		07/08/15	1.7	5.0			dead top, resprouts
62	9094423		09/11/15		8			
71	9094423	moderate	05/20/14	6.4				
71	9094423		07/03/14	5.3				
71	9094423		07/15/14	5	4.6		62	
71	9094423		08/27/14	3.6	5.0	saturated	62	
71	9094423		10/22/14	3.5	5.0			
71	9094423		07/08/15	1.3	3.0			dead top, resprouts
71	9094423		09/11/15		5.75			
73	9094423	moderate	05/20/14	9.0				
73	9094423		07/03/14	7.4				
73	9094423		07/15/14	5.7	4.6		66	
73	9094423		08/27/14	5.2	4.5	saturated	64	
73	9094423		10/22/14	3.1	4.8			
73	9094423		07/08/15	3.1	3.0			dead top, resprouts
73	9094423		09/11/15		5			
82	9094423	none	05/20/14	2.7				
82	9094423		07/03/14	2.5				
82	9094423		07/15/14	1.9	4.6	48	62	
82	9094423		08/27/14	1.9	5.5	saturated	63	
82	9094423		10/22/14	2.3	5.8	34		
82	9094423		07/08/15	1	3.0			dead top, resprouts
82	9094423		09/11/15		6.5			
103	9094423	none	05/20/14	1.2				
103	9094423		07/03/14	0.9				
103	9094423		07/15/14	0.9	4	30	62	
103	9094423		08/27/14	0.6	6.0	saturated	63	
103	9094423		10/22/14	0.8	6.0	27		
103	9094423		07/08/15	0.8	3.8	51.3		dead top, resprouts
103	9094423		09/11/15		7.25			
104	9094423	none	05/20/14	2.2				
104	9094423		07/03/14	2.3				
104	9094423		07/15/14	1.2	5	32	61	
104	9094423		08/27/14	1.8	6.5	saturated	63	
104	9094423		10/22/14	1.2	7.0	18		
104	9094423		07/08/15	1.3	4.5			dead top, resprouts
104	9094423		09/11/15		7			
111	9094423	moderate	05/20/14	6.8				
111	9094423		07/03/14	6.1				
111	9094423		07/15/14	4.3	5		64	
111	9094423		08/27/14	3.8	5.0	saturated	64	
111	9094423		10/22/14	3.6	5.3	40		
111	9094423		07/08/15	3.8	1.5			dead top, resprouts
111	9094423		09/11/15		3			

Plot #	Accession	Beginning Salinity Value	Date	Salinity (mmhos)	Height (ft)	Soil Moisture (%)	Soil Temp. (degrees F)	Notes
146	9094423	moderate	05/20/14	7.0				
146	9094423		07/03/14	5.6				
146	9094423		07/15/14	6.2	4.8		62	
146	9094423		08/27/14	4.1	5.0	saturated	65	
146	9094423		10/22/14	4.8	5.0	49		
146	9094423		07/08/15	4	3.3			dead top, resprouts
146	9094423		09/11/15		5.5			
162	9094423	slight	05/20/14	4.5				
162	9094423		07/03/14	4.0				
162	9094423		07/15/14	2.7	4.2	29	65	
162	9094423		08/27/14	2.0	5.0	saturated	65	
162	9094423		10/22/14	2.2	5.0	39		
162	9094423		07/08/15	3.2	5.0			chewed at top of tube
162	9094423		09/11/15		6.25			
167	9094423	slight	05/20/14	4.5				
167	9094423		07/03/14	3.6				
167	9094423		07/15/14	2	4.2	34	63	
167	9094423		08/27/14	2.7	5.0	saturated	62	
167	9094423		10/22/14	2.7	5.0	19		
167	9094423		07/08/15	2.4	1.3			dead top, resprouts
167	9094423		09/11/15		5			
188	9094423	moderate	05/20/14	8.8				
188	9094423		07/03/14	6.0				
188	9094423		07/15/14	7.2	4.4		66	
188	9094423		08/27/14	4.0	4.5	saturated	65	rned leaf margin
188	9094423		10/22/14	4.5	4.5			
188	9094423		07/08/15	5.3				4.5' tall before it died
188	9094423		09/11/15					4.25' tall before it died
195	9094423	slight	05/20/14	4.7				
195	9094423		07/03/14	3.9				
195	9094423		07/15/14	3.2	4.8		65	
195	9094423		08/27/14	2.8	5.5	saturated	64	
195	9094423		10/22/14	2.9	4.3	32		
195	9094423		07/08/15	2.8	3.8			dead top, resprouts
195	9094423		09/11/15		7.75			
205	9094423	moderate	05/20/14	8.1				
205	9094423		07/03/14	7.3				
205	9094423		07/15/14	7	4.4		66	
205	9094423		08/27/14	6.6	5	saturated	64	rned leaf margin
205	9094423		10/22/14	4.8	4.5			
205	9094423		07/08/15	4.1				4.5' tall before it died
205	9094423		09/11/15					4.5' tall before it died
236	9094423	slight	05/20/14	5.7				
236	9094423		07/03/14	3.7				
236	9094423		07/15/14	3.8	1.6		63	
236	9094423		08/27/14	2.3	3.0	saturated	63	
236	9094423		10/22/14	1.7	4.0	43		
236	9094423		07/08/15	3.8	2.5			dead top, resprouts
236	9094423		09/11/15		5.75			

Plot #	Accession	Beginning Salinity Value	Date	Salinity (mmhos)	Height (ft)	Soil Moisture (%)	Soil Temp. (degrees F)	Notes
244	9094423	slight	05/20/14	4.1				
244	9094423		07/03/14	3.8				
244	9094423		07/15/14	3.8	4.8	51	67	
244	9094423		08/27/14	2.5	6.0	saturated	66	
244	9094423		10/22/14	2.4	6.2	44		
244	9094423		07/08/15	2.8	5.5			dead top, resprouts
244	9094423		09/11/15		7.5			
249	9094423	slight	05/20/14	5.1				
249	9094423		07/03/14	5.3				
249	9094423		07/15/14	4	4.8		65	
249	9094423		08/27/14	3.5	5.0	saturated	63	
249	9094423		10/22/14	3.6	5.0			
249	9094423		07/08/15	3.6	5.5			
249	9094423		09/11/15		6.5			
250	9094423	moderate	05/20/14	7.0				
250	9094423		07/03/14	6.1				
250	9094423		07/15/14	6	4		63	
250	9094423		08/27/14	3.9	4.5	saturated	65	
250	9094423		10/22/14	4.3	4.5			
250	9094423		07/08/15	2.9	2.0			dead top, resprouts
250	9094423		09/11/15		4			
3	9094424	moderate	05/20/14	8.2				
3	9094424		07/03/14	6.7				
3	9094424		07/15/14	6.9	4.8		65	
3	9094424		08/27/14	5.2	5.0	saturated	63	
3	9094424		10/22/14	4.0	5.5			
3	9094424		07/08/15	5.27	3.0			dead top, resprouts
3	9094424		09/11/15					5.5' tall before it died
11	9094424	none	05/20/14	0.7				
11	9094424		07/03/14	0.7				
11	9094424		07/15/14	0.7	4.8	15	64	
11	9094424		08/27/14	0.6	5.5	saturated	64	
11	9094424		10/22/14	0.6	5.5	14		
11	9094424		07/08/15	0.6	3.5	46		dead top, resprouts
11	9094424		09/11/15		7.25			
14	9094424	moderate	05/20/14	6.0				
14	9094424		07/03/14	3.3				
14	9094424		07/15/14	5.1	4.6	54	60	
14	9094424		08/27/14	3.8	4.5	saturated	63	
14	9094424		10/22/14	2.8	4.8			
14	9094424		07/08/15	1.1				4.5' before it died
14	9094424		09/11/15					4.5' tall before it died
18	9094424	none	05/20/14	3.0				
18	9094424		07/03/14	1.3				
18	9094424		07/15/14	1.3	4	51	64	
18	9094424		08/27/14	0.8	5.0	saturated	63	
18	9094424		10/22/14	0.4	5.3	31		
18	9094424		07/08/15	1.3	4.5	51		dead top, resprouts
18	9094424		09/11/15		7.75			

