

2023 Progress Report of Activities

Bismarck Plant Materials Center

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Bismarck Plant Materials Center

Plants are an important tool for conservation. The Bismarck Plant Materials Center (PMC), which is part of the USDA Natural Resources Conservation Service, is one in a network of 25 PMC's nationwide dedicated to providing vegetative solutions to conservation problems. It has provided conservation plant materials and technology for more than 80 years to land users in Minnesota, North Dakota, and South Dakota. It works closely with other federal and state agencies, universities, and nonprofit organizations on various tasks. These include:



Bismarck Plant Materials Center Office and Training Center.

- ❖ Development/selection of adapted grass, forb, legume, tree, and shrub cultivars and releases for conservation plantings.
- ❖ Breeder and Foundation seed production of releases. Seed is distributed to commercial growers and nurseries.
- ❖ Technology development related to grass, forb, tree and shrub establishment, management, and use.
- ❖ Disseminate conservation plant information through publications, training, and other outreach activities.

Each year the Bismarck PMC meets with the Plant Materials technical committees from each state to develop their needs assessment, which determines the annual PMC workload.

PMC 3-Day Training



Participants at 2023 PMC Training.

There were 22 NRCS Field Office employees from Minnesota, South Dakota and North Dakota that attended the 3-day training from August 15-17. Time was spent in the classroom and the field each day. Participants received a comprehensive training on PMC activities relative to studies, field trials, Foundation seed production, equipment and seeding demonstrations, along with many other components of plant materials technology. Guest speakers from our various partner agencies added expertise and diversity on a variety of pertinent topics. Special thanks to all those that contributed to the training and attendees from across the tri-state region. We look forward to hosting another training in 2024.



Learning about pollinator species and their habitat.

Herbaceous Establishment Training

Three herbaceous establishment trainings were conducted in North Dakota this past summer. Locations were Towner, Jamestown, and Dickinson. Combined across all locations, there were eighty-five participants from NRCS, Conservation District, and partnering organizations. The agenda for the training sessions provided opportunities for interactive discussions on herbaceous establishment. Morning topics in the classroom included an overview of the Plant Materials Program, seedbed preparation, seeding depth, seed quality, and grass identification characteristics. Afternoons were in the field with hands-on activities related to grass drills, seedbed preparation, grass and forb identification, stand evaluation, stand management and propagation of conservation trees and shrubs. Presenters were staff from the PMC, other NRCS offices, Conservation Districts, and partnering organizations. Thanks to all who planned, organized, and participated in the training events!



Participants working on their plant identification skills.



The attributes of seed drills used for establishing grasses and forbs are being discussed.

Tribal Outreach

The Plant Materials Program continues to offer plant materials and technical assistance to tribal communities across the region. In 2023, tribal outreach took place in various ways. There were 330 sweetgrass plants grown in the greenhouse and distributed to 27 entities. There were discussions with 8 tribal liaisons and tribes, most of them in person, to identify specific plant material needs. A native plant propagation workshop was held in Belcourt, North Dakota. An interactive conversation was held on propagation of native plants and participants in the workshop were given an opportunity to propagate sweetgrass plants that they could take home. Plant Materials program staff attended several meetings between United Tribes Technical College and Mandan Agricultural Research Service to provide technical assistance for a native plant propagation project.



Participants learned how to propagate sweetgrass at a native plant workshop in Belcourt, North Dakota.

Bee Friendly Schools

Bees, butterflies, and other pollinator species have found a home at various local schools across North Dakota. The Bismarck PMC began a cooperative project (Urban Pollinator Program) with North Dakota Game and Fish (NDGF) to teach students about pollinators and help them establish pollinator habitat at their respective schools. The NDGF provides educational material related to pollinators and their habitat and the PMC grows approximately 100 grass and forb plants for each school. Species include wild bergamot, showy milkweed, butterfly milkweed, rose milkweed, hoary vervain, columbine, smooth blue aster, stiff goldenrod, yellow coneflower, anise hyssop, blanketflower, little bluestem, Indiangrass, and sideoats grama. There are 5-10 schools participating each year. Students not only learn about pollinators and their habitat; they also learn about planting and caring for plants.



Native, perennial species and annuals were mixed to create a pollinator garden at this school.

