NRCS Bismarck Plant Materials Center

2019 Progress Report of Activities

3308 University Drive, Bismarck, North Dakota 58504 | Telephone: 701-250-4330 | http://plant-materials.nrcs.usda.gov/ndpmc

Bismarck Plant Materials Center

Mission and Goals

The Bismarck Plant Materials Center (PMC) has been in existence for more than 70 years. It is part of the USDA Natural Resources Conservation Service and is one of a network of 27 Plant Materials Centers nationwide. Its mission is to provide vegetative solutions and technology for conservation challenges in Minnesota, North Dakota, and South Dakota.

The area served by the Bismarck PMC is an environmentally and geographically diverse region blessed with large acreages of productive cropland, grassland, and forest, including an abundance of rivers, lakes, streams, and valuable mineral resources. Weather is extreme. Temperatures vary from winter lows of -40 degrees F to summer highs near 110 degrees F. Annual precipitation ranges from 14 inches in the northwest to 34 inches in the southeast area of the region.

Some needs of the region include adapted grasses, forbs, legumes, trees and shrubs for: prairie restoration, wetland and riparian sites, filter strips, saline and alkaline sites, wildlife food plots, alternative income crops, windbreaks, shoreline stabilization, agroforestry, pollinator habitat, livestock grazing and soil health. To meet these needs, the PMC develops adapted releases, tests existing cultivars, tests and develops seeding and management strategies, and produces and distributes breeder and foundation seed. Testing and development is conducted on site at the Bismarck PMC and at other locations throughout the region. At the PMC, soils are a Mandan silt loam, precipitation averages 16-inches, 152 frost free days, and the Plant Hardiness Zone is 4A. The PMC regularly partners with other federal agencies, state agencies, universities, soil conservation districts and local farmers and ranchers to test and evaluate plant materials and technologies at diverse off-center sites.

Information generated by the Bismarck Plant Materials Center can be obtained by contacting the PMC, accessing it from the PMC website or by contacting your local NRCS field office. Tours and training are also available upon request.

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BISMARCK PMC STAFF

Plant Materials Specialist
Wayne Markegard

PMC Manager
Wayne Duckwitz

Agronomist
Nancy Jensen

Forester
Craig Stange (Retired)

Soil Conservationist
Steve Allard, Jr

Office Automation Clerk
Julius Sayler

Biological Science Technician
Michael Bellon

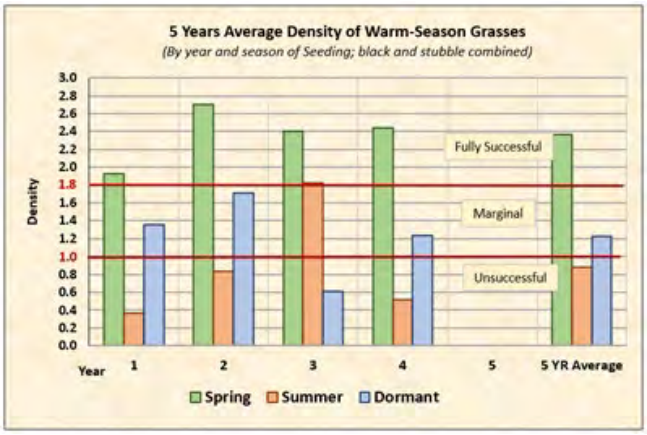
Biological Science Technician (ACES)
Virginia Mehlhoff

Biological Science Aid (seasonal)
Jay Opdahl

Perennial Warm-Season Grass Establishment

The PMC initiated a 5-year study in 2013 to evaluate native warm-season perennial grass establishment in three different seeding windows and two different seedbed types. The goal is to determine which seeding dates and type of seedbed will provide the best opportunity for success. These are replicated plots seeded annually in spring, summer, and dormant seeding windows in both conventional-till fallow and no-till stubble. Plots are evaluated by the "Frequency Grid" method. This method records the frequency of having one or more plants growing in defined grid areas. It does not count actual number of plants. Based on the frequency grid formula, densities above 1.8 plants/ft^2 indicate a successful planting. Densities below 1 plant/ft^2 are considered unsuccessful, and those in between are marginal.

