

Potential Grass Releases

Plant evaluation, selection and release continue to be important functions of the Plant Materials Program. Releases from the Bismarck Plant Materials Center provide farmers and ranchers with sources of grasses, forbs and trees adapted to the Northern Great Plains. Grass species currently being evaluated for potential release are listed below. Progress and future evaluation plans by the PMC are also listed.

Virginia wildrye (*Elymus virginicus*): A composite of material with ND, SD, and MN origins comprises the breeder population. A seed production field planted in 2013 is expected to produce seed in 2014. Conservation field trials to compare the selected population with the cultivar ‘Omaha’ are being planned for spring of 2014. Trials to evaluate the species as a weed control measure in new tree plantings are also being planned for 2014.

Indiangrass (*Sorghastrum nutans*): A breeder population from 25 Minnesota sources is producing seed at the PMC. The population is much leafier than the cultivar ‘Tomahawk’. A seed production field was planted in 2013. Additional data will be collected on the breeder population in 2014.

Prairie dropseed (*Sporobolus heterolepis*): Seed selected from SD, ND, and MN populations was grown to produce the breeder population. Large seed was selected as a means to improve the poor seedling vigor and improve establishment. Breeder seed was harvested in 2012 and 2013. An establishment trial and seed increase field will be planted in 2014.

Prairie sandreed (*Calamovilfa longifolia*): Selections with Minnesota origins comprise the breeder population. Plants selected showed some tolerance to foliar and stem diseases. Breeder seed was produced in 2013. Trials will be seeded in 2014 to compare performance of the releases Koch and Goshen to the Bismarck PMC selection.

Sand bluestem (*Andropogon hallii*): No release of sand bluestem consistently produces viable seed in the Northern Great Plains. Plants from a small assembly at the PMC that produced seed were designated as a breeder population in 2012. Some of the selected plants exhibited big bluestem characteristics in 2013, so were eliminated from the population. Additional evaluation and selection is needed to choose a breeder population.



prairie dropseed

Cupplant

Cupplant (*Silphium perfoliatum*) is a perennial forb, native to the tall grass prairie region of the Great Plains. In North and South Dakota, it is native only in extreme eastern portions of each state. It is a square-stemmed plant that can grow to 7 feet tall. The leaves join the stem to form cups where water can accumulate for use by insects and birds. The flowers appear similar to small sunflowers. It produces abundant biomass and has an extensive root system. It attracts various pollinator species. It is naturally found in lowland prairies and open woodlands.

Seed was collected from Ransom County, ND in 2011. Ransom County is on the northern edge of cupplant’s natural range.

A small plot of cupplant was planted at the PMC in the spring of 2012 from the Ransom County seed. There are seven 100-foot long rows, spaced 8 feet apart with plants spaced 3 feet apart. The plot was established from 4-month-old seedlings grown in the greenhouse. Seed was exposed to cold, wet stratification for 3 months prior to greenhouse seeding. Greenhouse seedlings were planted to the field on June 11, 2012. The first year produced only rosette growth, which is typical of the species.

Growth in 2013 was good, with an average height at harvesting



*Native stand of cupplant in Ransom County
(Andy Hoenhause, landowner)*

of over 6 feet. The first seed harvest from the PMC plot was in late September 2013. Seed production was good and seed is currently being cleaned. There was no sign of insect damage from *Eucosma giganteana*, a species known to damage growing terminal buds in cupplant (species described by Paul Johnson, SDSU entomologist).

Plant data will be taken and seed will be harvested for the next 3-5 years. Depending on plant performance, a northern origin release will be considered.

AC Saltlander Quackgrass Comparison

The quest continues for plant species that can be seeded on saline sites. AC Saltlander and NewHy are two grass releases that have tolerance to saline conditions and have potential to produce abundant forage. AC Saltlander is a natural cross between quackgrass and Eurasian bluebunch wheatgrass. It was originally found in Turkey. NewHy is a cross between quackgrass and North American bluebunch wheatgrass. It was developed by researchers in Utah and Saskatchewan. Though both releases were selected for the bunch type growth of its bluebunch parent, questions have been raised concerning their potential rhizome spread.

