

Proceedings: 2nd Annual Native Seed Quality Workshop
Feb. 26-27, 2002
Ft. Collins, CO

Seed Production of New Native Rangeland Shrub, Forb, and Grass Releases

Mark Majerus
USDA Plant Materials Center
Bridger, Montana

The Plant Materials Center collects, evaluates, and releases plant materials for conservation use in Montana and Wyoming. It is part of a network of 26 Plant Material Centers nationwide. The Bridger PMC was established in 1959 with primary emphasis on developing native plant material for coal stripmine reclamation and trees and shrubs for windbreak and shelterbelts. The Bridger PMC has made 19 releases as public varieties. The Breeder and Foundation seed must be maintained for all of these releases as long as there is a commercial demand.

The cultural practices are very similar for most of the Foundation seed production, with some practices unique to individual species.

◆ Seedbed Preparation--all previous crops are plowed, disked, roller-harrowed and either fallowed or put into grain to aid in cleaning up the field. Fallow ground is leveled with a land-plane to facilitate furrow irrigation. The seedbed is smooth and firm prior to planting.

◆ Planting--Seeding is done with a two-row planter equipped with double-disk furrow openers with depth bands and trailing packer wheels. Planting depth should not exceed 1/2 inch. Packer wheels are critical to get good seed/soil contact. The drill is equipped with 'cotton boxes' (larger seed) and a 'Planet Jr.' box (smaller seed) with metering holes varying from 1mm to 10mm. The row spacing used at the PMC is wide (3 ft) because of the amount of hand roguing which requires access between rows. Most commercial growers use 22" or 24" row spacing on irrigated sites and 24" to 40" spacing under dryland conditions.

◆ Cultivation--New seedlings are close cultivated with a belly-mount cultivator with shields. As the stands develop a larger two-row cultivator or a two-row rototiller are used. Rotomowing is used during the establishment year to minimize seed set on the grassy weeds.

◆ Weed Control--Most agriculture chemicals are not labeled specifically for grasses, forbs, or shrubs grown for seed production. However, some of the more common chemicals such as 2,4-D[®], Curtail[®], Clarity[®], and glyphosate are specifically labeled for grass grown for seed production. 'Special Use' labeling has been acquired for some chemicals so that they can be used off-label for seed production. Unfortunately chemical tolerances for each species is often learned through trial and error. All chemical application must be done prior to the boot stage of grasses and pre-flowering for forbs and shrubs.

◆ Irrigation--In the semi-arid areas of eastern Montana and Wyoming, irrigation is essential for seed production. There are three critical times that a crop must not be experiencing moisture stress; *early development*--during the early growth period as seedheads and flowers are beginning to form, *post-anthesis*--following flowering and pollination just as seeds are starting to form, and *primordia development*--in the late summer and fall when seedhead primordia for the next years

crop are developing. All irrigation is done in furrows from gated pipe. Polyacrylamide (PAM[®]) granules are used to minimize the silt load in the waste water.

◆ Harvesting--Almost all Foundation fields are harvested by swathing and combining the dried windrows. A seed stripper is used on the species that have very indeterminate ripening or have awns or appendages that can be easily snagged by the stripper. Very few modifications are necessary on a standard grain combine. Because most grass seeds are lighter than grains, wind control is the most important adjustment. Air movement must be reduced by either restricting inlet air flow and/or fan speed. Special sieves and screens are available specifically for grass and legume seed crops (Peterson sieve). With standard grain sieves there is a considerable amount of stems and leaves that find their way to the seed bin, increasing the time and cost of handling and conditioning the seed.

◆ Post-Harvest Management--The period between seed harvest and winter freeze-up is the most critical time in the life cycle of a seed production field. It is at this time that the cool-season grass develop new seedhead primordia for the following year. It is critical that decedent material be removed to allow the formation of new tillers. Mowing, harrowing, rotary-hoeing, and grazing can be used to remove excess foliage. Soil moisture and soil fertility must be maintained so that the plants go into the winter in good condition. Fertilizer is applied during September at a rate of 80# available nitrogen/acre and 40# phosphorus/acre. If the site is sandy, the fertilizer application can be split between fall and early spring to minimize leaching.