The final seeding of this 5-year study was completed with a dormant seeding in 2018. Final evaluation of those plots will be completed in 2020. Evaluation results from the first 4 years of data indicate that spring seedings are more successful than dormant or summer seedings, and that there is little difference between seeding into stubble vs seeding into tilled fallow. It was also noted that plots evaluated in both the first season and third season after seeding improved an average of 70% in stand density between that time. Early annual grassy weed pressure was heavier on the tilled portions of the plots as compared to the stubble. The corresponding chart illustrates the differences in plant density of the different seeding windows. All spring seeded plots have been successful and exhibit the least amount of variability over the 4 years. Emergence was poor where residue was extremely heavy in some of the stubble-seeded plots. It confirms the importance of having good residue management at harvest and/or the need for row-cleaners on a no-till drill when heavy residues exist. A final report for this study will be completed in 2020.



Forb Establishment Trial

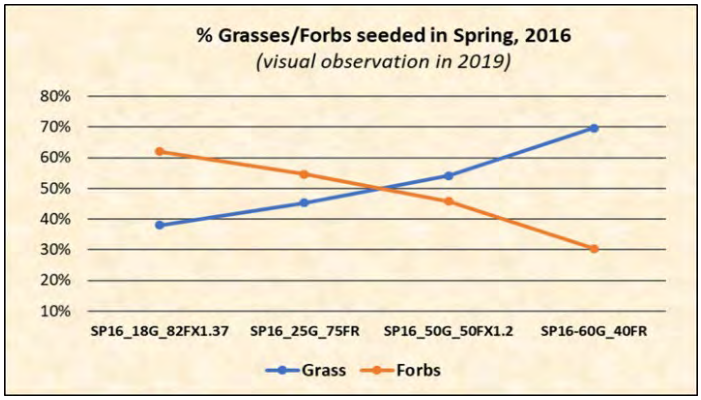
Efforts by land managers to establish successful pollinator plantings have not always achieved the desired results, so public and private land managers continue to sort out combinations of grass/forb ratios, seeding rates, and seeding dates that will provide optimum pollinator habitat at reasonable cost. In 2016, the Bismarck PMC initiated the first phase of several field trials to support NRCS Field Office Technical Guide (FOTG) standards for establishment of pollinator-friendly program plantings. Phase I included plots with different seeding rates and seed ratios of grasses to forbs in the mix. All plots were seeded to the grass component of the mix in spring 2016. The forb component of the different mixes was seeded in 3 different seeding windows; 1) seeded with grasses in spring 2016; 2) interseeded into existing grass in fall 2016; 3) interseeded into grass in spring 2017. Phase I also included an identical set of plots with totally different forb species. One group of plots contained forb species considered most likely to establish (A Forbs), while the other group of plots contained forbs (still being included in many program plantings) considered less likely to establish (B Forbs). Evaluation results will be summarized in a final report and related technical document once all data has been collected and summarized.

A second phase of plots (Phase II) with different seeding rates and ratios of grasses to forbs was initiated in spring 2017. All plots were seeded in the spring and included the same A Forb species that had been seeded in the Phase I plots.

In 2019, the PMC established the third phase of plots (Phase III) with pollinator-friendly species. They are replicated plots comparing 40/60 grass/forb mixes seeded at full rate, 1.25 X full rate, and 1.5 X full rate in a spring-seeded and dormant-seeded window. Initial evaluation on these plots will start in 2020.

Observations and data for the Phase I and Phase II plots have been recorded for three and two years, respectively. Some of the early observations from the Phase I plots include:

- Spring seeding the grasses and forbs together resulted in 80% more forbs than by dormant seeding grass followed by interseeding forbs in the spring or the following fall. The A Forbs are more prevalent in number and established more quickly than the B Forbs. However, by the third year of evaluation, plant densities evolved to more of an equilibrium.
- Plots that were spring seeded to grasses and forbs continue to maintain higher densities of both, while plots in the other two seeding windows now have adequate plant densities to maintain higher percentages of forbs as compared to the first and second year.