The PMC planted a replicated trial to evaluate spread of both releases. Seedlings were grown in the greenhouse and transplanted to a PMC field plot in 2012. Spread and plant size were compared to quackgrass and smooth brome (a common rhizomatous grass). Growth was similar for all entries the first year. Biomass production and spread were measured in 2013. Quackgrass appeared to spread the longest distance overall. Forage yields were similar for all entries. Some of the data collected is summarized in the table below.

Date	Parameter	AC Saltlander	NewHy	Brome	Quackgrass
9/12/2012	Plant width	31.1	31.9	27.7	28.7
5/16/2013	Plant width	32.75	31.35	24.7	38.8
7/12/2013	Plant width	39.85	34.75	29.9	46.9
7/12/2013	Dry matter (Kg)*	5.1	5.3	5.3	5.3

* weight based on 10 plants per plot

Lodgepole pine (*Pinus contorta*)

For nearly a decade the USDA-ARS Northern Great Plains Research Lab and the Plant Materials Center have been monitoring a lodgepole pine study in Mandan, ND. Twenty-five seed sources from 5 states and 3 Canadian provinces were established in a provenance study in 1980. After 15 years, they were scored by Dr. Rich Cunningham, the lead researcher at ARS. In 2006, PMC staff collected cones from the best looking and highest scoring seed sources. Three field plantings on public and private land were established in 2008 from this seed. Based on these field plantings, seed sources were reselected and seed was collected in 2012.

The growth rate of lodgepole pine has been similar to ponderosa pine in all of our studies. Lodgepole pine has a darker green foliage color than ponderosa or Scotch pine and has about a 10% lower initial establishment rate.

Cone harvest and plot maintenance has been time consuming and challenging. Seed of lodgepole pine as well as other types of pine must be harvested before the cone scales open and seeds are dispersed. The trees have grown so large over the last 33 years that extensive pruning was needed to allow bucket truck access for cone harvest. Over 30 gallons of cones were collected from 8 seed sources in 2013.

Lodgepole pine seedlings from selected seed sources (seed collected in 2012) will be available for 2014 field plantings.



Lodgepole pine provenance test before and after partial pruning



ARS Bur Oak (*Quercus macrocarpa*)

A bur oak provenance test established in 1993 at the USDA-ARS Northern Great Plains Research Lab in Mandan, ND, has been converted to a seed orchard by removing poorer scoring selections and plot debris. Canopy raising (pruning), thinning and cleanup has been completed on a portion of the site. As a result, maintenance will be easier. Anticipated future maintenance consists of one to two mowings and a single application of glyphosate. Seed from the site will be available to conservation nurseries interested in superior seed sources of bur oak.

Aerial view of bur oak seed orchard showing chemical weed control around selected trees



The Nature Conservancy Cottonwood (*Populus deltoides*) Restoration Study

Since the installation of Garrison Dam, the Missouri River north of Bismarck has been downcutting. Very little cottonwood regeneration has naturally occurred. Due to the downcutting and sandy nature of the river bottom soils, much of what was once an extensive cottonwood growing site has become droughty and suitable only for growing a few conifers and drought tolerant hardwoods.

Methods to establish cottonwoods in these dewatered flood plains were explored. There were three different plant stock types evaluated: 6-foot unrooted cuttings (modified from an Idaho PMC procedure), deep pots (modified from New Mexico and Montana PMC techniques) and traditional conservation grade planting stock.

The 6-foot cuttings were waterjetted into the ground 6 feet, hoping to reach the capillary fringe of the water table. (High pressure water was used to drill a 6-foot deep planting hole in about 10 seconds.) The deep pot material was 3-5 feet tall growing out of a 4-inch x 4-inch x 14-inch pot and was planted in a hole drilled 4 feet deep with a tractor powered post auger. The conservation stock was planted by hand in the traditional way. Weed control fabric squares were placed around one-half the entries of each stock type.