The earlier releases from the Bridger PMC were all cultivars. More recently PMC's are using the Pre-Varietal release procedure; whereby seed is released as *Source Identified*, *Selected*, or *Tested* germplasm. 'Source Identified' is wildland collected, or commercially grown material from a specific documented native site. 'Selected' germplasm is the release of the best plant material of several collections of the same species. 'Tested' germplasm is plant material that has been progeny tested to ensure that the selected characteristic is maintained in subsequent generations. These Pre-Varietal options can make plant material available sooner; the only downfall is that they have limited field-testing prior to releasing to the commercial seed industry. Foundation (cultivar) and G-1 (Pre-variatal) seed is made available through the Foundation Seed programs at Montana State University-Bozeman and the University of Wyoming-Laramie. All proceeds from the sale of Foundation/G-1 seed supports graduate research on plant/seed related problems at these two universities.

New Native Releases for Rangelands

The following is a brief summary of the unique seed production and seed conditioning techniques used on the most recent releases from the Bridger PMC.

'Trailhead' basin wildrye

Basin wildrye was once a major component of the grassland communities in the valley bottoms of the Intermountain and Great Basin area. Because of an elevated growth point, the plants can be damaged by grazing or haying during the active growth period. However, when the plant is dormant (at seed maturity), it can be grazed, hayed, or burned with no damage to the plant. In seed production, mowing is a weed control option during the establishment year. However, this practice must be avoided with basin wildrye because of the potential damage to the actively growing plant.

There are only two commercial released of basin wildrye; Trailhead (tetraploid $2n=28$) is characteristically green in color and exhibits greater drought tolerance, while 'Magnar' (octoploid $2n=56$) is a blue-green and best adapted to the mountains and foothills.

Weed Control If properly managed, seed production fields of Trailhead basin wildrye can remain productive for up to 10 years. Downy brome and hairy chess are the most critical weeds as they are almost impossible to clean out of basin wildrye seed. Mechanical control methods involve late fall cultivation with a Triple-K™ or vibra-shank cultivator at a diagonal through the rows, followed by rotary-hoeing to uproot the annual brome. Chemical brome control can be accomplished with Sencor® applied in latefall/early winter or spraying the field with glyphosate prior to spring green-up of the basin wildrye.

Harvesting Trailhead basin wildrye can have seedhead heights of 6-8 feet. If direct cut, the header can be raised as high as it can go, but must be equipped with a pickup reel to pull the seedheads into the combine header. Direct cutting puts a lot of green leaves and stems through the machine, some of which ends up in the seed hopper. Sieves must be periodically cleaned and the seed crop may have to be dried prior to long term storage. If swathed, a cutting height of about 30" can be utilized. Combining from dried windrows result in a more uniformly mature crop and a very clean product in the seed hopper.

Disease and Pests Basin wildrye can be infested with a black lygus plant bug, but even high populations will not affect the rapid growth of this grass. Trailhead can also be exhibit some leaf rust during wet years, but with very little impact on seed production.

'Rimrock' Indian ricegrass

Indian ricegrass is adapted to sandy, as well as, clayey upland sites. It has a history of use by Native Americans, who made a porridge from the pulverized seed. The seed is relished by songbirds and upland game birds. Researchers at Montana State University have determined that milled seed produces a gluten-free flour that can be used to make bakery products for gluten-intolerant (Celiac disease) people. Presently Indian ricegrass seed can be sold on the reclamation market for much higher prices than the flour industry is able to pay.

Weed Control Annual grassy weeds are the most problematic in Indian ricegrass. Because of the shallow rooting of this grass, cross cultivation or even the use of a rotary-hoe is not an option. Downy brome, hairy chess, and Japanese brome are all winter annuals that green up early in the spring, or stay somewhat active all winter long. The stand can be sprayed with glyphosate early in the spring, just prior to the emergence of the first Indian ricegrass leaf. There is a very small window of opportunity with this practice.

