United States Department of Agriculture

NRCS Bridger Plant Materials Center

2021 Progress Report of Activities

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The Bridger Plant Materials Center (MTPMC) strives to provide technical information and other products supporting USDA - Natural Resources Conservation Service (NRCS) Center staff and their clients. This report presents a brief overview of 2021 activities at the MTPMC within the Montana-Wyoming Plant Materials program and includes links to published Technical Documents on the MTPMC website.

Research Activities

Three replicated studies initiated in 2020 related to cover crops and soil health were continued at the MTPMC in 2021. Michelle Majeski, new PMC study leader, continued work on two studies initiated in 2020 by Ryan Noack of the Big Sky Watershed Corps program. The first is titled *Sorghum-Sudangrass Varietal Production and Cost Comparison* and compares the stand establishment, height, and biomass production of four popular sorghum-sudangrass varieties. With numerous varieties of variable price available on the commercial market and little replicated testing in Montana and Wyoming, this study aims to quantify variety performance relative to seed cost. A second companion study titled, *Sorghum-Sudangrass Varietal Performance as a Component of a Cover Crop Mix*, tests the performance of the four tested sorghum-sudangrass varieties when incorporated into a cover crop mix.

Figure 1. Darren Zentner and Michelle Majeski collecting data for sorghum-sudangrass varietal study, 2021.

The third cover crop study continued this year is titled *Impact of Cover Crop Seeding Rate on Stand Establishment and Biomass Production* and compares various cover crop seeding rates (50, 75, 100, and 125% of the recommended rate) and their effect on stand establishment and biomass production per acre. The same conventional seven species, warm season cover crop mix was again used this year. As previously mentioned, the goal of the study is to determine if conventional seeding rates are providing optimum production and conservation benefits relative to cost. The new trend at Bridger of continuing field studies for at least two years helps staff explain and predict variation resulting from annual weather fluctuations and improve interpretation of study results.

Figure 2. Biomass sampling in cover crop seeding rate study.

Figure 3. Sixweeks fescue study site.

A new study was initiated in 2021 titled, *Effects of Three Different Seeding Rates and Two Different Seeding Times of Sixweeks Fescue to Suppress Cheatgrass in a Rangeland Setting*. The goal of the study was to determine if seeding of early successional species such as native sixweeks fescue (*Vulpia octoflora*) may help suppress winter annual weeds like cheatgrass. Drill seeding rates of 1.0, 1.5, and 2.0 times the full stand rate will be used and seeded as dormant fall 2021 and spring 2022 plantings. Species density and canopy cover (of cheatgrass and other species), as well as bare ground, will be evaluated.

In addition to replicated studies, Darren Zentner, PMC Farm Foreman, continued collecting data on an Opportunity Germplasm Nevada bluegrass seeding trial he initiated in 2020. There is some evidence at Bridger that inconsistent seedling emergence and stand establishment of Opportunity Germplasm Nevada bluegrass may relate to seeding depth and packer wheel pressure. Another identical trial planted on a slighter different soil type was also installed in 2021. Both trials were sown at four depths and four packer wheel pressures to determine optimum drill seeding settings and each was evaluated for seedling density.

Figure 4. Darren Zentner seeding Opportunity Germplasm Nevada bluegrass.

Products and Technology Transfer

In 2021, MTPMC staff and the Plant Materials Specialist completed and posted several publications and continued offering webinar-based training programs for NRCS field staff and partners.

The release brochure for Opportunity Germplasm Nevada bluegrass was revised and updated this year. This MTPMC release was originally selected for superior performance on low pH and heavy metal contaminated sites but has much broader applications, including for low precipitation range sites. A tall-statured bunchgrass, it is useful as early spring grazing, wildlife cover and nesting, and logging road revegetation.

Figure 5. Opportunity Germplasm Nevada bluegrass.

Two Plant Guides were developed this year, one for fuzzytongue penstemon (*Penstemon eriantherus*) and one for Gardner's saltbush (*Atriplex gardneri*). Fuzzytongue penstemon is an excellent drought tolerant, native pollinator species. The MTPMC release, Old Works Germplasm, was selected for use on acidic and heavy metal contaminated sites such as those in the Butte and Anaconda, Montana areas, but has numerous range and native plant community applications, especially for pollinator applications.