As of September all deep pot plants had grown, with most growing out the top of 4-foot tree shelters. The conservation stock was mostly alive with heights of 3-4 feet. Disappointedly, most of the unrooted cuttings did not survive the summer. Based on test well data from the middle of each plot, the water table was never closer than 8.5 feet to the surface, so the unrooted cuttings were never in saturated soils.

It will be interesting to see the survival over winter. Winter stress may show a difference between plants protected with weed control fabric and those without fabric. The study will be repeated again next spring on sites with a greater likelihood of a water table within 5-6 feet of the surface.



Firming soil on a deep pot cottonwood planted 4 feet deep



Preparing 6-foot deep unrooted cutting hole with water jet stinger



After one season most deep pot material is growing out the top of 4-foot tree shelters

Skunkbush Sumac (*Rhus trilobata*)

This study was initially established to determine the resistance of 25 seed sources to commonly occurring leaf spot diseases. Through personnel and program direction changes this study is now inactive. The plant material will be maintained but future evaluations and analysis are not planned.

Knowledge acquired to date:

- ‘Konza’, a release from the Manhattan, KS Plant Materials Center, appears to be the most robust with the least amount of leaf spot after 3 years.
- ‘Bighorn’, a release from Los Lunas, NM Plant Materials Center, exhibited a high degree of limb breakage at weak forks.
- Though the Transline label lists sumac, it caused considerable damage to the skunkbush sumac. It did provide good thistle control. Followup with chemical representatives concluded that the chemical studies were conducted using Staghorn sumac rather than skunkbush.
- Seeding a dense stand of blue grama between the rows greatly reduces maintenance and erosion.



‘Konza’ skunkbush sumac growing in nearly weed free blue grama sod

National Park Reimbursable Projects

The Bismarck PMC continues to partner with USDI, National Park Service. Four reimbursable agreements are in place for seed production of native grasses. This seed is to be used for reclamation of disturbed sites within the boundaries of the park. Active agreements in 2013 were with Grand Teton National Park, Badlands National Park, Theodore Roosevelt National Park, and Mount Rushmore National Monument. The parks each identified key species for reclamation activities and collected seed generally within their park boundaries of those species. The seed was cleaned at the PMC, germination and purity tested, and then planted to establish seed increase fields. The seed produced from the PMC fields is harvested, cleaned and distributed to the parks. In 2013, ten seed production fields were harvested. Total bulk seed was over 3,300 pounds. The seed is being cleaned at the PMC and will be tested and available to the parks in the spring of 2014. The following table shows species grown for each of the park agreements.



Blue grama seed production field at the PMC

Badlands National Park	Western wheatgrass	Green needlegrass	Sand dropseed	Blue grama
Theodore Roosevelt National Park	Western wheatgrass	Prairie junegrass	Blue grama	Sideoats grama
Grand Teton National Park	Slender wheatgrass	Mountain brome grass		
Mt. Rushmore National Monument	Big bluestem	Little bluestem		

Warm-Season Grass Seeding Date Trial

Spring seeding dates are recommended for native warm-season grasses in the Northern Great Plains. Some years, moisture and temperature conditions for planting are unfavorable in the spring. Late summer, dormant and snow seedings have been successful at times, but results have been sporadic. Most warm-season grass plantings have been on black, conventionally tilled sites. Will establishment outcomes be different with recently popular no-till farming practices?