Field Plantings

Field plantings are a means to evaluate new plants or plant technology under actual use conditions at sites away from the Plant Materials Center. Each year specific plant materials are offered for evaluation. Staff from NRCS field offices, conservation districts, tribes, or other partners locate sites with local producers and coordinate planting and data collection. Herbaceous and woody material are evaluated for three and five years, respectively. The data is a valuable component for NRCS Field Office Technical Guides (FOTG).

In 2023, thirty-three field plantings were under evaluation. Species included gray birch, Canaan fir, northern white cedar, Virginia wildrye, and cup plant. Planted prior to 2023, gray birch, Canaan fir, and northern white cedar were established to test their adaptability to the region. Tober Germplasm Virginia wildrye was seeded in 2023 to promote the release, compare performance to similar species, and test its adaptability in the western Dakotas. Cup plant field plantings were also seeded in 2023. They were established to test performance in pollinator plantings. In preliminary data, gray birch is showing some adaptability in the eastern Dakotas and Minnesota. Northern white cedar and Canaan fir have had poor survivability. In 2024, cup plant is being offered for targeted field plantings to test its ability to filter nutrients and reduce soil/water movement. Plans in 2024 also include follow up on field plantings that are 6 to 10 years old.

Off-Center Evaluation Planting Update

Currently there are active Off-Center Evaluation Plantings (OCEP) located at Dickinson, North Dakota and Brookings, South Dakota. Their primary purpose is long-term evaluation of woody species. It is a place to screen species for potential conservation use prior to widespread field evaluations. Vigor, disease, size, and overall performance are evaluated



Vigorous 'McDermand' Ussurian pear trees

annually. New entries in 2023 were Norway spruce and northern catalpa. Depending on performance and adaptability, these species could provide additional conifer and/or tall deciduous tree options for

Northern Great Plains windbreaks. Both shagbark and bitternut hickory were planted in 2022 and 2023 as deciduous trees with potentially longer lifespans. So far, they have high survival rates, but extremely poor vigor. 'McDermand' Ussurian pear was a standout at the Dickinson OCEP. Forty-five year old trees were vigorous in growth and showed no signs of decline.



'Meadowlark' forsythia shrubs are healthy despite being browsed.

The opportunity arose in 2023 to revisit an older, inactive OCEP at Morris, Minnesota. After 35 years of growth, 'Meadowlark' forsythia stood out as being a dense, vigorous shrub. 'Meadowlark' is a cultivar introduced by North Dakota State University, South Dakota State University, and the Arnold Arboretum. As well as at Dickinson, 'McDermand' Ussurian pear trees appeared vigorous and healthy at Morris.

Special thanks to everyone that has helped with planting, maintenance, and data collection.

Foundation Seed Production

The Bismarck PMC continues to grow and clean Breeder and Foundation seed of conservation plant releases. It is the PMC's obligation to maintain sufficient seed/plant supplies of each of them. Currently, there



Prescribed burn on 'Bison' big bluestem Foundation seed field.

are 17 Foundation seed production fields (1-2 acres in size) of different grass releases. There are 9 breeder fields (.25 ac. or less) of different forb or grass releases. Some of the seed produced in the breeder blocks is utilized for field plantings to test possible conservation solutions. Cup plant is a species that was harvested in 2023 and seed will be available for

2024 field plantings. Seasonal snowfall reached 101.2", making it the second highest on record in the Bismarck area. The PMC also received above average spring precipitation making the Missouri-river fed irrigation system not heavily relied upon during the 2023 growing season. Prescribed burns were completed on the warm-season fields by the first week of May. As a result, warm-season grass seed yields



'Lodorm green needlegrass prior to harvest on 27 June 2023.

increased compared to 2022 when burns were not completed. Favorable growing conditions throughout the season also attributed to yield increases for cool-season grasses.

Breeder and Foundation seed is distributed through North Dakota Foundation Seedstocks to seed growers for increasing quantity of PMC named releases. The seed they produce is sold to commercial vendors or directly to the public for conservation plantings. The goal of the foundation seed program is to maintain a diverse supply of high-quality seed that is adapted to our region. In 2023, the PMC distributed 3,132 pounds of 10 different releases to seed growers.