- Based on visual observations in 2019, higher percentages of forbs in the mix resulted in higher percentages of forbs in the established plots. Seeding rates above the full recommended rates did not appear to improve the stand enough to justify the added seed costs.
- Plots were infested with annual grassy weeds in the establishment year so were clipped twice during the first season. Clipping beyond the first season appeared to have a negative impact on forbs.

Continuation of these trials is merited for determining optimum seeding rates, ratios, species and seeding windows for program plantings in this region.

Seeding Grass into Stubble

There is often discussion regarding the best seedbed for establishing perennial grass plantings. Many landowners/operators prefer to seed into soybean stubble, but that is not always an available option. In 2017 the PMC initiated a field trial to evaluate establishment of grasses into previous crop stubble of 14 different common annual crops, including some winter species. The PMC seeded these crops in 2017 and in 2018. This was followed with a no-till seeding of 10 individual warm and/or cool-season perennial grass species into the stubble of those crops in 2018 and 2019, respectively. Based on 2019 observation of the 2018 grass plantings, there appears to be very little establishment difference regardless of annual crop species. These plots will be formally evaluated in 2020 and 2021 to compare establishment differences.

Field Plantings

Field plantings are a means to evaluate new plants or plant technology under actual use conditions at sites away from the PMC. Generally, each year the PMC offers specific plant materials for testing and provides criteria and forms for data collection. Staff from NRCS Field offices, SCD's, Tribal or other agencies locate sites with local producers and coordinate planting and data collection. Herbaceous material is usually evaluated for three years and woody material is evaluated for five years. The gathered information is valuable for determining potential species that meet the criteria for conservation use in specific areas and is incorporated into Field Office Technical Guides when merited.

Years Planted	Species (Yrs of Eval)	Total Plantings	% of Plantings Still Active	% Survival in Remaining Plantings	Performance Rating for surviving trees	% of all plantings w/	
						80+ percent survival	50+ percent survival
2015-2016	Douglas fir (5/4)	24	50%	67	4.8	16.7%	37.5%
2019	Canaan fir (1)	9	100%	72	4.6	33.3%	100.0%
2019	Gray birch (1)	5	100%	93	1.8	100.0%	100.0%

In 2019, the PMC provided Canaan fir and gray birch to 8 cooperators for 14 new field plantings. The gray birch transplants were grown by Towner Nursery from seed collected at the Becker, MN off-center evaluation site. All new plantings made in 2019, along with 12 plantings of previously established Douglas fir, were evaluated this year by sponsoring field office staff. The table above provides the evaluation summaries for each species. Survival of Douglas fir is quite variable, with some cooperators experiencing excellent survival, while other sites have witnessed total loss.

There were no herbaceous field plantings under evaluation in 2019. The most recent herbaceous species evaluated was Virginia wildrye. It will be submitted for release as Tober Germplasm Virginia wildrye, in early 2020.

Off-Center Evaluation Plantings

Off-center Evaluation Plantings (OCEP) provide a way to test tree and shrub species long-term at sites where conditions differ from those at the PMC. Generally, new entries are incorporated into the planting each year while maintaining and evaluating previously planted entries. Plant material, including released and experimental lines, are evaluated on a set schedule for up to 45years or the life of the planting. Overall growth, including height, width, vigor and disease and insect resistance are evaluated. Relevant information is incorporated into Field Office Technical Guide Specifications. The PMC continues to evaluate tree and shrub species at two formal off-center evaluation locations: Brookings, South Dakota, and Dickinson, North Dakota. The PMC added three new accessions at each location in 2019: gray birch, northern white cedar (arborvitae), and Canaan fir. All three species were evaluated in September and were doing well at both locations. Site specific woody information is provided in an individual annual report for each location. These are available from the PMC upon request.