A replicated trial to compare 3 seeding dates and 3 seedbed types has begun at the PMC. The 3 seeding dates are spring, late summer, and dormant (late fall). The 3 seedbeds, which provide different amounts of residue, are barley stubble, barley stubble planted with millet after barley harvest, and black-tilled. The warm-season species included in each planting are big bluestem, switchgrass, sideoats grama, Indiangrass, and blue grama. Canada wildrye, a cool-season species known to be successful in dormant plantings is being used as a check. The first seeding was in late summer on August 20, 2013. A dormant seeding was on November 5, 2013. The spring seeding will be in late May /early June of 2014. Temperature and moisture conditions have been recorded at each planting date and will be recorded for the spring planting. Temperature and moisture will also be recorded beginning in late winter when air temperatures begin to fluctuate above freezing.

The late summer seeding showed little or no above-ground growth by the time of a killing frost in 2013. Canada wildrye

was the only identifiable seedling. Overall height of the few seedlings was an inch or less. Seedlings will be counted in all plots in 2014 and 2015.

The entire study will be duplicated at the PMC, beginning in 2014. As weather conditions vary, seeding in multiple years should better determine reliability of results.

Foundation Seed Report

Seed production in 2013 was generally good on all PMC seed increase fields. Over 7,000 pounds of foundation seed of 14 varieties were harvested. This seed is currently being cleaned and tested and will be available to commercial growers in the spring of 2014. Fifteen varieties of foundation seed totaling 4,618 PLS pounds was distributed to 11 growers in 2013. Interest in commercial seed production has increased somewhat from previous years. Since 1996, more than 44,000 pounds of foundation seed of 24 grass and forb releases has been distributed to commercial growers. The goal of PMC foundation seed production is to maintain supplies of high quality foundation seed of the 40 PMC cooperative releases. This seed is made available to commercial growers to produce seed that is readily available for conservation plantings. What this means to the conservationist is a reliable supply of quality northern hardy seed. More information on all [conservation plant releases](#) can be viewed at the Bismarck PMC website release section.



Harvesting 'Mandan' Canada wildrye. It was released in 1946, and is still a popular variety used in conservation plantings today.

Field Plantings

Field plantings provide opportunity to assess plant materials across our region at numerous off-center locations with a diversity of environmental conditions. All of the current field plantings in our service area are tree and shrub species evaluated for potential conservation use. Field plantings also provide valuable information for the NRCS Field Office Technical Guide and related publications. Field offices have been extremely cooperative in soliciting and working with area landowners to plan and install each planting, and provide oversight and annual evaluation of each species/variety during its initial 5 years. Entries planted in previous years that are still under evaluation are black cherry, pin cherry, common ninebark, and white poplar. In 2013, twenty-eight cooperators planted 418 Meyer's spruce and 522 Mongolian Scots pine in 40 plantings across the PMC service area. There are currently 69 cooperators and 94 active tree and shrub field plantings across MN, ND, and SD. Deer browse, herbicide damage, weed/grass competition, cultivator blight, drought, winter injury, and saturated soils were the most prevalent reasons for poor performance and stand loss. Saturated soils and high humidity in 2011 resulted in greater mortality of the cherry species where those conditions existed. Mortality in common ninebark was higher in 2013, and only 50% of those plantings remain active after 3 years. The evaluation summary is shown in the following table.



Well-maintained field planting in Hennepin County, MN (Jack Wahlfors, landowner)

Year(s) Planted	Species	Total Plantings (Average 25 plants/planting)	Active Plantings as of 12/31/13	% of Plantings Still Active	% Survival in Remaining Plantings	Performance Rating of Active Plantings (1-10; 1 = Best)
2008/09	Pin cherry	31	9	29%	74	4.2
2008/09	Black cherry	43	16	37%	68	4.0
2010/11	Common ninebark	26	13	50%	56	5.2
2010/11	White poplar	6	4	67%	65	3.3
2013	Meyer's spruce	16	15	94%	81	2.4
2013	Mongolian pine	23	22	96%	82	3.0

Carrington, ND Salinity Trial

This is an ongoing project with area soil conservation districts and NDSU Carrington Research Extension Center. The field trial was established to evaluate forages that best establish from seed and continue to grow and develop in saline-affected soils. The PMC assists cooperators with annual clipping of forage samples to determine production and forage quality of species/variety at different salinity gradients in the plots.