Tall Fescue/Orchardgrass Winter Hardiness

Cool-season grasses can provide early spring and fall cover and forage. Tall fescue and orchardgrass are widely used, cool-season grasses that were introduced from Europe into the United States by early settlers. In the Northern Great Plains, success of these species has been limited because of their susceptibility to winter injury. In May 2020, the PMC seeded tall fescue and orchardgrass at Bismarck to evaluate adaptation (winter hardiness) and performance. Fifteen cultivars of each species claiming to have winter hardiness were individually seeded into replicated plots. Plants have been evaluated each spring and fall and again the following spring and fall each year since 2020. There has been no visible winter injury through 2023. On 5 July 2023 plants were clipped to an 8 inch stubble height and residue removed. Few or no seedheads were visible in orchardgrass plots at the time of clipping. It is hypothesized that clipping or some form of defoliation may make weaken them and therefore, they would be more susceptible to winter injury. Plants will be evaluated again in the spring of 2024 to determine winter injury and vigor. Future plans include evaluating promising cultivars in cooperation with farmers and ranchers.



Height of orchardgrass is about 2 feet just prior to clipping.

Grass Establishment in Winter-Grain Stubble

Many factors influence grass establishment. The type of seedbed is one of the factors. When planting into a no-till seedbed, the previous years' crop needs to be considered. Some crops have potential to produce large amounts of biomass and some have allelopathic chemicals that may negatively affect the crop being seeded. Rye is a species with both attributes.

Studies in the literature indicate rye may influence the growth of other plant species through leaching of chemicals from plant residues (allelopathy). It has also been reported that decomposition products from rye tissues of different ages have different toxicity levels. In 2021, the PMC began a study to evaluate and compare the success of establishing grasses into winter rye, winter wheat and spring wheat stubble that had overwintered. The winter grains were planted in September 2021 and spring wheat was planted in May 2022. Grain of winter wheat and winter rye was harvested in July 2022. Grain of spring wheat was harvested in early August 2022.

The straw was removed after grain harvest, leaving the stubble standing on all plots. Monocultures of cool and warm-season native grasses were seeded 17 May 2023 in each type of grain stubble. Broadleaf and grassy weeds were severe throughout 2023. Kochia was particularly troublesome. Initially, rye stubble had fewer weeds than winter or spring wheat stubble. Plots were clipped and weed residue was removed on 20 June 2023 to open the canopy for the seeded grasses. Weeds were again covering the plots by the end of the growing season. No grass counts were made in 2023. Visual observations found some grass plants growing under the weed canopy. Grass establishment will be evaluated in 2024.



Less weeds were removed from the winter rye stubble on 20 June 2023 compared to winter and spring wheat stubble.

Stony Hills Muhly Collection

Plains muhly, also known as stony hills muhly is a warm-season grass that is native from Kentucky west to the Rocky Mountains, north to central Alberta, east to central Manitoba and south to Mexico. It is found growing in a variety of conditions. It grows in dry gravelly prairies on rocky slopes, rocky limestone outcrops, and in sandy drainages. It can provide fair to good quality forage for livestock and wildlife. In 2022, the PMC became a partner in a study led by Dr. Arvid Boe at South Dakota State University to investigate plains muhly for potential revegetation of coarse textured, infertile, sloping or otherwise drought or fragile soils in the Northern Great Plains in response to ongoing climate change. The species would offer another species for revegetating marginal land.

Plant collection began in 2022. Multiple plants have been collected from various types of sites in North Dakota, South Dakota and Iowa. In 2023, plants collected by the PMC in 2022 were divided and planted into individual pots. These plants along with plants collected by Dr. Boe will be grown in the PMC greenhouse until field planting at Bismarck in the spring of 2024. Data will be collected on plant growth and overall performance for 3-5 years, with potential for a release.



Plains muhly growing on a gravelly steep slope near Garrison Dam in North Dakota.

Biomass of Rye Cover Crop

Understanding the interaction of planting date and seeding rate of regionally adapted cover crop varieties across different climatic conditions is important for successful establishment and management of cover crops in agriculture cropping systems. The Bismarck PMC along with 13 other Plant Materials Centers across the nation began a cooperative study with the Agricultural Research Service and North Carolina State University in 2023 to evaluate the effect of planting dates, seeding rates, and timing of termination on adapted varieties of cereal rye. Future studies will evaluate other grasses and legumes commonly recommended by NRCS for cover cropping.

The PMC seeded 'Aroostook' cereal rye at five different seeding rates on 11 September 2023, 22 September 2023, and 10 October 2023. Seeding rates included: 15, 30, 60, 90, and 120 pounds/acre. Photos were taken two weeks after the first killing frost for canopy cover estimates. In the spring 2024, biomass will be determined at different growth stages using Plant Map 3D, an advanced imagery technology developed by cooperating scientists, and green canopy cover using photo imagery. In addition to the photo imagery for biomass determinations, a late biomass harvest will be taken to further refine biomass imagery technology.