Figure 6. Fuzzytongue penstemon.

Gardner's saltbush is a native, warm-season shrub useful for range restoration and revegetation of some salt-affected sites. It is a beneficial year-round browse and forage for wildlife, sheep, and cattle and tolerates moderate use. Since it resprouts after fire, Gardner's saltbush can be used as a fuel break to stop or slow fire spread.

Figure 7. Gardner's saltbush.

The final study report titled, *Effect of Berseem Clover Seeding Rate on Density and Biomass Production in a Warm Season Cover Crop Mix – One Year Results* was finalized in 2021. Cover crops are useful tools for enhancing soil health and providing other conservation benefits, but little information is available on individual species performance in multi-species mixes. Additionally, there are limited options for legumes in warm season cover crop mixes in this part of the US. This study evaluates berseem clover, which demonstrated adaptation to Montana and Wyoming environments in earlier trials. The study was led by Mark Henning, Area Resource Conservationist in Miles City, and investigated the effect of 1, 2, and 4 PLS pounds per acre seeding rates of 'Frosty' berseem clover in a six-species, warm season cover crop mix. In this study, the 4-pound rate resulted in significantly higher berseem plant density and aboveground biomass production than the other rates (Table 1). There was no significant effect of seeding rate on aboveground biomass of the cover cop mix.

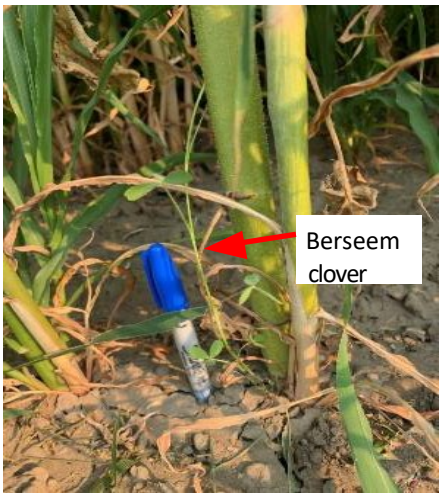

Figure 8. Berseem clover in a mix.

Table 1. 'Frosty' berseem clover plant density and aboveground biomass by seeding rate, Bridger, MT.

Seeding Rate	Plant Density	Biomass
--lb/A--	*--plants/foot--*	*--lb/A--*
1.0	0.213 B*	0.7438 B*
2.0	0.425 B	1.8563 B
4.0	1.075 A	5.8313 A

*ANOVA means in columns followed by the same letters are not significantly different according to Tukey's HSD at $P<0.05$.

A second study completed in 2021 was *Seed Mix Proportions and a Seed Carrier for Establishing Pollinator Habitat*. This study was led by Monica Pokorny, Plant Materials Specialist, and investigated the effect of various grass:forb proportions (20:80; 40:60; 60:40) and a seed carrier on forb establishment in a pollinator planting. Grasses included bluebunch wheatgrass, Nevada bluegrass, and slender wheatgrass. Forbs included blanketflower, Lewis blue flax, Maximilian sunflower, prairie coneflower, western yarrow, and white prairie clover. Plant density and aboveground biomass was evaluated for three years. Higher forb proportions did not improve forb density except for blanketflower. The highest proportion of forbs did improve forb aboveground biomass when no seed carrier was used. A seed carrier did not improve the density and biomass production of forbs or small-seeded grass species. Slender wheatgrass dominated the grass biomass in the study

Figure 9. Seed mix proportion study.

and may have contributed to the lack of significant differences in forb density and biomass in the three seeding proportions. See the final study report for additional results including trends over time.

The items discussed above are available on the MTPMC website, and the following documents and trainings are available on the Montana-Wyoming Plants Materials website.