Plot #	Accession	Beginning Salinity Value	Date	Salinity (mmhos)	Height (ft)	Soil Moisture (%)	Soil Temp. (degrees F)	Notes
51	9094424	none	05/20/14	1.3				
51	9094424		07/03/14	1.5				
51	9094424		07/15/14	1.5	4.6		63	
51	9094424		08/27/14	1.2	5.0	saturated	66	
51	9094424		10/22/14	1.2	5.0	29		
51	9094424		07/08/15	1.2	1.5	50		dead top, resprouts
51	9094424		09/11/15					4.5' tall before it died
54	9094424	moderate	05/20/14	6.7				
54	9094424		07/03/14	5.5				
54	9094424		07/15/14	4.5	3.6		63	
54	9094424		08/27/14	3.4	4.5	saturated	62	
54	9094424		10/22/14	3.6	4.0			
54	9094424		07/08/15	2.8	2.5			dead top, resprouts
54	9094424		09/11/15		4.25			
57	9094424	moderate	05/20/14	8.6				
57	9094424		07/03/14	6.5				
57	9094424		07/15/14	7.2	3.6	47	64	
57	9094424		08/27/14	5.2	3.5	saturated	64	
57	9094424		10/22/14	4.7	7.0			
57	9094424		07/08/15	3.6				3.0' tall before it died
57	9094424		09/11/15					3.5' tall before it died
63	9094424	none	05/20/14	2.7				
63	9094424		07/03/14	2.9				
63	9094424		07/15/14	3.1	4.8		63	
63	9094424		08/27/14	2.6	6.0	saturated	63	
63	9094424		10/22/14	2.0	6.3	32		
63	9094424		07/08/15	1.1	4.0			dead top, resprouts
63	9094424		09/11/15		7.5			
68	9094424	none	05/20/14	1.1				
68	9094424		07/03/14	0.9				
68	9094424		07/15/14	0.8	3	49	65	
68	9094424		08/27/14	0.8	5.0	saturated	66	
68	9094424		10/22/14	0.7	5.0	23		
68	9094424		07/08/15	0.8	1.5	47		dead top, resprouts
68	9094424		09/11/15		3			
78	9094424	slight	05/20/14	4.4				
78	9094424		07/03/14	4.9				
78	9094424		07/15/14	4	4.6		62	
78	9094424		08/27/14	3.0	4.5	saturated	65	
78	9094424		10/22/14	3.0	4.5			
78	9094424		07/08/15	2.6	2.0			dead top, resprouts
78	9094424		09/11/15		5.25			
89	9094424	none	05/20/14	3.9				
89	9094424		07/03/14	3.5				
89	9094424		07/15/14	2	5	41	64	
89	9094424		08/27/14	2.4	5.5	saturated	64	
89	9094424		10/22/14	2.4	5.8	39		
89	9094424		07/08/15	1.9				6.0' tall before it died
89	9094424		09/11/15					5.75' tall before it died

Plot #	Accession	Beginning Salinity Value	Date	Salinity (mmhos)	Height (ft)	Soil Moisture (%)	Soil Temp. (degrees F)	Notes
105	9094424	moderate	05/20/14	8.7				
105	9094424		07/03/14	7.6				
105	9094424		07/15/14	7.3	4.8		63	
105	9094424		08/27/14	5.4	5.0	saturated	63	
105	9094424		10/22/14	3.8	5.0			dead?
105	9094424		07/08/15	4.5				5.0' tall before it died
105	9094424		09/11/15					4.75' tall before it died
114	9094424	none	05/20/14	1.7				
114	9094424		07/03/14	1.0				
114	9094424		07/15/14	1	4	40	64	
114	9094424		08/27/14	0.6	6.0	saturated	64	
114	9094424		10/22/14	0.3	6.0	33		
114	9094424		07/08/15	0.8	3.8	50.9		dead top, resprouts
114	9094424		09/11/15		6.25			
130	9094424	slight	05/20/14	4.9				
130	9094424		07/03/14	4.1				
130	9094424		07/15/14	3.9	3.8	48	64	
130	9094424		08/27/14	3.3	4.5	saturated	64	
130	9094424		10/22/14	2.7	4.5	43		
130	9094424		07/08/15	3	3.0			dead top, resprouts
130	9094424		09/11/15		3			
143	9094424	moderate	05/20/14	6.6				
143	9094424		07/03/14	6.1				
143	9094424		07/15/14	5.4	4		64	
143	9094424		08/27/14	3.4	4.0	saturated	64	
143	9094424		10/22/14	3.8	4.0			
143	9094424		07/08/15	2.8				4' tall before it died
143	9094424		09/11/15					4.5' tall before it died
154	9094424	slight	05/20/14	5.3				
154	9094424		07/03/14	4.1				
154	9094424		07/15/14	2.3	4.2	36	62	
154	9094424		08/27/14	2.2	6.0	saturated	64	
154	9094424		10/22/14	3.3	5.5	46		
154	9094424		07/08/15	3.1	1.75			dead top, resprouts
154	9094424		09/11/15		2.75			
192	9094424	slight	05/20/14	4.8				
192	9094424		07/03/14	4.7				
192	9094424		07/15/14	3.9	3.6		66	
192	9094424		08/27/14	3.7	4.0	saturated	64	
192	9094424		10/22/14	3.2	4.0			
192	9094424		07/08/15	4				4' tall before it died
192	9094424		09/11/15					3.75' tall before it died
216	9094424	moderate	05/20/14	10.0				
216	9094424		07/03/14	8.9				
216	9094424		07/15/14	7.2	4.4		67	
216	9094424		08/27/14	6.1	4.5	saturated	64	red leaf margin
216	9094424		10/22/14	5.2	4.5			
216	9094424		07/08/15	5.3				4.5' tall before it died
216	9094424		09/11/15					4.5' tall before it died

Plot #	Accession	Beginning Salinity Value	Date	Salinity (mmhos)	Height (ft)	Soil Moisture (%)	Soil Temp. (degrees F)	Notes
219	9094424	slight	05/20/14	4.2				
219	9094424		07/03/14	4.3				
219	9094424		07/15/14	4.2	4.4		67	
219	9094424		08/27/14	3.4	5.5	saturated	64	
219	9094424		10/22/14	4.6	5.3	46		
219	9094424		07/08/15	2.3	5.5			small lvs, burnt edges
219	9094424		09/11/15					5.5' tall before it died
254	9094424	slight	05/20/14	4.6				
254	9094424		07/03/14	3.2				
254	9094424		07/15/14	3	4.2	51	67	
254	9094424		08/27/14	2.3	5.5	saturated	64	
254	9094424		10/22/14	1.9	5.5	22		
254	9094424		07/08/15	1	5.0	51.8		top chewed off at 5'
254	9094424		09/11/15		7.25			
261	9094424	slight	05/20/14	4.6				
261	9094424		07/03/14	4.0				
261	9094424		07/15/14	2.9	4.4		66	
261	9094424		08/27/14	2.8	4.5	saturated	64	
261	9094424		10/22/14	2.7	4.5	31		
261	9094424		07/08/15	2.8				4.5' tall before it died
261	9094424		09/11/15		6.75			
5	9094425	moderate	05/20/14	7.4				
5	9094425		07/03/14	5.3				
5	9094425		07/15/14	5.5	5.0		62	
5	9094425		08/27/14	4.2	5.0	saturated	63	
5	9094425		10/22/14	3.7	5.0			too wet to register
5	9094425		07/08/15	2.4				5' tall before it died
5	9094425		09/11/15					4.75' tall before it died
27	9094425	slight	05/20/14	5.3				
27	9094425		07/03/14	4.6				
27	9094425		07/15/14	4.2	5		63	
27	9094425		08/27/14	3.1	6.0	saturated	63	
27	9094425		10/22/14	2.7	6.0	51	54	
27	9094425		07/08/15	2.8	4.0			dead top, resprouts
27	9094425		09/11/15		6.5			
35	9094425	none	05/20/14	0.9				
35	9094425		07/03/14	1.1				
35	9094425		07/15/14	1.3	3.6	40	63	
35	9094425		08/27/14	0.8	4.5	saturated	64	
35	9094425		10/22/14	0.8	4.5	26		
35	9094425		07/08/15	0.9	3.0	42		dead top, resprouts
35	9094425		09/11/15		5.5			
42	9094425	none	05/20/14	3.6				
42	9094425		07/03/14	4.9				
42	9094425		07/15/14	5.1	3.8	51	65	
42	9094425		08/27/14	3.8	4.5	saturated	64	
42	9094425		10/22/14	1.3	4.0	51		
42	9094425		07/08/15	2.7				4.0' tall before it died
42	9094425		09/11/15					4.0' tall before it died