An anticipated outcome of the study is to develop guidance and recommendations for possibly lowering the seed cost of cover crops to increase adoption and feasibility of using them.



Rye canopy 38 days after 11 September 2023 seeding. Seeding rates (left to right) are 15, 30, 60, 90, and 120 pounds/acre.

Henderson Wildlife Management Area Project

A grassland once heavily infested with Kentucky bluegrass and smooth brome at the Henderson Wildlife Management Area (WMA) is being restored to native grasses and forbs. The Henderson WMA, owned and managed by the North Dakota Game and Fish (NDGF), is located approximately 10 miles east of Bismarck, North Dakota. In 2019 the NDGF began a corn/soybean rotation to prepare the site for seeding of native grasses and forbs. In the spring of 2022, 100 acres were seeded to a native mix of 80% grass and 26% forbs (106% of ND NRCS seeding rates). There were 10 grass and 13 forb species in the seeded mix. Surprisingly, all seeded grasses and forbs, except leadplant, were found growing by the end of the seeding year. Annual weeds and sweet clover have been vigorous at times causing the need for spot clipping and haying. Check areas with no clipping and haying were left to allow observations of management effectiveness. Livestock grazing management of high intensity short duration every other year is tentatively planned to begin in the spring of 2024. Exclusion areas will be defined to provide opportunity to collect forb data under grazed and



Many grasses and forbs are abundant in the seeded area.

nonuse conditions. Data will be used to determine the effects of livestock grazing on forb persistence, bloom periods, and grazing preference. A partnership with North Dakota State University to collect data and interpret results is being explored.



The grass/forb mix was no-till seeded into variable amount of corn/soybean residue.

Conservation Trial-Planting into Green Rye Cover Crop

Cereal rye is a frequently used cover crop that is seeded in the fall following the harvest of a commodity crop. Soybeans are commonly planted directly into the “green” cover in the spring followed by a herbicide application to terminate the rye. The PMC initiated a cover crop field trial this fall to assess how different seeding rates of cereal rye as a monoculture and a mix with radishes/turnips affect biomass production and weed suppression. A sudangrass/pearl millet mix will be “green” seeded into the living rye, followed by a glyphosate application to terminate the rye stand. The mix will be mowed several times throughout the summer to encourage tillering, increase vegetative growth, and cause the root system to penetrate deep, relieving compacted soil. Soil health measurements will be collected in the fall of 2024 to evaluate the impacts these cover crops and management strategies may have in a single season.

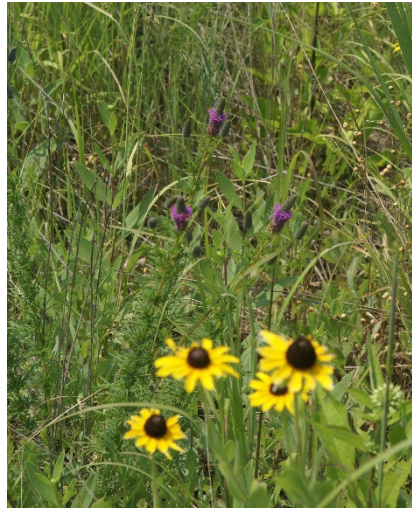


In this plot, 2 pounds of Brassica species were seeded with 30 pounds/acre of cereal rye.

Establishing Pollinator Habitat

Planting disturbed land back to native grasses and wildflowers can be beneficial in providing pollen and nectar resources as well as cover and nesting sites for a variety of pollinator species. However, grass and wildflower establishment can be

challenging and expensive. In 2016, the Bismarck PMC began a conservation trial (non-replicated) to evaluate different grass/forb ratios, species, seeding rates and seeding dates for pollinator habitat establishment. In Phase I, seeding forbs as part of a warm/cool season grass mix was compared to seeding forbs into previously seeded grass. Three different grass/forb ratios and two different forb mixes were also compared. In Phase II, seeds of forbs and grasses were mixed at various ratios and seeded at different rates in the spring of 2017. In Phase III, forb establishment was compared for spring and dormant seeding dates. All plots in Phase III were seeded at 40% grass and 60% forbs with



Several grass and wildflower species are growing in this spring seeded plot.