Tribal Outreach

The PMC continues to offer plant materials and technical assistance to tribal communities across the region. In 2019, the PMC grew 577 sweetgrass and white sage in the greenhouse and distributed them to 12 different tribal entities. The intent is to provide seed/plant sources of these cultural species that the recipients can grow and propagate for future needs and provide opportunities to involve youth and adults in outreach to their community. Occasionally, the PMC has additional species of herbaceous and/or woody plant materials available to tribal communities for cultural and conservation plantings and provides technical assistance and training as needed.

Cover Crop Demonstration

The PMC cooperated with field offices in Rolla and Minnewaukan, North Dakota to seed cover crop demonstration/education plots for promoting producer awareness and interest in cover crops as a tool for enhancing conservation and soil heath. Plots established well, regardless of being seeded later than originally planned due to abnormally wet spring and summer precipitation. The Minnewaukan planting was established on saline soils where participants could compare saline tolerance for a variety of cover crops. The field office conducted a well-attended late-September field day event where these plots and adjacent, larger acreage plots (established by the conservation district) were discussed.

Forb/Shrub Interseeding

The PMC cooperated with conservation district partners in seeding three off-center demonstration plantings in 2019. In late April, the PMC cooperated with the Bison, South Dakota field office to interseed four native shrub species (winterfat, leadplant, forage kochia, and 4-wing saltbush) into a cooperating rancher's existing native pasture in the Faith, South Dakota area. There were three replications of each species planted alone and planted in a mix of all four species. Half of the plots were drill seeded and half were broadcast seeded. Immediately after seeding, the rancher hot-wired half of all plots and grazed the area to provide a comparison of hoof vs. no hoof impact. The site was evaluated in August. There was no visible shrub establishment at that time. The PMC will continue to observe and collect data on this field trial in 2020.

Pollinator Habitat Project

Pollinator populations and the plants upon which they depend are declining. The North Dakota Game and Fish Department created the Urban Pollinator Program to assist educational organizations in developing urban pollinator gardens throughout North Dakota to help provide habitat in areas that may otherwise be limited. The program also provides students with hands-on educational opportunities related to pollinators. In 2019, the PMC became a partner and grew approximately 1100 grass and forb plants that were distributed to 9 area schools. Species included: smooth blue aster, bergamot, blanketflower, columbine, yellow coneflower, stiff goldenrod, hyssop, butterfly milkweed, rose milkweed, hoary vervain, Indiangrass, little bluestem, and sideoats grama. The PMC will be growing forbs and grasses again in 2020 to distribute to 10 additional schools for creating pollinator habitat.

Feed the People

A garden was established at the PMC to provide fresh produce to those in need. Approximately 3545 pounds (collectively) of squash, tomatoes, beets and parsley, were donated and delivered to 12 food pantries and soup kitchens in the Bismarck/ Mandan area.

New Plant Releases

The PMC is continually evaluating potential grass and forb species that address conservation needs. The PMC has received name approval for the proposed release of Tober Germplasm Virginia wildrye, scheduled for release approval in 2019-2020. It is named in honor of long-time NRCS employee, PMC Manager, and Plant Materials Specialist, Dwight Tober. In 2019, forage yield and quality data were collected, and a new seed production field was summer planted at the PMC. Preparation of required documentation for release began in 2019 and will be completed in 2020. Seed previously grown at the PMC should be available by the summer of 2020 to growers for producing Select Class seed.

Virginia wildrye is a short lived, cool-season species that can grow in sun or shade. It readily reseed itself in plantings where there is bare ground. It is most persistent in moist, heavier textured soils. The potential uses are similar to those of Canada wildrye. These include wildlife habitat, riparian buffers, conservation cover for erosion and livestock forage.

Cover Crop Cultivar Trial

Cover crops are important tools for maintaining soil health. To evaluate specific cover crop cultivars in an array of geographical areas, replicated field trials were planted at 24 Plant Materials Centers (PMC) across the nation. All PMCs evaluated the same species and cultivars. While PMCs in southern states planted the cover crop trials in the fall after crop harvest, the PMCs in the northern states, including the Bismarck PMC, planted them in the spring for a full season of growth and evaluation. At Bismarck, the trial was planted on June 5, 2017 and again on May 16, 2018. Emergence, bloom period, plant height, disease and insect resistance, and winter survival were evaluated. A final report for the study at Bismarck was completed in 2019 and can be found on the Bismarck PMC website. Cover crop data from various PMC trials will be compiled to develop Regional Technical Notes in 2020. These will be available on the National Technical Support Center websites in Fort Worth, TX; Greensboro, NC, and Portland, OR.