Species and yield data that exceeded the average production at each salinity level are shown in red in the table below. This is summarized data from the first 3 years of forage clipping indicating the average production of both plot locations in the Carrington study. There is a considerable amount of data yet to be collected before the conclusion of this study in 2015.

The second table below indicates forage quality from the samples collected in 2013. Numbers and species in red indicate those that were better than the average of all samples combined.



Clipping cool-season grass in salinity trial plot

3 Yr. Carrington Production Averages			Clip 1		Clip 2		Clip 3		Clip 4		Clip 5		AVG EC @ 2" dS/m	AVG Yield T/A
Species	Type	Variety	EC @ 2" dS/m	Dry Tons/Acre	EC @ 2" dS/m	Dry Tons/Acre	EC @ 2" dS/m	Dry Tons/Acre	EC @ 2" dS/m	Dry Tons/Acre	EC @ 2" dS/m	Dry Tons/Acre		
Foxtail	Creeping	Garrison	4.5	2.9	5.1	2.4	5.7	2.3	6.2	2.2	5.8	1.9	5.4	2.4
Bromegrass	Smooth	Lincoln	4.6	2.4	5.3	3.4	4.9	2.8	4.3	2.1	5.4	1.7	4.9	2.5
Bromegrass	Meadow	Fleet	3.6	2.5	3.9	2.6	4.7	1.4	4.1	2.0	4.2	1.6	4.1	2.0
Wildrye	Canada	Mandan	3.4	2.5	4.0	3.6	3.6	3.1	4.4	2.4	4.3	2.0	4.0	2.7
Wildrye	Beardless	Shoshone	2.5	2.3	4.0	3.0	3.9	1.9	5.5	2.2	6.1	3.2	4.4	2.5
Wheatgrass	Tall	Alkar	2.6	3.6	4.0	4.1	4.5	3.6	5.0	4.3	6.6	4.1	4.6	3.9
Wheatgrass	Slender	Revenue	2.3	3.0	3.8	3.8	3.9	3.1	4.8	3.3	6.4	2.6	4.2	3.2
Wheatgrass	Western	Rodan	1.9	2.8	3.8	2.7	4.3	2.2	5.2	2.6	7.0	2.3	4.5	2.5
Wheatgrass	Hybrid	NewHy	2.3	3.2	4.2	3.3	4.4	2.9	5.7	3.0	7.8	3.1	4.9	3.1
Wheatgrass	Green	AC Saltlander	1.9	3.2	4.3	3.3	4.8	3.6	6.5	3.8	7.3	2.5	5.0	3.3
Saltlander Forage Grass Mix			2.0	3.6	3.1	3.4	4.8	3.5	5.9	3.6	7.6	3.7	4.7	3.6
Mean -->			2.9	2.9	4.1	3.2	4.5	2.8	5.2	2.9	6.2	2.6	4.6	2.9

Unit system: SI derived unit
 Unit of: Electric conductance
 Symbol: S
 Named after: Werner von Siemens
 In SI base units: 1 S = 1 kg⁻¹·m²·s⁻³·A²

- EC dS/m = measurement of electrical conductance
- Higher numbers indicate increasing soil salinity
- By agricultural standards, soils with an EC greater than 4 dS/m are considered saline
- Numbers in red indicate higher forage production than the average of all species