Weeds and a few cool-season grass are the dominant species in this dormant seeded plot.

one mix of forbs and grasses. Since 2017, forbs have been counted on the various plots.

Data collection for Phase 1 and Phase II was completed in 2022. In 2023, final data was collected on the plots that had been seeded in 2019 (Phase III). Plots seeded dormant had sparse vegetation. Weeds were abundant and very few forbs were present. There were a few cool-season grass plants and few to no warm-season grasses. The spring seeded plots had more forbs and grasses.

Preliminary results from all phases of the trial indicate that spring seeding was the most successful for forb establishment. Seeding high rates of forbs did not always result in the most forb plants. Forbs listed as the easiest to establish (Group A forbs) in the ND NRCS Technical Guide were the most prevalent in the plots. As noted over the years and in this trial, native forb and grass plantings take time to establish. Data will be summarized, and a report of findings will be distributed in late 2024.



Summer staff are vital in maintaining fields and test plots at the Bismarck Plant Materials Center.

Publications/Presentations 2023

Following are lists of publications and presentations by the Bismarck PMC in 2023. All publications from the Bismarck Plant Materials Center can be found by going to the website <https://www.nrcs.usda.gov/plant-materials/publications> and searching by NDPMC.

Plant Chat (October 2022) newsletter	publication
Plant Chat (February) newsletter	publication
Foundation Seed Availability/Prices	publication
Brookings Off-Center Evaluation Planting Annual Report	publication
Dickinson Off-Center Evaluation Planting Annual Report	publication
Seed News	publication
Bismarck Plant Materials Center Brochure	publication
Progress Report 2022	publication
Technical Committee Meetings- South Dakota, North Dakota, Minnesota	presentation
Herbaceous Establishment workshops (3)-ND	presentation
Prairie Red Plum Release Overview	presentation
Tech Talk Thursday South Dakota-Cultivar Development	presentation
Native Forb Propagation and Collection Workshop	presentation
North Dakota Association of Conservation Districts Convention	presentation
Plant Materials Center 3 Day Training	presentation, tour
Dickinson Off-Center Evaluation Planting	tour
Plant Materials Center Tour-Minnesota participants	tour
Plant Materials Center Tour-South Dakota participants	tour

Bismarck Plant Materials Center Releases (1946-2023)

Cool-Season Grasses

‘Mandan’ Canada wildrye
‘Garrison’ creeping foxtail
‘Nordan; crested wheatgrass
‘NU-ARS AC2’* crested wheatgrass
‘Lodorm’ green needlegrass
‘Haymaker’* intermediate wheatgrass
‘Manifest’ intermediate wheatgrass
‘Reliant’ intermediate wheatgrass
‘Manska’ pubescent wheatgrass
‘Mankota’ Russian wildrye
Tober Germplasm Virginia wildrye
‘Rodan’ western wheatgrass

Warm-Season Grasses

‘Bison’ big bluestem
‘Bonilla’ big bluestem
Bounty Germplasm big bluestem
‘Sunnyview’* big bluestem
Bad River Ecotype blue grama
Bismarck Germplasm buffalograss
‘Tomahawk’ Indiangrass
Badlands Ecotype little bluestem
Itasca Germplasm little bluestem
Red River Germplasm prairie cordgrass
‘Killdeer’ sideoats grama
‘Pierre’ sideoats grama
‘Dacotah’ switchgrass
‘Forestburg’ switchgrass

Trees

‘Homestead’ Arnold hawthorn
‘McKenzie’ black chokeberry
‘Centennial’ cotoneaster
‘Cardan’ green ash
‘Oahe’ hackberry
‘Prairie Red’ hybrid plum
‘CanAm’ hybrid poplar
‘Legacy’ late lilac
‘Midwest’ Manchurian crabapple
‘Scarlet’ Mongolian cherry
‘Regal’ Russian almond
‘Sakakawea’ silver buffaloberry
‘McDermant’ Ussurian (Harbin) pear
Survivor Germplasm false indigo
Riverview Germplasm black currant
Prairie Harvest Germplasm hackberry
Silver Sands Germplasm sandbar willow

Forbs/Legumes

Medicine Creek Germplasm Maximilian sunflower
Bismarck Germplasm narrow-leaved coneflower
Bismarck Germplasm purple prairieclover
Bismarck Germplasm stiff sunflower
Antelope Germplasm slender white prairieclover
‘Sholty’ yellow-flowered alfalfa

* PMC was secondary Releaser

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