Training

As a result of the positive feedback received on our virtual training in 2019 and 2020, webinars for NRCS field staff and partners were again offered in 2021. Montana Plant Materials staff provided training on a variety of topics including *Overview of the Montana Plant Materials Program, Planning a Seeding*, *Designing a Seed Mix, Color Sorter Technology*, *Seed Quality and Seed Labels*, *Seeding Calculations*, and *Integrating Plant Materials Documents in the Field Office Technical Guide*. A total of 499 field staff and conservation partners attended these presentations. Recordings and/or PowerPoints of these presentations can also be found on the Montana and Wyoming NRCS SharePoint for NRCS employees.

Outreach to NRCS Customers, Partners, and the Public

Figure 10. Forest habitat type training for NRCS staff.

In addition to training provided through webinars, Montana Plant Materials program staff collaborated with NRCS staff, customers, partners, and the public to provide presentations and assistance to multiple audiences. Various activities included groups such as the Carbon County Weed District, the Special K Ranch in Columbus, Bridger High School Advanced Biology and Vocational Agriculture, the Nature Conservancy, Lake and Gallatin County Conservation Districts, Montana Weed Control Association, NRCS forest habitat type training, and seed processing equipment and techniques training.

Figure 11. Cattle grazing a cover crop used as a site preparation method prior to seeding perennial species for diversifying crested wheatgrass grasslands.

Field Plantings

Field plantings are a collaboration of Plant Materials staff with NRCS Field Offices to evaluate new plant species or planting technologies under a variety of soil, climatic, and land uses to assess their conservation potential under actual use conditions. In 2021, we evaluated three field plantings in Montana and Wyoming. In a smooth brome pasture diversification project near Stanford, MT, blanketflower was initially the best establishing native forb and sainfoin the best establishing introduced forb. However, poor site preparation resulted in the site reverting to pre-seeding conditions with seeded species presence rare. In a similar smooth brome pasture diversification project near Cascade, MT, small burnet, cicer milkvetch and forage chicory drill seeded into glyphosate-treated pasture established and increased in density, canopy cover, and height over time. Sainfoin established on this site but decreased as the smooth brome recovered from the herbicide treatment. A crested wheatgrass renovation project near Wheatland, WY, tested several methods for diversifying rangeland including combinations of disking, herbicides, cover crops and perennial seeding. The treatment the producer is most satisfied with is the disk treatment where perennial species were broadcast seeded directly following a disking of crested wheatgrass stand. Alfalfa and switchgrass are now present on the site and crested wheatgrass production increased. This treatment was the cheapest and least labor intensive of the mechanical treatments and added some modest diversity to the rangeland site.

Check out results of all MT and WY plantings on the field planting reports website. Reports provide useful information on lessons learned for future conservation plantings.

Figure 12. Color sorter seed processing machine.

Figure 13. Back of plot drill seeding a study on 14-inch row spacing.

Foundation Seed

A majority of cost-efficient, readily available conservation species seed originates from the Plant Materials Program. Demand for MTPMC Foundation seed by commercial seed producers for certified seed production remains high. In 2021, the MTPMC maintained 39 Foundation and Breeder seed production fields or orchards. A total of 23 seed orders of 13 MTPMC releases totaling approximately 1,386 PLS pounds were shipped to commercial seed producers from Bridger in 2021. Making sure Foundation seed is available for certified seed production by commercial seed growers is extremely important to our program, and ensures a consistent supply is available for various conservation practices (like revegetation after wildfires!). The MTPMC continues to work with our cooperators who are contracting produce Foundation seed. In the interim, the MTPMC will continue to distribute Foundation seed, although in more modest quantities, to commercial growers. A listing of our releases can be found online.

The MTPMC is one of 25 Centers nationwide using plants to solve natural resource problems. Our current program emphasis addresses rangeland health, cover crops and soil health, pollinator-friendly plantings, woody plant establishment, and technology transfer, training, and outreach. Our work reflects the current needs identified by our field staff. Our primary products include the development of new conservation technologies, conservation staff training, plant testing and selection, and Foundation seed production.

Bridger PMC Staff
Manager: Joe Scianna
Study Leader: Michelle Majeski
Farm Foreman: Darren Zentner
Plant Materials Specialist: Monica Pokorny

PMC Address
98 South River Road, Bridger, MT 59014
Tel: 406.662.3579