Plot #	Accession	Beginning Salinity Value	Date	Salinity (mmhos)	Height (ft)	Soil Moisture (%)	Soil Temp. (degrees F)	Notes
56	9094425	moderate	05/20/14	9.0				
56	9094425		07/03/14	9.1				
56	9094425		07/15/14	8.7	4.8	47	64	
56	9094425		08/27/14	5.0	4.0	saturated	63	
56	9094425		10/22/14	1.4	dead			
56	9094425		07/08/15	3.4	1.0			dead top, resprouts
56	9094425		09/11/15		1.75			
60	9094425	none	05/20/14	3.4				
60	9094425		07/03/14	1.3				
60	9094425		07/15/14	3.6	4.6		65	
60	9094425		08/27/14	1.8	4.5	saturated	63	
60	9094425		10/22/14	2.4	4.5			dead?
60	9094425		07/08/15	2.9				5.0' tall before it died
60	9094425		09/11/15					4.0' tall before it died
64	9094425	none	05/20/14	3.6				
64	9094425		07/03/14	3.2				
64	9094425		07/15/14	4	4.6	48	63	
64	9094425		08/27/14	3.0	4.5	saturated	63	
64	9094425		10/22/14	2.3	4.5			
64	9094425		07/08/15	0.9	4.5			dead top, resprouts
64	9094425		09/11/15		7			
75	9094425	slight	05/20/14	4.9				
75	9094425		07/03/14	3.2				
75	9094425		07/15/14	3.6	5.2		62	
75	9094425		08/27/14	2.8	6.0	saturated	65	
75	9094425		10/22/14	2.3	5.0	52		1' of top broken off
75	9094425		07/08/15	2.8	0.5			dead top, resprouts
75	9094425		09/11/15					5.0' tall before it died
76	9094425	slight	05/20/14	4.6				
76	9094425		07/03/14	3.4				
76	9094425		07/15/14	3.5	5.2	45	63	
76	9094425		08/27/14	2.2	6.0	saturated	64	
76	9094425		10/22/14	1.8	6.3	48		
76	9094425		07/08/15	1.8	4.3			dead top, resprouts
76	9094425		09/11/15		7			
83	9094425	none	05/20/14	1.4				
83	9094425		07/03/14	1.5				
83	9094425		07/15/14	1.5	5.6	45	63	
83	9094425		08/27/14	1.0	6.0	saturated	63	
83	9094425		10/22/14	1.3	5.8	25		
83	9094425		07/08/15	1.2	5.0			dead top, resprouts
83	9094425		09/11/15		8			
102	9094425	none	05/20/14	1.9				
102	9094425		07/03/14	1.3				
102	9094425		07/15/14	1.5	5.2	41	63	
102	9094425		08/27/14	0.9	6.5	saturated	64	
102	9094425		10/22/14	0.9	6.0	17		
102	9094425		07/08/15	0.9	4.8	50.6		dead top, resprouts
102	9094425		09/11/15		7.5			

Plot #	Accession	Beginning Salinity Value	Date	Salinity (mmhos)	Height (ft)	Soil Moisture (%)	Soil Temp. (degrees F)	Notes
109	9094425	none	05/20/14	2.0				
109	9094425		07/03/14	1.5				
109	9094425		07/15/14	1.2	5	48	62	
109	9094425		08/27/14	1.3	6.5	saturated	64	
109	9094425		10/22/14	1.1	6.3	42		
109	9094425		07/08/15	0.8				6.5' tall before it died
109	9094425		09/11/15		6.75			
127	9094425	slight	05/20/14	4.1				
127	9094425		07/03/14	4.7				
127	9094425		07/15/14	2.3	4.8		64	
127	9094425		08/27/14	3.8	5.0	saturated	64	
127	9094425		10/22/14	3.8	4.8			
127	9094425		07/08/15	3.8	4.3			dead top, resprouts
127	9094425		09/11/15		4			
139	9094425	moderate	05/20/14	6.7				
139	9094425		07/03/14	4.8				
139	9094425		07/15/14	4.7	3.6		63	
139	9094425		08/27/14	3.5	3.0	saturated	64	
139	9094425		10/22/14	3.2	4.0	24		dead?
139	9094425		07/08/15	3.4	3.8			dead top, resprouts
139	9094425		09/11/15		4			
147	9094425	moderate	05/20/14	6.9				
147	9094425		07/03/14	5.5				
147	9094425		07/15/14	5.2	4.6		63	
147	9094425		08/27/14	4.0	5.0	saturated	64	
147	9094425		10/22/14	3.5	4.5			
147	9094425		07/08/15	3.2				4.5' tall before it died
147	9094425		09/11/15					4.5' tall before it died
161	9094425	moderate	05/20/14	8.3				
161	9094425		07/03/14	8.9				
161	9094425		07/15/14	6.7	4.8	49	64	
161	9094425		08/27/14	6.8	4.5	saturated	65	
161	9094425		10/22/14	6.1	4.5			
161	9094425		07/08/15	4.4				4.5' tall before it died
161	9094425		09/11/15					4.25' tall before it died
168	9094425	slight	05/20/14	4.0				
168	9094425		07/03/14	2.6				
168	9094425		07/15/14	1.2	5	46	64	
168	9094425		08/27/14	1.7	6.0	saturated	64	
168	9094425		10/22/14	2.1	5.5			
168	9094425		07/08/15	1.9	6.0			
168	9094425		09/11/15		7			
198	9094425	slight	05/20/14	4.5				
198	9094425		07/03/14	3.9				
198	9094425		07/15/14	3.3	4.8		64	
198	9094425		08/27/14	2.3	5.0	saturated	64	
198	9094425		10/22/14	3.1	5.0	50		
198	9094425		07/08/15	3	3.8			dead top, resprouts
198	9094425		09/11/15		5.75			

Plot #	Accession	Beginning Salinity Value	Date	Salinity (mmhos)	Height (ft)	Soil Moisture (%)	Soil Temp. (degrees F)	Notes
201	9094425	moderate	05/20/14	6.2				
201	9094425		07/03/14	3.7				
201	9094425		07/15/14	4.3	4.8		62	
201	9094425		08/27/14	3.6	5.5	saturated	63	
201	9094425		10/22/14	3.5		40		
201	9094425		07/08/15	3.9	5.5			
201	9094425		09/11/15					5.5' tall before it died
203	9094425	moderate	05/20/14	10.0				
203	9094425		07/03/14	8.1				
203	9094425		07/15/14	6.7	4.2		65	
203	9094425		08/27/14	5.3	4.5	saturated	64	
203	9094425		10/22/14	4.8	4.5			dead?
203	9094425		07/08/15	6.5				5.5' tall before it died
203	9094425		09/11/15					4.5' tall before it died
230	9094425	slight	05/20/14	5.5				
230	9094425		07/03/14	6.0				
230	9094425		07/15/14	4.6	4.6		68	
230	9094425		08/27/14	5.6	4.5	saturated	65	
230	9094425		10/22/14	4.5				missed height??
230	9094425		07/08/15	3	1.0			dead top, resprouts
230	9094425		09/11/15		1.5			
7	9094426	none	05/20/14	0.9				
7	9094426		07/03/14	0.4				
7	9094426		07/15/14	0.8	2.0	22	64	dead top
7	9094426		08/27/14	0.6	3.5	saturated	64	
7	9094426		10/22/14	0.3	4.5	27		
7	9094426		07/08/15	0.7	3.0	49		dead top, resprouts
7	9094426		09/11/15		0.7			
16	9094426	none	05/20/14	3.5				
16	9094426		07/03/14	3.0				
16	9094426		07/15/14	2.9	5.0		66	
16	9094426		08/27/14	2.6	5.5	saturated	62	
16	9094426		10/22/14	1.2	5.5	50.1		
16	9094426		07/08/15	2.5	4.0			dead top, resprouts
16	9094426		09/11/15		6.25			
21	9094426	moderate	05/20/14	7.7				
21	9094426		07/03/14	6.5				
21	9094426		07/15/14	6.0	4.6	43	63	
21	9094426		08/27/14	4.3	5.0	saturated	63	
21	9094426		10/22/14	1.8	4.8	43		
21	9094426		07/08/15	3.2	1.5			dead top, resprouts
21	9094426		09/11/15		2.75			
32	9094426	slight	05/20/14	4.6				
32	9094426		07/03/14	4.1				
32	9094426		07/15/14	3.6	4.2	35	63	
32	9094426		08/27/14	3.4	5.0	saturated	62	
32	9094426		10/22/14	3.0	5.0	43		
32	9094426		07/08/15	2.5	5.0			
32	9094426		09/11/15		6.25			

Plot #	Accession	Beginning Salinity Value	Date	Salinity (mmhos)	Height (ft)	Soil Moisture (%)	Soil Temp. (degrees F)	Notes
36	9094426	moderate	05/20/14	6.6				
36	9094426		07/03/14	5.5				
36	9094426		07/15/14	4.5	4.8		63	
36	9094426		08/27/14	3.5	5.0	saturated	64	
36	9094426		10/22/14	1.4	4.8			
36	9094426		07/08/15	3.7	2.5			dead top, resprouts
36	9094426		09/11/15		5.5			
37	9094426	none	05/20/14	2.8				
37	9094426		07/03/14	2.2				
37	9094426		07/15/14	2.8	5	43	65	
37	9094426		08/27/14	2.2	5.0	saturated	63	
37	9094426		10/22/14	1.3	5.0	25	55	
37	9094426		07/08/15	1.6	4.5			dead top, resprouts
37	9094426		09/11/15		5.5			
40	9094426	moderate	05/20/14	8.0				
40	9094426		07/03/14	6.5				
40	9094426		07/15/14	6.8	0.6		65	dead top
40	9094426		08/27/14	4.5	1.5	saturated	63	dead top
40	9094426		10/22/14	2.2	4.8	46		
40	9094426		07/08/15	3.2	2.0			dead top, resprouts
40	9094426		09/11/15		3.5			
47	9094426	slight	05/20/14	4.0				
47	9094426		07/03/14	3.2				
47	9094426		07/15/14	3.2	4.6	44	64	
47	9094426		08/27/14	2.6	6.0	saturated	63	
47	9094426		10/22/14	2.6	6.5	46		
47	9094426		07/08/15	2.9	3.5		67	dead top, resprouts
47	9094426		09/11/15		5.75			
67	9094426	slight	05/20/14	4.1				
67	9094426		07/03/14	3.8				
67	9094426		07/15/14	3.6	4.8	35	63	
67	9094426		08/27/14	2.9	5.5	saturated	93	
67	9094426		10/22/14	1.9	5.8	50		
67	9094426		07/08/15	2.3	2.0			dead top, resprouts
67	9094426		09/11/15		3.75			
80	9094426	none	05/20/14	2.9				
80	9094426		07/03/14	2.2				
80	9094426		07/15/14	0.9	4.6	22	63	
80	9094426		08/27/14	0.4	5.0	saturated	64	
80	9094426		10/22/14	1.9	5.5	20		
80	9094426		07/08/15	1.9	2.0			dead top, resprouts
80	9094426		09/11/15		6.25			
87	9094426	none	05/20/14	0.9				
87	9094426		07/03/14	0.7				
87	9094426		07/15/14	0.8	2	38	62	
87	9094426		08/27/14	0.4	2.5	saturated	64	dead top
87	9094426		10/22/14	0.6	4.5	37		
87	9094426		07/08/15	0.5	2.0	48.1		dead top, resprouts
87	9094426		09/11/15		4			