Harvesting Indian ricegrass seed is usually ready for harvest shortly after the 4th of July. Seed loss to shatter can be significant. Rimrock has far better seed retention than either Paloma or Nezpar. Research at the University of Utah has found that at maturity the angle of the glumes is more acute in Rimrock, thus holding the seed in the diffuse panicle longer. Rimrock seed production is consistently twice that of Paloma or Nezpar, simply because of the lower shatter rate. Direct harvested seed may require drying. The windrows created by swathing can be quite fluffy because of the diffuse panicle, making windrows very susceptible to wind damage. At the Bridger PMC a four-wheel ATV is used to flatten the windrows.

Seed Conditioning The indian ricegrass seed is subtended by tufts of hairs, reducing the flowability of the seed. One or two trips through a barley-debearder processes the seed down to a hard, shiny dark brown seed. The seed is then easily cleaned over a standard screen mill.

‘High Plains’ Sandberg bluegrass

This is the first and only release of Sandberg bluegrass. It is a composite of three collections from the high plains of Wyoming; one from near Buffalo, near Casper and from the Green River area. Although Sandberg bluegrass is quite common in most rangelands, it matures very early, dries up and is usually quite inconspicuous for the rest of the growing season.

Weed Control Because this grass matures so early, most weeds have yet to set seed when the Sandberg bluegrass seed is harvested. Because of the shallow root system the more aggressive cultivation practices should be avoided.

Harvesting This species readily shatters, so the timing of seed harvest is critical. The stand can be swathed when the seed is in the firm dough stage and the seed will continue to mature. The combine-run of this seed can be very clean if the combine can be equipped with a small lower screen instead of a sieve.

Seed Conditioning Seed of Sandberg bluegrass has been cleaned using a series of screening mill, indent cylinder, and gravity table. Pigweed and downy brome have been the most common contaminants, but are easily extracted with the proper cleaning equipment.

‘Foothills’ Canada bluegrass

Canada bluegrass is a naturalized species that does well on coarse infertile soils in the mountains and foothills. It is not as aggressive as Kentucky bluegrass and is adapted to a broad range of soil textures, pH’s, and exposures. There are two private releases--Ruebens and Talon, both from Northern Idaho.

Weed Control Canada bluegrass is a rhizomatous grass that will eventually form a solid stand, if allowed. It will withstand aggressive cultivation and the thinning affect of cross cultivation can even extend the seed production life of the stand. This species will tolerate a broad range of chemicals, provided they are applied at the boot stage or earlier.

Harvesting Canada bluegrass exhibits very little seed shatter, holding the seed in the head well after seed maturity. This is somewhat characteristic of the bluegrasses that have extensive wooly hairs at the base of the seed. Seed can be direct combined, but the short stature may make it less desirable than picking it up out of a dried windrow.

Seed Conditioning Seed maturity of Canada bluegrass is much later than most bluegrasses making it possible to get contamination from late maturing weeds such as prostrate pigweed and green foxtail. Both these weeds can be extracted with a combination of indent cylinder and gravity table. Running the seed through a hammermill will remove most of the wooly hairs and increase the flowability of the seed.

‘Antelope’ slender white prairieclover

Antelope is the first release of slender white prairieclover. Although it was collected in 1947, it was just recently released because of the increased demand for more commercially available native forbs for CRP, wildlife, and reclamation plantings. Although found growing with purple prairieclover, slender white can be found on more arid and sandy sites. This species attracts a small white wasp that serves as the primary pollinator.

Weed Control There are no chemicals specifically labeled for use on slender white prairieclover, however with a little creativity, most chemicals labeled for use on legumes such as alfalfa or clovers can be safely used on slender white prairieclover. A study was established in the spring of 2001 at the Bridger PMC to evaluate pre-emergent (Sencor[®], Treflan[®], Karmex[®], and Velpar[®]) and post-emergent (Buctril[®], Pursuit[®], Plateau[®], and Butyrac[®]) chemicals. In the

study the Sencor[®] and Buctril[®] had the best performance, but the combination of Buctril[®] and Pursuit[®] on the remaining non-study portion of the field actually had the best weed control. Poast[®] can be used for the control of grassy weeds. Once established, this plant is strongly rooted and has very fibrous stems (much like flax). These characteristics make it tolerant of severe cross cultivation.