2013 Carrington Salinity Trial - Forage Quality Averages						
Variety and Species	Crude Protein %	** Acid Detergent Fiber %	** Neutral Detergent Fiber %	**Crude Fiber %	Total Digestible Nutrient Estimate %	*** Relative Feed Value
Garrison Creeping Foxtail	4.15	43.63	64.37	34.91	52.80	80
Lincoln Smooth Bromegrass	4.71	41.58	62.11	33.27	55.14	85
Fleet Meadow Bromegrass	5.69	43.59	64.66	34.87	52.85	79
Mandan Canada Wildrye	5.64	41.15	66.07	32.92	55.63	80
Shoshone Beardless Wildrye	7.13	43.29	69.12	34.79	52.97	74
Alkar Tall Wheatgrass	5.77	46.64	72.66	37.31	49.37	67
Revenue Slender Wheatgrass	5.81	42.11	69.66	33.69	54.54	75
Rodan Western Wheatgrass	5.15	40.42	63.91	35.86	56.30	80
NewHy Hybrid Wheatgrass	4.85	40.63	62.33	32.50	56.23	85
AC Saltlander Green Wheatgrass	4.95	40.31	62.44	32.25	56.59	86
Saltlander Forage Mix	5.42	40.55	62.04	32.44	56.32	86
Averages-->	5.40	40.93	64.04	33.14	53.10	77

- * Numbers in red indicate better quality than the average of all species
- ** Lower percentages of Acid Detergent Fiber, Neutral Detergent Fiber, and Crude Fiber indicate better quality
- ***RFV= Relative Feed Value: an overall quality rating based on the other quality components

Conservation Field Trials

The Bismarck plant materials program provides support and assistance for numerous field trial plantings across our three-state area. Assistance included providing PMC foundation seeds and plant materials, equipment, manpower for seeding plots, clipping, analyzing plot production, and evaluation of the sites. There are numerous conservation field trial plantings in the PMC service area that provide opportunity to evaluate current and potential PMC releases and other plant materials in diverse soils and climatic environments.

The **Grasses and Forbs Field Trial** evaluation work was completed at the Bison and Wessington Springs, SD locations in 2012. Evaluation data will be included in the PMC technical report, and a summary of evaluation findings will also be provided in a separate publication.

The PMC continues to support the **Biomass/Biofuel Research Project** at Central Lakes College Ag and Energy Center in Staples, MN. The PMC provided seed and helped establish plots of several species of grasses that are being evaluated, harvested, and processed as a heat energy biofuel source. The PMC also provided 400 pounds of field pennycress seed to support alternative biofuels research. Their analysis indicates field pennycress seed has high oil content and good biofuel potential, so they are now moving forward with the production challenges of this winter annual.

The PMC provided technology and seeding assistance for the **Plankinton, SD Outdoor Classroom** located on Conservation District property. Forty different plots of individual grasses and grass and forb combinations were seeded in May 2012. The District also planted a number of different tree and shrub species adjacent to the herbaceous plots. This site is utilized for District educational purposes and the PMC will continue to provide technical assistance related to maintenance and evaluation of these plots.

In June 2013, the Marshall County, MN Conservation District established a **Grasses and Forbs Field Trial** on a site located on the Marshall County Fairground property. They also planted a variety of tree and shrub species adjacent to the herbaceous plots. The Bismarck PMC provided seed, seeding equipment, and technical assistance to prepare the seed mixes and seed the plots. Twenty individual species plots and seven plots of different program and pollinator mixes were established for educational purposes in their community. Several species of new and potential PMC releases were included for evaluation and comparison purposes in this trial. Carlson Seed Farm (an area commercial seed vendor) donated seed for most of the program mixes in this trial.

The PMC is working with South Dakota producer Curt Knight, NDSU Extension, and the Miller, SD field office on a field trial on **Stockpiling Grasses and Forbs for Winter Grazing**. Individual plots of mixed grass and mixed grass and forb species are being evaluated to determine which combinations provide optimum production and quality for a winter grazing program. A benchmark clipping for forage quality was completed in July, and individual plots will be sampled bimonthly for the next 2 years to collect needed data. Samples will be collected from areas of each plot where no forage has been removed by summer harvest, and from regrowth areas that received a summer harvest. The PMC is providing technical assistance with evaluating, sampling, and collecting data that will hopefully provide more plant options for livestock producers.