Plot #	Accession	Beginning Salinity Value	Date	Salinity (mmhos)	Height (ft)	Soil Moisture (%)	Soil Temp. (degrees F)	Notes
94	9094426	moderate	05/20/14	7.1				
94	9094426		07/03/14	5.2				
94	9094426		07/15/14	5.3	4	46	64	
94	9094426		08/27/14	4.0	4.5	saturated	64	
94	9094426		10/22/14	3.5	4.5			
94	9094426		07/08/15	2.8	3.0			dead top, resprouts
94	9094426		09/11/15					4.0' tall before it died
95	9094426	slight	05/20/14	4.4				
95	9094426		07/03/14	3.9				
95	9094426		07/15/14	3.1	5.2		64	
95	9094426		08/27/14	2.6	5.5	saturated	64	
95	9094426		10/22/14	2.9	4.3	49		
95	9094426		07/08/15	2.3	2.5			dead top, resprouts
95	9094426		09/11/15		5.5			
97	9094426	none	05/20/14	0.8				
97	9094426		07/03/14	0.8				
97	9094426		07/15/14	0.8	5.2	47	62	
97	9094426		08/27/14	0.5	6.0	saturated	65	
97	9094426		10/22/14	0.3	6.3	26		double leader
97	9094426		07/08/15	0.7	0.5	48.6		6' dead top, resprouts
97	9094426		09/11/15		3.75			
101	9094426	none	05/20/14	1.3				
101	9094426		07/03/14	1.5				
101	9094426		07/15/14	1.9	1.6	45	62	dead top
101	9094426		08/27/14	1.0	2.5	saturated	65	dead top
101	9094426		10/22/14	0.9	4.8	43		
101	9094426		07/08/15	1.4				all dead
101	9094426		09/11/15					4.75' tall before it died
107	9094426	slight	05/20/14	5.7				
107	9094426		07/03/14	5.5				
107	9094426		07/15/14	5.4	3.6		63	
107	9094426		08/27/14	3.4	3.5	saturated	64	
107	9094426		10/22/14	3.3	3.5			dead?
107	9094426		07/08/15	3.1				3.0' tall before it died
107	9094426		09/11/15					3.0' tall before it died
113	9094426	moderate	05/20/14	6.5				
113	9094426		07/03/14	4.3				
113	9094426		07/15/14	5.2	4		63	
113	9094426		08/27/14	4.2	4.0	saturated	63	
113	9094426		10/22/14	4.1	4.0			dead?
113	9094426		07/08/15	3.3	1.8			dead top, resprouts
113	9094426		09/11/15		4.75			
169	9094426	slight	05/20/14	4.6				
169	9094426		07/03/14	4.0				
169	9094426		07/15/14	3.1	4.2	46	64	
169	9094426		08/27/14	3.8	4.5	saturated	64	
169	9094426		10/22/14	3.2	4.5			
169	9094426		07/08/15	2.4	2.0			dead top, resprouts
169	9094426		09/11/15		5.25			

Plot #	Accession	Beginning Salinity Value	Date	Salinity (mmhos)	Height (ft)	Soil Moisture (%)	Soil Temp. (degrees F)	Notes
196	9094426	slight	05/20/14	4.9				
196	9094426		07/03/14	5.1				
196	9094426		07/15/14	3	4.2		67	
196	9094426		08/27/14	4.5	5	saturated	63	
196	9094426		10/22/14	3.8	4.0	48		
196	9094426		07/08/15	2.9	4.5			dead top, resprouts
196	9094426		09/11/15		6.75			
197	9094426	moderate	05/20/14	6.4				
197	9094426		07/03/14	5.7				
197	9094426		07/15/14	5	4.2		64	
197	9094426		08/27/14	3.9	4.5	saturated	64	red leaf margin
197	9094426		10/22/14	2.7	4.3			
197	9094426		07/08/15	2.8	3.8			dead top, resprouts
197	9094426		09/11/15		5.75			
214	9094426	moderate	05/20/14	7.9				
214	9094426		07/03/14	6.6				
214	9094426		07/15/14	5.9	2.4		66	
214	9094426		08/27/14	4.2	3.0	saturated	63	very low vigor
214	9094426		10/22/14	4.3	3.0			
214	9094426		07/08/15	5				2.5' tall before it died
214	9094426		09/11/15					2.25' tall before it died
6	9094427	slight	05/20/14	5.7				
6	9094427		07/03/14	2.1				
6	9094427		07/15/14	4.2	5.2		21	61
6	9094427		08/27/14	3.1	6.0	saturated		64
6	9094427		10/22/14	1.9	6.3		51	
6	9094427		07/08/15	2.8	4.5			dead top, resprouts
6	9094427		09/11/15		7.25			
10	9094427	none	05/20/14	0.7				
10	9094427		07/03/14	0.7				
10	9094427		07/15/14	0.7	5.6		31	64
10	9094427		08/27/14	0.7	5.5	saturated		64
10	9094427		10/22/14	0.6	5.5		30	
10	9094427		07/08/15	0.4	5.0		43	dead top, resprouts
10	9094427		09/11/15		8.5			
17	9094427	none	05/20/14	1.0				
17	9094427		07/03/14	0.9				
17	9094427		07/15/14	0.9	5			64
17	9094427		08/27/14	0.8	6.0	saturated		64
17	9094427		10/22/14	0.6	5.8		26	
17	9094427		07/08/15	0.7	4.0		48	dead top, resprouts
17	9094427		09/11/15		7			
22	9094427	moderate	05/20/14	7.5				
22	9094427		07/03/14	5.1				
22	9094427		07/15/14	4.9	5		51	64
22	9094427		08/27/14	3.2	5.5	saturated		63
22	9094427		10/22/14	2.1	6.0			
22	9094427		07/08/15	1.9	0.5			5.5' dead top, resprouts
22	9094427		09/11/15		3.5			

Plot #	Accession	Beginning Salinity Value	Date	Salinity (mmhos)	Height (ft)	Soil Moisture (%)	Soil Temp. (degrees F)	Notes
38	9094427	moderate	05/20/14	8.5				
38	9094427		07/03/14	8.5				
38	9094427		07/15/14	8.3	5		64	
38	9094427		08/27/14	6.3	5.0	saturated	63	
38	9094427		10/22/14	3.3	5.0			
38	9094427		07/08/15	5.3	5.5			
38	9094427		09/11/15					5.5' tall before it died
41	9094427	moderate	05/20/14	7.1				
41	9094427		07/03/14	5.0				
41	9094427		07/15/14	5.3	5		65	
41	9094427		08/27/14	4.0	5.5	saturated	63	
41	9094427		10/22/14	2.4	2.5	47		
41	9094427		07/08/15	2.7	3.0			dead top, resprouts
41	9094427		09/11/15		5.5			
52	9094427	none	05/20/14	0.9				
52	9094427		07/03/14	0.9				
52	9094427		07/15/14	0.9	4.6	27	63	
52	9094427		08/27/14	0.8	5.0	saturated	63	
52	9094427		10/22/14	0.8	5.0	24		
52	9094427		07/08/15	0.7	5.5	50.2		
52	9094427		09/11/15		7.25			
55	9094427	slight	05/20/14	5.6				
55	9094427		07/03/14	5.7				
55	9094427		07/15/14	4.7	5.2		64	
55	9094427		08/27/14	3.1	5.0	saturated	63	
55	9094427		10/22/14	2.6	5.3	44		
55	9094427		07/08/15	3.4	5.5			dead top, resprouts
55	9094427		09/11/15		6.5			
69	9094427	none	05/20/14	1.1				
69	9094427		07/03/14	1.2				
69	9094427		07/15/14	1.3	4.6	35	64	
69	9094427		08/27/14	0.9	4.5	saturated	64	
69	9094427		10/22/14	0.8	4.5	33		
69	9094427		07/08/15	0.8	4.5			dead top, resprouts
69	9094427		09/11/15		7.5			
74	9094427	moderate	05/20/14	7.2				
74	9094427		07/03/14	6.6				
74	9094427		07/15/14	6.7	5.2		62	
74	9094427		08/27/14	5.6	5.5	saturated	64	
74	9094427		10/22/14	5.5	5.5			dead?
74	9094427		07/08/15	4.4				5.0' tall before it died
74	9094427		09/11/15					5.25' tall before it died
86	9094427	none	05/20/14	1.1				
86	9094427		07/03/14	1.0				
86	9094427		07/15/14	1	5.2	17	65	
86	9094427		08/27/14	0.8	6.0	saturated	63	
86	9094427		10/22/14	0.8	5.5	25		
86	9094427		07/08/15	0.4	4.5	47.3		dead top, resprouts
86	9094427		09/11/15		7.25			