SPECIES	CULTIVARS
Austrian winterpea	Arvica, Dunn, Frostmaster, Lynx, Maxum, Survivor15, Whistler, Windham,
Hairy vetch	Groff, Lana, Purple bounty, Purple prosperity, TNT, Villana
Rye	Aroostook, Brassetto, Bates, Elbon, FL401, Guardian, Hazlet, Maton, MatonII, Merced, Oklon, Rymin, Wheeler, Wintergrazer70, Wrens abruzzi
Daikon radish	Big dog, Concorde, Control, Defender, Driller, Eco-till, Graza, Groundhog, Lunch, Nitro, Sodbuster, Tillage
Black oats	Cosaque, Soil Saver
Balansa clover	Fixation, Frontier
Red clover	Cinnamon+, Cyclone, Dynamite, Freedom!, Kenland, Mammoth, Starfire, Wildcat
Crimson clover	AU Robin, AU Sunrise, AU Sunup, Contea, Dixie, KYpride

Potential Release Species

Sand bluestem- Sand bluestem is a tall, warm-season, rhizomatous, perennial grass species that grows naturally on sandy sites. It is a great stabilizer of sandy soils and produces abundant forage that is palatable to livestock. Species with such attributes are limited. Since 2003, the PMC has worked to develop a sand bluestem release for use in the Northern Great Plains. Currently, a population of sand bluestem has been selected and is growing at the PMC.

Prairie dropseed - Prairie dropseed is a clump forming native, warm-season grass. Its potential use would be for adding diversity to prairie plantings, and for wildlife and pollinator habitat. Its' fine leaves and delicate seed heads also make it desirable for horticultural plantings. The PMC began work on this species because no released cultivar was available for conservation use in the Northern Great Plains. Collections were made from South Dakota, North Dakota, and Minnesota.

Seedling vigor is generally poor for the species, so selections at the PMC were based on large seed, which is known to improve vigor in some grass species. Seed has been produced from the selected breeder population since 2010. Seed germination is being tested on stored seed to determine viability of the seed as it ages. In 2019, selected plant material was shared with the University of Minnesota for genetic work and further testing. The Bismarck Plant Materials Center has put further work toward release development on hold.

Plant Materials Training

Two different training events were provided by the PMC for NRCS, conservation district, and other conservation agency personnel in 2019. In June, the PMC participated with NRCS and the Minnesota Board of Soil and Water Resources to provide one-day trainings in Detroit Lakes, Morris, and Ivanhoe. Approximately 60 participants spent the mornings in the classroom with topics that included plant ID, seedbed preparation, drill calibration, and maintenance related to perennial herbaceous establishment principles. The afternoon portion of the agenda each day was spent in the field observing recently established program plantings at several different sites. A grass drill was provided at each location and afternoon sessions allowed hands-on opportunities to discuss drill components, drill calibration, plant density, species identification and management strategies for weed control at each site.

A second training event was provided for 24 participants from North Dakota and South Dakota at the PMC during the second week of August. This was a 3-day event with time spent in the classroom and the field each day. Participants received a more comprehensive training on PMC activities relative to studies, field trials, Foundation seed production, equipment, and seeding demonstrations, in addition to the many components of plant materials technology. Post-training surveys indicated that this was a very educational event and a much-needed part of every conservation-oriented employees' experience. The PMC will again provide these trainings in the future, as time allows.