Harvesting Once the seedheads mature, they become brittle and readily shatter. If the stand is to be swathed, it must be done at the firm dough stage so that the seedheads will stay intact. The windrows need only dry a day or two before combining.

Seed Conditioning The combine-run seed is still encased in a capsule, often subtended by the persistent sepals. The first run over a screen mill should utilize the extra size of the seed pods to aid in the removal of smaller weed seeds, such as pigweed and kochia. Following the first cleaning run, the seed is then run through a hammermill to thresh the seed down to the naked kidney shaped seed, which can be again run over a screen mill to obtain a clean product. A gravity table may need to be used as a final treatment.

‘Wytana’ 4-wing saltbush & Gardner saltbush

Wytana 4-wing saltbush is not a true 4-wing, but rather a natural hybrid between 4-wing and Gardner saltbush. It is found throughout eastern Montana and Wyoming. The saltbushes are highly valued winter forage for both domestic livestock and wildlife. The leaves are persistent and retain high forage value through the winter months.

Weed Control There are no agriculture chemicals that are specifically labeled for use on any saltbush species, however chemicals labeled for woody crops such as fruit and nut trees can be safely used. Based on a study at the Bridger PMC, optimum weed control was obtained with late fall (second year of growth) application of 2#/acre of Simazine[®]. Other chemicals with good broadleaf weed control are Treflan[®] and Casoron[®]. The saltbush plants are well rooted and are tolerant of cross cultivation. The most problematic of weeds is Russian thistle, as the seed is very difficult to separate from saltbush seed.

Harvesting Unlike the true 4-wing saltbush (which must be hand harvested), Wytana can be cut back and it will produce seed on ‘first-year’ wood. This species is dioecious, but a planted field will generally produce a 1:5 male:female ratio. Seed is best harvested by swathing and then combining out of a dried windrow. Following harvest the plants should be mowed back to a 4” stubble.

Seed Conditioning The combine-run seed should be passed through a screen mill, utilizing its large size to screen out small weed seeds and leaf material. The seed must then be sent through the barley debearder to de-wing the seed. Utricle fill is quite variable from one year to the next, thus seed fill standards are set to accommodate this variability (45% or greater utricule fill).

‘Open Range’ winterfat

Winterfat is a very important winter browse species for domestic livestock (particularly sheep) and wildlife. This plant retains most of the leaves during the winter months and has been found to have winter crude protein levels of 7 to 11%. This species is one that can be used for CRP enhancement, wildlife habitat, mineland reclamation and range renovation.

Weed Control The Bridger PMC has yet to test any chemical weed control on this species. Like the saltsushes, it will probably tolerate some of the dormant fall applied pre-emergents. It will tolerate close cultivation, but can take only light cross cultivation with narrow

spikes. A rotary-hoe or spike-tooth harrow can be used in early spring on weed seedlings before much top growth develops on the winterfat.

Harvesting The seed of winterfat consists of the folded cotyledons and root radicle in a thin membrane surrounded by two tufted hairy bracts. Because of the thin seedcoat and vegetative nature of the seed, germination and emergence can all happen in less than six days if soil moisture conditions are good. The woody plants can be swather and combined out of a dried windrow. The seed matures late and is ready for harvest in early to mid October. Once the cotyledons are formed and starting to dry (turning from green to light brown) the seed can be harvested. Seed shatter can be extensive if allowed to mature too much. This fluffy seed is difficult to get through a combine, as there are numerous stems and leaves that are carried through with the seed. The sieves have to be completely open to prevent the fluffy seed from riding over the sieve and out the back-end of the combine.

Seed Conditioning The combine-run seed must first be run over a screen mill to separate as much of the leaf and stem material as possible. This process will reduce the volume by at least ½. There is conflicting opinions on whether the seed should be processed down to a naked utricle or left encased in the hairy bracts. Either way, the viability of winterfat seed is good for only two years. At both the Bridger, MT and Aberdeen, ID PMC's the G-1 seed of winterfat is processed down to a naked seed to facilitate ease of metering through a drill. The fluffy seed must be processed through a hammermill, as a barley debarber or seed scarifier are not aggressive enough. The hammered seed is again run over a screen mill for final cleaning.