Plot #	Accession	Beginning Salinity Value	Date	Salinity (mmhos)	Height (ft)	Soil Moisture (%)	Soil Temp. (degrees F)	Notes
93	9094427	none	05/20/14	2.2				
93	9094427		07/03/14	1.9				
93	9094427		07/15/14	1.9	4.8	51	61	
93	9094427		08/27/14	1.6	6.0	saturated	65	
93	9094427		10/22/14	1.5	6.0	41		
93	9094427		07/08/15	1.5	3.5			dead top, resprouts
93	9094427		09/11/15		8			
100	9094427	none	05/20/14	1.0				
100	9094427		07/03/14	0.9				
100	9094427		07/15/14	0.9	5	42	64	
100	9094427		08/27/14	0.5	6.0	saturated	65	
100	9094427		10/22/14	0.6	5.3	14		
100	9094427		07/08/15	0.6	5.0	49.6		dead top, resprouts
100	9094427		09/11/15		7.25			
128	9094427	moderate	05/20/14	7.2				
128	9094427		07/03/14	6.9				
128	9094427		07/15/14	6.8	5.6		64	
128	9094427		08/27/14	5.1	5.5	saturated	63	curled edges
128	9094427		10/22/14	5.2	5.3	51		
128	9094427		07/08/15	4.2	0.5			5.5' dead top, resprouts
128	9094427		09/11/15					5.5' tall before it died
182	9094427	slight	05/20/14	4.7				
182	9094427		07/03/14	3.6				
182	9094427		07/15/14	4.2	5		64	
182	9094427		08/27/14	3.5	5.5	saturated	64	
182	9094427		10/22/14	2.3	5.5	52		
182	9094427		07/08/15	2.7	7.0			healthy, some browsed
182	9094427		09/11/15		8.25			
190	9094427	moderate	05/20/14	9.7				
190	9094427		07/03/14	9.5				
190	9094427		07/15/14	7.8	5		65	
190	9094427		08/27/14	5.1	5.0	saturated	65	
190	9094427		10/22/14	5.3	5.0			
190	9094427		07/08/15	5.3				5' tall before it died
190	9094427		09/11/15					5.0' tall before it died
211	9094427	slight	05/20/14	5.1				
211	9094427		07/03/14	3.9				
211	9094427		07/15/14	3.3	4.2	41	64	
211	9094427		08/27/14	2.8	5.5	saturated	64	
211	9094427		10/22/14	2.5	5.8	35		
211	9094427		07/08/15	1.3	4.3			dead top, resprouts
211	9094427		09/11/15		6.5			
237	9094427	slight	05/20/14	4.7				
237	9094427		07/03/14	4.3				
237	9094427		07/15/14	2.8	4.4		64	
237	9094427		08/27/14	1.5	5.0	saturated	64	
237	9094427		10/22/14	3.0	4.5			
237	9094427		07/08/15	2.5	0.5			top chewed off at 5'
237	9094427		09/11/15		2.25			

Plot #	Accession	Beginning Salinity Value	Date	Salinity (mmhos)	Height (ft)	Soil Moisture (%)	Soil Temp. (degrees F)	Notes
240	9094427	moderate	05/20/14	8.7				
240	9094427		07/03/14	8.3				
240	9094427		07/15/14	6.5	3.2		66	
240	9094427		08/27/14	5.1	3.0	saturated	63	
240	9094427		10/22/14	5.4	3.5			
240	9094427		07/08/15	4.8				3.5' tall before it died
240	9094427		09/11/15					3.25' tall before it died
247	9094427	slight	05/20/14	4.2				
247	9094427		07/03/14	3.4				
247	9094427		07/15/14	3.1	4.8	43	68	
247	9094427		08/27/14	3.1	5.0	saturated	65	
247	9094427		10/22/14	1.5	5.3	37		
247	9094427		07/08/15	2.8	6.0			
247	9094427		09/11/15		8.25			
256	9094427	slight	05/20/14	5.2				
256	9094427		07/03/14	4.1				
256	9094427		07/15/14	3.6	5.4	50	67	
256	9094427		08/27/14	1.4	5.5	saturated	65	
256	9094427		10/22/14	2.3	5.3	37		
256	9094427		07/08/15	1	5.0			top chewed off at 5'
256	9094427		09/11/15		6.75			
13	9094432	none	05/20/14	2.8				
13	9094432		07/03/14	1.5				
13	9094432		07/15/14	0.8	3.0	26	64	
13	9094432		08/27/14	0.7	5.5	saturated	63	
13	9094432		10/22/14	1.2	6.0	36		
13	9094432		07/08/15	1	3.5			dead top, resprouts
13	9094432		09/11/15		7			
29	9094432	none	05/20/14	2.6				
29	9094432		07/03/14	2.4				
29	9094432		07/15/14	0.2	4.6		65	
29	9094432		08/27/14	1.2	6.0	saturated	62	
29	9094432		10/22/14	1.0	6.0	31		
29	9094432		07/08/15	1.2	3.0			dead top, resprouts
29	9094432		09/11/15		7.5			
31	9094432	none	05/20/14	2.7				
31	9094432		07/03/14	2.8				
31	9094432		07/15/14	2.8	4.6		63	
31	9094432		08/27/14	2.3	6.0	saturated	64	
31	9094432		10/22/14	2.6	6.0	44		
31	9094432		07/08/15	1	5.0			dead top, resprouts
31	9094432		09/11/15		7			
49	9094432	none	05/20/14	2.9				
49	9094432		07/03/14	2.9				
49	9094432		07/15/14	2.5	4.6		63	
49	9094432		08/27/14	2.3	6.0	saturated	62	
49	9094432		10/22/14	2.4	6.0			
49	9094432		07/08/15	2.7	4.5			dead top, resprouts
49	9094432		09/11/15		6.75			

Plot #	Accession	Beginning Salinity Value	Date	Salinity (mmhos)	Height (ft)	Soil Moisture (%)	Soil Temp. (degrees F)	Notes
59	9094432	moderate	05/20/14	6.5				
59	9094432		07/03/14	5.2				
59	9094432		07/15/14	5.9	4.6		64	
59	9094432		08/27/14	4.7	5.0	saturated	63	
59	9094432		10/22/14	4.1	4.8			
59	9094432		07/08/15	3.5	3.3			dead top, resprouts
59	9094432		09/11/15		5.25			
65	9094432	none	05/20/14	2.5				
65	9094432		07/03/14	3.0				
65	9094432		07/15/14	2.2	4.6		63	
65	9094432		08/27/14	1.7	6.5	saturated	62	
65	9094432		10/22/14	2.1	6.0	41		
65	9094432		07/08/15	1.1	5.3			dead top, resprouts
65	9094432		09/11/15		8			
77	9094432	slight	05/20/14	4.8				
77	9094432		07/03/14	4.7				
77	9094432		07/15/14	4	4		63	
77	9094432		08/27/14	3.4	4.5	saturated	65	
77	9094432		10/22/14	2.6	4.8	49		
77	9094432		07/08/15	2.6	5.3			
77	9094432		09/11/15		7			
99	9094432	none	05/20/14	1.5				
99	9094432		07/03/14	1.3				
99	9094432		07/15/14	1.3	5	37	63	
99	9094432		08/27/14	1.1	6.0	saturated	65	
99	9094432		10/22/14	1.1	5.8	22		
99	9094432		07/08/15	1.1				6.0' tall before it died
99	9094432		09/11/15					6.0' tall before it died
110	9094432	none	05/20/14	2.9				
110	9094432		07/03/14	2.7				
110	9094432		07/15/14	3.2	4.8	50	63	
110	9094432		08/27/14	2.4	6.0	saturated	64	
110	9094432		10/22/14	1.2	6.0			
110	9094432		07/08/15	1.8	5.5			dead top, resprouts
110	9094432		09/11/15		8			
118	9094432	moderate	05/20/14	6.2				
118	9094432		07/03/14	4.1				
118	9094432		07/15/14	4.2	5.6	42	63	
118	9094432		08/27/14	3.3	6.5	saturated	63	burned leaf margin
118	9094432		10/22/14	3.2	6.3	47		
118	9094432		07/08/15	2.5				6.5' tall before it died
118	9094432		09/11/15					6.5' tall before it died
122	9094432	moderate	05/20/14	6.8				
122	9094432		07/03/14	5.7				
122	9094432		07/15/14	4.4	5	26	63	
122	9094432		08/27/14	3.5	6.0	saturated	63	
122	9094432		10/22/14	0.8	5.6	42		
122	9094432		07/08/15	2.5	2.5			dead top, resprouts
122	9094432		09/11/15		4.25			