Herbaceous Seed Production and Distribution

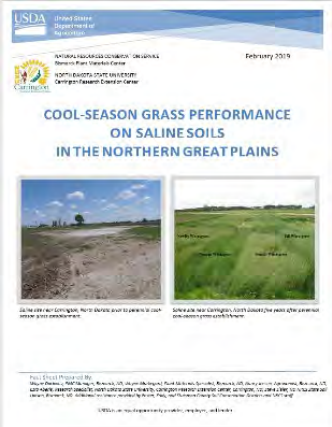
The Bismarck PMC continues to grow and clean Breeder and Foundation seed of conservation plant releases. Established fields of each release listed below were maintained and/or harvested in 2019. Fields averaged 1 acre in size.

Breeder and Foundation seed is distributed through North Dakota Foundation Seedstocks to seed growers for increasing the quantity of the named release. The seed grower then sells the seed directly, or through a vendor, to the public for conservation plantings. In 2019, 1365 pounds of Foundation/Select Class seed were distributed to seed growers. Seed distribution to growers, from 1996-2018, has totaled almost 48,000 PLS pounds. This represents 23 cooperative releases from the Bismarck PMC.

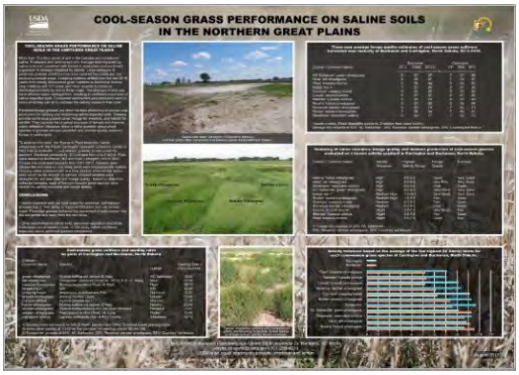
RELEASE	SPECIES
Bad River	blue grama
Dacotah	switchgrass
Manifest	intermediate wheatgrass
Manska	pubescent wheatgrass
Pierre	sideoats grama
Rodan	western wheatgrass
Tomahawk	Indiangrass
Lodorm	green needlegrass
Badlands*	little bluestem
Bounty	big bluestem
Bonilla*	big bluestem
Bison*	big bluestem
Mandan	Canada wildrye

* not harvested due to adequate seed supply in cooler

Carrington Salinity Study



This study was initiated to evaluate salinity tolerance of 11 cool-season grasses established in varying salinity gradients at two different locations near Carrington, ND. The goal was to provide additional support for recommendations on saline tolerant species for program plantings. The plots were evaluated annually for 5 years. In 2019, the PMC completed a fact sheet and a poster highlighting the results. The poster was presented at the "America's Grassland Conference" held in August in Bismarck, ND. These publications provide information on salinity tolerance, feed quality, and biomass production of the cool-season perennial grass species included in the trial.



Publications-2019

Following is a list of publications developed by the Bismarck PMC in 2019. These and prior publication can be found on the Bismarck Plant Materials website at:
https://www.nrcs.usda.gov/wps/portal/nrcs/publications/plantmaterials/pmc/central/ndpmc/pub/

Prairie Sandreed Assembly and Evaluation for Conservation Use in the Northern Great Plains -*final report*
Yield and Quality of Perennial Cool-Season Grasses on Saline Soils in the Northern Great Plains-Plant Materials Technical Note No. 1.
Cool-Season Grass Performance on Saline Soils in the Northern Great Plains - *February 2019*
Plant Chat-Seeding Depth; The Virtues of Varieties-*March 2019*
Seed News - *2019*
Legume and Cool-Season Grass Mixtures: A Demonstration Planting in Perkins County, South Dakota
Field Evaluation of Hybrid Poplar Accessions to Soil Salinity -*final report*
Great Plains Tree Improvement Committee Bur Oak Provenance Test- *March 2019*
2018 Progress Report -*January 2019*
Improved Forage Grass Releases by the Bismarck Plant Materials Center and Partners-*Poster and Abstract for 2019 America's Grassland Conference*
Cool-Season Grass Performance on Saline Soils in the Northern Great Plains-*Poster and Abstract for 2019 America's Grasslands Conference*
Evaluation of Cool-Season Cover Crops in the Northern Great Plains-*final report October 2019*