Forage plots at Curt Knight ranch

Windbreak Crop Response

The PMC forester has been working with NRCS and SCD staff as well as universities across the Great Plains and Canada to initiate a study evaluating the impacts of windbreaks on crop yield. Nearly a century of plot-scaled data shows yield increases. This study will utilize data from combine yield monitors and aerial photography to evaluate the impacts on a field-sized scale. With the currently available data, thousands of field years of information could be collected and analyzed in a short time. Currently, data collection methods are being fine-tuned while university partners seek ways to employ a statistician.

Training

Three one-day plant materials training events were provided for approximately 100 field staff at three South Dakota locations in August 2013. Workshop topics at Brookings, Chamberlain, and Wall included seed quality, understanding seed labels, establishment, drill calibration, post-establishment maintenance, grass identification, and soil health. The PMC provided field and plot tours for several groups during the year, and set up a booth display at the Mandan ARS summer field day event. Future training will include mini-events by video conference as we utilize that technology to reduce travel time and expenses, while having the ability to reach a larger audience.

Tribal Outreach

The Bismarck Plant Materials Specialist met with plant material representatives from five Minnesota tribes in April 2013 for roundtable discussions on needs and opportunities relative to the plant materials program in this region. Some of the topics included: species significant to the tribes, potential for future demonstration plantings, current plant and technology requests, and impacts of climate change on species preservation. A new Tribal plants request form was developed to streamline the request process, and a 2012 tribal report was provided for those who attended the meetings. Twelve tribal entities submitted requests for plant materials in 2013. Plants and seed provided included sweetgrass, white sage, prairie cordgrass, assorted fruit trees and shrubs, 12 different species of native grass seed, and 19 other species of transplants. Several plantings included youth involvement with planting, maintenance, and the cultural education components of these projects. The PMC assisted with a native grasses landscape demonstration planting adjacent to a new science building on the United Tribes Technical College campus in south Bismarck. Tribal interest in native and cultural plants continues to grow and is certainly stretching the PMC capacity to keep up with the demand.



Landscape demonstration planting at United Tribes Technical College

Douglas Fir (*Pseudotsuga menziesii* var. *glauca*)

Landowners and conservation districts across the Great Plains continually request additional tall tree species suitable for conservation plantings. For nearly 80 years, ten Douglas Fir trees have been growing at the ARS station in Mandan. Eighty years of growth indicate these individuals are adapted to the climatic variability of central North Dakota. Longevity of survival hints at their potential in conservation plantings across the Dakotas. Inclusion in the NRCS Field Office Technical Guide would be dependent on field planting results. This plant would add another species and genus to the North Dakota plant list. Adding another genus would increase resiliency to insects and disease in conservation plantings.

Towards this end, PMC staff rented and borrowed bucket lifts to harvest cones in August 2013. Cones were dried and tumbled to release seeds. Douglas fir has a narrow harvest window. Harvest was about 4 days later than optimum. Much



An opened Douglas fir cone

of the seed had been shed before harvest. Only 1000 viable seeds were gleaned from the 9 gallons of harvested cones.

Douglas fir seedlings should be available for 2015 field plantings. Field plantings will be used to determine the soils and the eastern boundary within the service area (ND, SD, MN) where it is adapted.



Ten Douglas fir at ARS

National Cover Crop Study

Cover crops play an important role in soil health. The Bismarck PMC along with PMCs in CA, WA, OR, MO, MD and FL began a national study in 2012 to determine the effects that different cover crop mixes and their seeding rates have on soil health. Mixes of two species, four species, and six species at 20, 40, and 60 seeds/ft² rates are being evaluated. The planned duration of the study is 4 years. Soil samples are collected prior to any planting and will continue throughout each year. Samples will be analyzed for various soil health indicators such as nitrogen, organic matter, bulk density, moisture, temperature, and soil biota. Each year a commodity crop will be planted using no-till methods. The commodity crop will be harvested and yields recorded. Planting of the cover crop mixes will follow. The cover crop planting will be terminated at the end of the growing season and biomass yields will be determined. At the Bismarck PMC, cover crop mixes were

planted in August 2012 and were terminated 9/25/2012. Soil sampling, canopy cover measurement, and biomass harvest were done in 2012. Barley was planted as the commodity crop on 5/8/2013. It was terminated on 8/6/2013 and the cover crop mixes were no-till planted into the barley stubble on 8/20/2013. The cover crops were terminated by frost on 10/30/2013.