Plot #	Accession	Beginning Salinity Value	Date	Salinity (mmhos)	Height (ft)	Soil Moisture (%)	Soil Temp. (degrees F)	Notes
126	9094432	slight	05/20/14	4.6				
126	9094432		07/03/14	3.8				
126	9094432		07/15/14	3.7	5.6		63	
126	9094432		08/27/14	3.2	7.0	saturated	64	
126	9094432		10/22/14	2.7	6.5			
126	9094432		07/08/15	1.6	6.0			dead top, resprouts
126	9094432		09/11/15		8.25			
153	9094432	slight	05/20/14	5.6				
153	9094432		07/03/14	4.3				
153	9094432		07/15/14	3.4	4.4	47	65	
153	9094432		08/27/14	3.5	6.0	saturated	64	
153	9094432		10/22/14	3.2	5.5	48	53	
153	9094432		07/08/15	3.6	6			
153	9094432		09/11/15		8			
172	9094432	slight	05/20/14	5.9				
172	9094432		07/03/14	5.9				
172	9094432		07/15/14	4.2	4.2	36	65	
172	9094432		08/27/14	4.0	4.5	saturated	63	
172	9094432		10/22/14	3.3	4.5	30		
172	9094432		07/08/15	3.4	3.8			
172	9094432		09/11/15		5.25			
175	9094432	moderate	05/20/14	8.0				
175	9094432		07/03/14	7.7				
175	9094432		07/15/14	7.3	4		64	
175	9094432		08/27/14	6.5	4.0	saturated	65	
175	9094432		10/22/14	5.4	4.0			
175	9094432		07/08/15	5.9				3.0' tall before it died
175	9094432		09/11/15					3.75' tall before it died
187	9094432	moderate	05/20/14	9.5				
187	9094432		07/03/14	7.0				
187	9094432		07/15/14	5.7	5		64	
187	9094432		08/27/14	5.5	5.0	saturated	65	
187	9094432		10/22/14	4.7	5.3			
187	9094432		07/08/15	5.2	2.5			dead top, resprouts
187	9094432		09/11/15					5.0' tall before it died
208	9094432	slight	05/20/14	4.5				
208	9094432		07/03/14	4.3				
208	9094432		07/15/14	4.2	4.4		65	
208	9094432		08/27/14	3.7	4.5	saturated	65	
208	9094432		10/22/14	3.7	4.5	50		
208	9094432		07/08/15	3.9	6.0			
208	9094432		09/11/15		7			
217	9094432	moderate	05/20/14	10.0				
217	9094432		07/03/14	6.4				
217	9094432		07/15/14	6.6	4		66	
217	9094432		08/27/14	5.1	4.5	saturated	64	red leaf margin
217	9094432		10/22/14	4.4	4.5			
217	9094432		07/08/15	4				4.5' tall before it died
217	9094432		09/11/15					4.0' tall before it died

Plot #	Accession	Beginning Salinity Value	Date	Salinity (mmhos)	Height (ft)	Soil Moisture (%)	Soil Temp. (degrees F)	Notes
226	9094432	moderate	05/20/14	7.9				
226	9094432		07/03/14	6.8				
226	9094432		07/15/14	5.5	4.8		65	
226	9094432		08/27/14	4.7	5.0	saturated	64	small leaves
226	9094432		10/22/14	4.3				
226	9094432		07/08/15	5.5				4.5' tall before it died
226	9094432		09/11/15					4.5' tall before it died
238	9094432	slight	05/20/14	5.4				
238	9094432		07/03/14	5.5				
238	9094432		07/15/14	4.2	4		64	
238	9094432		08/27/14	3.1	5.0	saturated	64	
238	9094432		10/22/14	3.6	4.8			
238	9094432		07/08/15	3.2	5.5			
238	9094432		09/11/15		7.5			
242	9094432	moderate	05/20/14	8.8				
242	9094432		07/03/14	6.3				
242	9094432		07/15/14	7.5	4.2		65	
242	9094432		08/27/14	7.6	1.5	saturated	64	only a few leaves
242	9094432		10/22/14	6.1	4.3			
242	9094432		07/08/15	5.8				4.5' tall before it died
242	9094432		09/11/15					4.25' tall before it died
255	9094432	slight	05/20/14	4.1				
255	9094432		07/03/14	3.6				
255	9094432		07/15/14	3.4	4.2		32	66
255	9094432		08/27/14	2.9	5.0	saturated		65
255	9094432		10/22/14	2.1	4.8		11	
255	9094432		07/08/15	3	5.5			
255	9094432		09/11/15		6.5			
115		none	05/20/14	0.9				
115			07/03/14	1.1				
115			07/15/14	1.2	X		23	60
115			08/27/14	0.7		saturated		63
115			10/22/14	0.6			17	
115			07/08/15	1.1			49.4	
115			09/11/15					
116		none	05/20/14	1.6				
116			07/03/14	1.4				
116			07/15/14	1.2	X		31	62
116			08/27/14	1.2		saturated		62
116			10/22/14	1.3			23	
116			07/08/15	1.2				
116			09/11/15					
117		none	05/20/14	1.9				
117			07/03/14	1.9				
117			07/15/14	1.5	X		43	62
117			08/27/14	1.3		saturated		64
117			10/22/14	0.4			24	
117			07/08/15	1				
117			09/11/15					

Plot #	Accession	Beginning Salinity Value	Date	Salinity (mmhos)	Height (ft)	Soil Moisture (%)	Soil Temp. (degrees F)	Notes
119		none	05/20/14	1.8				
119			07/03/14	1.9				
119			07/15/14	1.8	X	42	59	
119			08/27/14	1.0		saturated	65	
119			10/22/14	1.4		19		
119			07/08/15	1.5				
119			09/11/15					
120		none	05/20/14	1.1				
120			07/03/14	1.0				
120			07/15/14	1.3	X	39	60	
120			08/27/14	0.9		saturated	62	
120			10/22/14	0.9		20	54	
120			07/08/15	0.8		51.6		
120			09/11/15					
125		none	05/20/14	3.0				
125			07/03/14	3.7				
125			07/15/14	2.9	X	47	62	
125			08/27/14	3.5		saturated	64	
125			10/22/14	2.9		22		
125			07/08/15	3.8				
125			09/11/15					
131		none	05/20/14	3.1				
131			07/03/14	4.9				
131			07/15/14	4.1	X		64	
131			08/27/14	4.5		saturated	62	
131			10/22/14	3.1		45		
131			07/08/15	3.9				
131			09/11/15					
132		none	05/20/14	0.8				
132			07/03/14	0.9				
132			07/15/14	0.7	X		62	
132			08/27/14	0.9		saturated	63	
132			10/22/14	0.5		16		
132			07/08/15	0.8		47.9		
132			09/11/15					
133		none	05/20/14	1.6				
133			07/03/14	1.8				
133			07/15/14	2.3	X	38	63	
133			08/27/14	1.6		saturated	63	
133			10/22/14	1.6		41		
133			07/08/15	2.3				
133			09/11/15					
134		none	05/20/14	3.4				
134			07/03/14	3.0				
134			07/15/14	3.1	X	35	64	
134			08/27/14	2.2		saturated	64	
134			10/22/14	2.2		23		
134			07/08/15	2.6				
134			09/11/15					

Plot #	Accession	Beginning Salinity Value	Date	Salinity (mmhos)	Height (ft)	Soil Moisture (%)	Soil Temp. (degrees F)	Notes
135		none	05/20/14	2.3				
135			07/03/14	2.9				
135			07/15/14	2.9	X	23	64	
135			08/27/14	2.7		saturated	65	
135			10/22/14	2.5		30		
135			07/08/15	2.6				
135			09/11/15					
136		none	05/20/14	3.1				
136			07/03/14	3.0				
136			07/15/14	2.3	X	49	62	
136			08/27/14	2.9		saturated	63	
136			10/22/14	2.4		36		
136			07/08/15	3				
136			09/11/15					
137		none	05/20/14	1.0				
137			07/03/14	1.3				
137			07/15/14	1.4	X	23	61	
137			08/27/14	1.0		saturated	63	
137			10/22/14	1.5		20		
137			07/08/15	1.1		50.6		
137			09/11/15					
138		none	05/20/14	1.7				
138			07/03/14	2.3				
138			07/15/14	2.2	X	38	61	
138			08/27/14	2.4		saturated	64	
138			10/22/14	1.2		23		
138			07/08/15	2.5				
138			09/11/15					
141		none	05/20/14	3.8				
141			07/03/14	3.7				
141			07/15/14	2.3	X		63	
141			08/27/14	3.9		saturated	63	
141			10/22/14	2.8		51		
141			07/08/15	3.6				
141			09/11/15					
142		none	05/20/14	3.5				
142			07/03/14	3.7				
142			07/15/14	3.8	X	52	63	
142			08/27/14	3.5		saturated	64	
142			10/22/14	3.3		44		
142			07/08/15	3.7				
142			09/11/15					
145		none	05/20/14	3.9				
145			07/03/14	5.0				
145			07/15/14	5.4	X		64	
145			08/27/14	4.7		saturated	64	
145			10/22/14	4.8				
145			07/08/15	4.1				
145			09/11/15					

Plot #	Accession	Beginning Salinity Value	Date	Salinity (mmhos)	Height (ft)	Soil Moisture (%)	Soil Temp. (degrees F)	Notes
148		none	05/20/14	2.9				
148			07/03/14	2.9				
148			07/15/14	2.6	X	38	64	
148			08/27/14	2.4		saturated	64	
148			10/22/14	2.6		35		
148			07/08/15	3.9				
148			09/11/15					
149		none	05/20/14	0.9				
149			07/03/14	0.8				
149			07/15/14	0.7	X	19	62	
149			08/27/14	0.6		saturated	64	
149			10/22/14	0.6		13		
149			07/08/15	1.2		47.1	67	
149			09/11/15					
150		none	05/20/14	1.6				
150			07/03/14	2.6				
150			07/15/14	2.7	X	39	63	
150			08/27/14	2.4		saturated	65	
150			10/22/14	2.5		36		
150			07/08/15	3.1			64	
150			09/11/15					
151		none	05/20/14	1.5				
151			07/03/14	1.2				
151			07/15/14	1.3	X	18	62	
151			08/27/14	1.1		saturated	65	
151			10/22/14	1.1		35		
151			07/08/15	1.2				
151			09/11/15					
152		none	05/20/14	3.0				
152			07/03/14	2.8				
152			07/15/14	2.9	X	43	63	
152			08/27/14	2.0		saturated	63	
152			10/22/14	2.2		25		
152			07/08/15	1.9				
152			09/11/15					
155		none	05/20/14	2.7				
155			07/03/14	3.1				
155			07/15/14	2	X	44	62	
155			08/27/14	2.9		saturated	64	
155			10/22/14	2.8		27		
155			07/08/15	3				
155			09/11/15					
156		none	05/20/14	3.1				
156			07/03/14	3.1				
156			07/15/14	2.5	X	46	62	
156			08/27/14	3.5		saturated	62	
156			10/22/14	2.6		41		
156			07/08/15	3.2				
156			09/11/15					

Plot #	Accession	Beginning Salinity Value	Date	Salinity (mmhos)	Height (ft)	Soil Moisture (%)	Soil Temp. (degrees F)	Notes
157		none	05/20/14	3.9				
157			07/03/14	4.6				
157			07/15/14	2.1	X	44	61	
157			08/27/14	4.3		saturated	62	
157			10/22/14	2.6		33		
157			07/08/15	3.7				
157			09/11/15					
158		none	05/20/14	3.9				
158			07/03/14	4.8				
158			07/15/14	3.7	X	36	62	
158			08/27/14	4.3		saturated	64	
158			10/22/14	3.4				
158			07/08/15	4.1				
158			09/11/15					
163		none	05/20/14	3.0				
163			07/03/14	3.0				
163			07/15/14	1.8	X	39	63	needs stake
163			08/27/14	2.3		saturated	65	needs stake
163			10/22/14	2.2		32		
163			07/08/15	3.4				
163			09/11/15					
164		none	05/20/14	0.8				
164			07/03/14	0.9				
164			07/15/14	0.8	X	22	63	
164			08/27/14	0.5		saturated	62	
164			10/22/14	0.7		14		
164			07/08/15	1		47.4		
164			09/11/15					
165		none	05/20/14	1.2				
165			07/03/14	1.2				
165			07/15/14	0.1	X	21	63	
165			08/27/14	1.0		saturated	63	
165			10/22/14	1.3		28		
165			07/08/15	1.3				
165			09/11/15					
166		none	05/20/14	2.7				
166			07/03/14	2.1				
166			07/15/14	2.1	X	46	63	
166			08/27/14	1.8		saturated	64	
166			10/22/14	2.5		40		
166			07/08/15	2.6				
166			09/11/15					
170		none	05/20/14	3.7				
170			07/03/14	3.9				
170			07/15/14	2.7	X	46	63	
170			08/27/14	2.4		saturated	62	
170			10/22/14	2.8		40		
170			07/08/15	4				
170			09/11/15					

Plot #	Accession	Beginning Salinity Value	Date	Salinity (mmhos)	Height (ft)	Soil Moisture (%)	Soil Temp. (degrees F)	Notes
171		none	05/20/14	1.5				
171			07/03/14	3.3				
171			07/15/14	3.1	X	46	63	
171			08/27/14	2.4		saturated	63	
171			10/22/14	2.4		32		
171			07/08/15	3.4				
171			09/11/15					
176		moderate	05/20/14	10.7				
176			07/03/14	9.5				
176			07/15/14	8.3	X		65	
176			08/27/14	10.0		saturated	65	
176			10/22/14	7.7				
176			07/08/15		9.5			
176			09/11/15					
178		none	05/20/14	2.2				
178			07/03/14	2.3				
178			07/15/14	2.3	X	40	64	
178			08/27/14	2.1		saturated	63	
178			10/22/14	3.6		38		
178			07/08/15	3.7				
178			09/11/15					
179		none	05/20/14	0.6				
179			07/03/14	1.6				
179			07/15/14	1.6	X	20	64	
179			08/27/14	1.2		saturated	63	
179			10/22/14	0.9		16		
179			07/08/15	1.4		49.4		
179			09/11/15					
180		none	05/20/14	1.7				
180			07/03/14	3.4				
180			07/15/14	2.6	X	26	64	
180			08/27/14	3.0		saturated	62	
180			10/22/14	2.7		18		
180			07/08/15	3.3				
180			09/11/15					
183		none	05/20/14	2.5				
183			07/03/14	2.3				
183			07/15/14	2.9	X	48	62	
183			08/27/14	1.8		saturated	63	
183			10/22/14	1.8		43		
183			07/08/15	2.4				
183			09/11/15					
184		none	05/20/14	3.4				
184			07/03/14	3.3				
184			07/15/14	2.4	X	48	60	
184			08/27/14	3.2		saturated	62	
184			10/22/14	2.8		50		
184			07/08/15	2.7				
184			09/11/15					

Plot #	Accession	Beginning Salinity Value	Date	Salinity (mmhos)	Height (ft)	Soil Moisture (%)	Soil Temp. (degrees F)	Notes
185		none	05/20/14	3.3				
185			07/03/14	2.3				
185			07/15/14	2.6	X	50	61	
185			08/27/14	3.2		saturated	63	
185			10/22/14	2.3		49		
185			07/08/15	3.4				
185			09/11/15					
186		none	05/20/14	3.0				
186			07/03/14	3.3				
186			07/15/14	2.5	X	39	62	
186			08/27/14	2.8		saturated	62	
186			10/22/14	2.1		34		
186			07/08/15	3.1				
186			09/11/15					
191		strong	05/20/14	11.4				
191			07/03/14	10.0				
191			07/15/14	1.2	X		68	
191			08/27/14	9.8		saturated	65	
191			10/22/14	9.1				
191			07/08/15	11.4				
191			09/11/15					
193		none	05/20/14	3.3				
193			07/03/14	3.7				
193			07/15/14	3.4	X	39	66	
193			08/27/14	3.2		saturated	63	
193			10/22/14	3.5		36		
193			07/08/15	4.3				
193			09/11/15					
194		none	05/20/14	3.6				
194			07/03/14	3.6				
194			07/15/14	3.5	X	35	65	
194			08/27/14	2.8		saturated	64	
194			10/22/14	2.2				
194			07/08/15	3.7				
194			09/11/15					
199		none	05/20/14	3.6				
199			07/03/14	3.4				
199			07/15/14	2.4	X		62	
199			08/27/14	3.0		saturated	64	
199			10/22/14	2.7				
199			07/08/15	3.2				dense grass canopy
199			09/11/15					
200		none	05/20/14	3.3				
200			07/03/14	3.0				
200			07/15/14	2.7	X		62	
200			08/27/14	2.9		saturated	62	
200			10/22/14	2.8		41		
200			07/08/15	3.4				dense grass canopy
200			09/11/15					