The cover crops had good growth in 2012. All species were present at termination. Biomass yields ranged from approximately 3400-4500 lbs/ac for planted plots. The plot with no planted cover crop yielded approximately 2500 pounds/ac. The highest yielder was the four species mix planted at 60seeds/ft². In 2013, volunteer barley became the primary cover crop. Though the planted cover crop species were found at clipping, plants were very small and produced very little biomass. Biomass yields in 2013 ranged from 2600 lbs/ac to over 3100 lbs/ac. Greater than 90% of the yield was barley. Cover crops appeared to greatly suppress weeds in 2012 and 2013.

Soil tests at the beginning of the study showed great amounts of total nitrogen. Overall, nitrogen levels continued to drop off in 2013. Microbial activity in the soil, as measured by Solvita 1-day CO₂-C test, was consistently greater in May 2013 than in the fall of 2012 or in August or October of 2013.

Continued monitoring of various soil parameters and yields of commodity and cover crops in the next few years should provide useful information on the influence that seeding rates and species diversity have on soil health.

Tree/Shrub Seed Harvest

Seed was harvested from 17 different species or seed sources this summer/fall. Most of the fruited species have been processed and are available to interested nurseries. No lodgepole pine seed has been processed as we wait for warmer weather to boil cones. Surprisingly, what started out to be a bumper crop year for plum turned into a bust. Though the plum rows were white with blossoms, little to no fruit was produced. Similar reports were received from across the Northern Plains.

Off-Center Evaluation Plantings (OCEPs)

Evaluations of new and existing tree and shrub species are on-going at the three current locations of Dickinson, ND; Becker, MN; and Brookings, SD. Five new species were added to these sites in May 2013: sycamore, Manchurian ash, American hazel, 'Berry Blue' honeyberry and 'Cinderella' honeyberry. There are currently 45 accessions of 33 species at the Brookings, SD site; 116 accessions of 93 species at the Becker, MN site; and 93 accessions of 66 species at the Dickinson, ND site. All plots were evaluated in early September, and some maintenance was included during the site visits. Tree shelters were provided or added for those species subject to animal predation so that they would remain viable for evaluation purposes. Evaluation data is added to the PMC technical report and utilized to determine potential for conservation use.



Fall evaluation of woody species at Becker off-Center site

New Plant Releases

The Bismarck PMC did not have a new plant release in 2013. However, there are several species currently in various stages of evaluation, selection, and seed increase for potential future release. Selections of Virginia wildrye and Indiangrass were seeded in increase plots and conservation field trials last year, and are scheduled for release in 2015 and/or 2016 if they continue to perform as expected.

Conservation Priorities

Current work at the PMC focuses on ten major conservation priorities: Streambank & Lakeshore Stabilization; Warm-Season Grass Promotion and Development; Alternative & Specialized Use of Conservation Plants; Tree & Shrub Related Technology; Native Prairie Ecosystem Restoration; Saline & Alkaline Tolerant Plant Materials; Wetland and Riparian Plant Materials; Filter Strips & Nutrient Management; Information, Education & Outreach; and Urban Conservation.

Who We Are

The Bismarck Plant Materials Center is one of 27 Plant Materials Centers operated by the United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS). The Center serves the States of Minnesota, North Dakota, and South Dakota. It is the mission of the Plant Materials Program to develop plant materials and plant science technology for the conservation of our natural resources.

Helping People Help the Land

USDA is an equal opportunity provider and employer.

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