Plot #	Accession	Beginning Salinity Value	Date	Salinity (mmhos)	Height (ft)	Soil Moisture (%)	Soil Temp. (degrees F)	Notes
202		strong	05/20/14	11.7				
202			07/03/14	9.9				
202			07/15/14	8.6	X		64	
202			08/27/14	8.4		saturated	64	
202			10/22/14	8.4				
202			07/08/15	9.1				
202			09/11/15					
204		strong	05/20/14	11.1				
204			07/03/14	8.1				
204			07/15/14	8.1	X		66	
204			08/27/14	9.2		saturated	64	
204			10/22/14	8.3				
204			07/08/15	10.5				
204			09/11/15					
207		strong	05/20/14	11.1				
207			07/03/14	10.1				
207			07/15/14	8.3	X		67	
207			08/27/14	9.2		saturated	65	
207			10/22/14	7.8				
207			07/08/15	8.3				
207			09/11/15					
209		none	05/20/14	3.0				
209			07/03/14	3.2				
209			07/15/14	2.8	X		62	
209			08/27/14	3.5		saturated	64	
209			10/22/14	2.7		39		
209			07/08/15	4.1				
209			09/11/15					
212		none	05/20/14	2.9				
212			07/03/14	4.0				
212			07/15/14	3.9	X		64	
212			08/27/14	4.1		saturated	64	
212			10/22/14	4.6		36		
212			07/08/15	4				
212			09/11/15					
218		strong	05/20/14	10.8				
218			07/03/14	10.1				
218			07/15/14	8.6	X		69	
218			08/27/14	9.1		saturated	64	
218			10/22/14	9.6			55	
218			07/08/15	10.8				
218			09/11/15					
220		none	05/20/14	2.2				
220			07/03/14	3.1				
220			07/15/14	1.6	X		66	
220			08/27/14	2.7		saturated	64	
220			10/22/14	2.6		40		
220			07/08/15	4				
220			09/11/15					

Plot #	Accession	Beginning Salinity Value	Date	Salinity (mmhos)	Height (ft)	Soil Moisture (%)	Soil Temp. (degrees F)	Notes
221		none	05/20/14	0.7				
221			07/03/14	0.9				
221			07/15/14	0.9	X		68	
221			08/27/14	0.6		saturated	62	
221			10/22/14	1.1		13		
221			07/08/15	1.2		51.2		
221			09/11/15					
222		none	05/20/14	3.1				
222			07/03/14	2.1				
222			07/15/14	0.4	X		65	
222			08/27/14	1.4		saturated	62	
222			10/22/14	1.4		11		
222			07/08/15	2.7				
222			09/11/15					
224		none	05/20/14	3.0				
224			07/03/14	2.8				
224			07/15/14	2.5	X		63	
224			08/27/14	2.5		saturated	62	
224			10/22/14	2.4		34		
224			07/08/15	3.5				
224			09/11/15					
227		moderate	05/20/14	10.3				
227			07/03/14	9.5				
227			07/15/14	6.1	X		68	
227			08/27/14	8.9		saturated	65	
227			10/22/14	4.6				
227			07/08/15	8.9				
227			09/11/15					
229		strong	05/20/14	14.5				
229			07/03/14	11.0				
229			07/15/14	9.2	X		70	
229			08/27/14	9.1		saturated	66	
229			10/22/14	8.8				
229			07/08/15	11.2				
229			09/11/15					
231		none	05/20/14	2.7				
231			07/03/14	3.5				
231			07/15/14	3.4	X		66	
231			08/27/14	3.4		saturated	64	
231			10/22/14	3.5		32		
231			07/08/15	4.2				
231			09/11/15					
232		none	05/20/14	0.7				
232			07/03/14	0.8				
232			07/15/14	0.8	X		65	
232			08/27/14	0.6		saturated	63	
232			10/22/14	0.6		19		
232			07/08/15	0.9		50.1		
232			09/11/15					

Plot #	Accession	Beginning Salinity Value	Date	Salinity (mmhos)	Height (ft)	Soil Moisture (%)	Soil Temp. (degrees F)	Notes
233		none	05/20/14	3.0				
233			07/03/14	3.3				
233			07/15/14	2.5	X		67	
233			08/27/14	3.0		saturated	63	
233			10/22/14	0.9		13		
233			07/08/15	3.3				
233			09/11/15					
234		slight	05/20/14	3.3				
234			07/03/14	3.3				
234			07/15/14	2.8	X		65	
234			08/27/14	3.2		saturated	61	
234			10/22/14	2.6				
234			07/08/15	3.4				
234			09/11/15					
235		none	05/20/14	1.5				
235			07/03/14	1.5				
235			07/15/14	1.4	X		63	
235			08/27/14	1.7		saturated	63	
235			10/22/14	1.6		32		
235			07/08/15	1.3				
235			09/11/15					
243		strong	05/20/14	11.6				
243			07/03/14	8.7				
243			07/15/14	7.8	X		67	
243			08/27/14	8.4		saturated	65	
243			10/22/14	7.9				
243			07/08/15	8.6				
243			09/11/15					
245		none	05/20/14	3.1				
245			07/03/14	3.6				
245			07/15/14	2.7	X	26	67	
245			08/27/14	3.7		saturated	64	
245			10/22/14	3.3				
245			07/08/15	4.1				
245			09/11/15					
251		strong	05/20/14	10.3				
251			07/03/14	8.5				
251			07/15/14	7.9	X		65	
251			08/27/14	8.5		saturated	64	
251			10/22/14	1.8				
251			07/08/15	8.3				
251			09/11/15					
252		moderate	05/20/14	9.7				
252			07/03/14	9.5				
252			07/15/14	8	X		65	
252			08/27/14	7.9		saturated	64	
252			10/22/14	7.6				
252			07/08/15	8.7				
252			09/11/15					

Plot #	Accession	Beginning Salinity Value	Date	Salinity (mmhos)	Height (ft)	Soil Moisture (%)	Soil Temp. (degrees F)	Notes
253		moderate	05/20/14	8.2				
253			07/03/14	6.3				
253			07/15/14	6.3	X		64	
253			08/27/14	6.6		saturated	64	
253			10/22/14	5.1				
253			07/08/15	6.9				
253			09/11/15					
257		none	05/20/14	3.5				
257			07/03/14	3.2				
257			07/15/14	3.1	X	42	62	
257			08/27/14	3.2		saturated	65	
257			10/22/14	2.0		19		
257			07/08/15	3.5				
257			09/11/15					
258		moderate	05/20/14	10.0				
258			07/03/14	9.0				
258			07/15/14	7	X		65	
258			08/27/14	7.2		saturated	65	
258			10/22/14	8.4				
258			07/08/15	0.75				
258			09/11/15					
260		none	05/20/14	3.2				
260			07/03/14	3.4				
260			07/15/14	2.5	X		64	
260			08/27/14	2.5		saturated	63	
260			10/22/14	2.5		18		
260			07/08/15	3.7				
260			09/11/15					
262		none	05/20/14	2.8				
262			07/03/14	2.5				
262			07/15/14	2.3	X	35	63	
262			08/27/14	2.3		saturated	64	
262			10/22/14	1.2		42		
262			07/08/15	3.1				
262			09/11/15					

SELECTION AND INCREASE

SELECTION AND INCREASE: TECHNICAL REPORT – 2015

Promising Woody Plant Material

The following accessions show potential for further evaluation and potential release:

Genus/species	Accession Number	Origin	Remarks
Roundleaf hawthorn <i>Crataegus chrysoarpa</i>	9076678	5 South Dakota counties	Field plantings, seed increase, Serious fire blight threatens the existence of this planting.
Bur oak <i>Quercus macrocarpa</i>	TBD, composite	Several states	ARS nursery converted to seed orchard. Culls have been removed and the canopies raised. Currently no demand for seed.
Chokecherry <i>Prunus virginiana</i>	TBD	TBD	NDSU breeding program. Some clones show apparent resistance to X- disease.
Chokecherry <i>Prunus virginiana</i>	9008183	Sheridan County, ND	Future is uncertain. Trees large and healthy. Replicated in NDSU study.
Black cherry <i>Prunus serotina</i>	9076737	Faribault and Anoka Counties, MN	In field plantings. In ND, SD, and MN FOTGs
Skunkbush sumac <i>Rhus trilobata</i>	TBD	TBD	Study will be closed out. Material will be left with minimal maintenance.
Common ninebark <i>Physocarpus opulifolius</i>	9082891	IA (seed source)	Field plantings, from Big Sioux Nursery, Watertown, SD.
Meyers spruce <i>Picea meyerii</i>	9094411	China	Field plantings. Proving to be more difficult to establish.
Mongolian Scots pine <i>Pinus sylvestris</i> var. <i>mongolica</i>	9094403	China	Field plantings, composite of 9063158, 9069172, 9076719, 9076718, 9069164. These seed sources may be resistant to pine nematode. Collected seed from Morris and Becker in 2015 to restock supplies.
Lodgepole pine <i>Pinus contorta</i> var. <i>latifolia</i>	9094433	Colorado to Canada	Has performed well at ARS and in two 8-year trials in ND. Will initiate Off-Center testing and field plantings in 2014. Suffered more severely from 2013 hail storm than did Ponderosa and Mongolian pine.
Douglas fir <i>Pseudotsuga menziesii</i>	9094341 9094342	Unknown	80-year-old trees at ARS; 64- year old trees at Hillside Park in Bismarck. Towner State Nursery is growing out seed for OCEP 2015 and 2016 field plantings. Goal is to add another tree genus to spread risk of failure due to pests and weather. 2016 field planting stock from Hillside seed source.