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GREEN STRIPS OR VEGETATIVE FUEL BREAKS

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Antelope on a Green Strip Planting of 'Immigrant' Forage Kochia

GREEN STRIPS OR VEGETATIVE FUEL BREAKS

According to the National Interagency Fire Center, between 1998 and 2008 there were on average 65,581 fires per year and an average of 6,114,135 acres burned each year in the United States. Rangelands in the western United States have been invaded by many annual weed species including cheatgrass, an introduced winter annual grass that produces large quantities of highly flammable fuel and has been one of the major causes of the increase in wildfire in the western United States. It is estimated that over 76 million acres are either infested with or susceptible to cheatgrass invasion (Pellant, 1996).

Fuel Breaks (USDA-NRCS Conservation Practice Standard 383) are defined as a strip or block of land on which the vegetation, debris and detritus have been reduced and/or modified to control or diminish the risk of the spread of fire crossing the strip or block of land.

Green-stripping is the practice of establishing or using patterns of fire resilient vegetation and/or material to reduce wildfire occurrence and size (USDI-BLM, 1987). In essence, a green strip as defined by BLM can be a fuel break as defined by NRCS.

Green strips reduce the chance of a fire starting and they also slow the rate that a fire will spread. Plants growing in a green strip are normally widely spaced with little or no litter between the plants which reduces the ability of fire to spread. Decreased fuel, shorter plant height, and higher fuel moisture content of the plants growing in the green strip will rapidly slow a fire when it encounters a green strip (Davidson and Smith, 1997).

Green-stripping is not the solution to decreasing the incidence of wildfire on western rangelands but it is a tool to help reduce the size and frequency of wildfires (Pellant, 1996). This technical note will provide criteria to consider when planning a green strip including site preparation, selection of plant materials, seeding, and post seeding and long-term management to maintain a green strip.

Planning

Establishing green strips can be challenging. A complete resource inventory to determine soil type, climatic parameters and existing vegetation should be conducted. The need to re-vegetate a parcel of land should be based on a desired future condition or goal. It requires patience, time and expense (Idaho Plant Materials (PM) Technical Note (TN) No. 10, USDA-NRCS, 2008). Placement of green strips is as important as the species planted. Obvious areas to consider planting green strips are along common ignition areas such as railroads, farmlands and highways. Green strips can also be established around homes or neighborhoods situated in high fire hazard rangelands, forestlands and high value areas such as wildlife winter range or endangered species habitat (Davidson and Smith, 1997). Green strips should be tied into existing firebreaks such as paved roads, well-maintained dirt roads and riparian areas (USDI-BLM, 1987).

The size of a green strip depends on the location and type of existing vegetation. In most sagebrush-grass rangelands, 300 foot width or greater is recommended. The width of

green strips next to roads can be reduced to 200 to 250 feet if the road edges are well-maintained. The length of a green strip is dependent on the area being protected and existing fire breaks which could be incorporated into the green strip (Davidson and Smith, 1997).

Site Preparation

Developing a new green strip requires the removal of the existing vegetation, preparation of a seedbed and the seeding of adapted plant material. Removing the existing vegetation reduces competition for water, nutrients and light, which allows new vegetation to become established. If cheatgrass is a major component of the pre-existing vegetation, additional steps in seedbed preparation are very likely going to be required to reduce the cheatgrass seed bank that is present in the soil. A two-pronged approach utilizing both mechanical and chemical seedbed preparation strategies will help to reduce the cheatgrass seed bank enough to allow the green strip species to establish. Prescribed fire to reduce cheatgrass often fails to consume seed on or near the soil surface and results in heavier stands of cheatgrass establishing after prescribed burning (Pellant, 1996).

Targeted livestock grazing can be used in conjunction with other forms of site preparation to suppress invasive annual grasses such as cheatgrass and medusahead. Seedheads of annual grasses must be removed while they are still green and before they reach the soft dough stage. Cheatgrass must be grazed in the spring at least at two intervals before it turns purple to assist with both biomass and plant density suppression. Ideally 2 years of targeted intensive grazing will cause cheatgrass populations to crash. Medusahead is less palatable than cheatgrass and has a narrower window of acceptability but animals will graze it for a few weeks in early spring (Mosley and Roselle, 2006).

Success in establishing green strips requires careful planning and timely land preparation. Grass, forb, legume and shrub seeds are generally small and germinate slowly. They should generally be seeded from ¼ to ½ inch deep for optimal seed-soil contact (Idaho PM TN No. 24, USDA-NRCS, 2008). Some species may require a shallower seeding depth. The type of equipment and methods used to prepare a site for a green strip will be determined to a large extent by site characteristics such as soil type, slope, degree of rockiness and accessibility (USDI-BLM, 1987). Seedbed preparation is often ignored in rangeland seedings (Davidson and Smith, 1997).

Seedbeds should be weed free, firm and moist prior to planting. The seedbed should be firm enough that a person's heel-print does not go deeper than ¼ to ½ inch into the prepared seedbed. All weeds need to be controlled to reduce competition and to facilitate seedling establishment. There are many types of equipment and tillage methods available to prepare a seedbed. If the proper equipment and experience is not available, arrangements with individuals that have the right type of equipment and experience to prepare a proper seedbed and to seed the site should be made (Idaho PM TN No. 10, USDA-NRCS, 2008).

Two methods of seedbed preparation are recommended (Idaho PM TN No. 10, USDA-NRCS, 2008).

Conventional or Clean Tillage – This type of seedbed can be prepared with plows, discs, chisels, tool-bars using sweeps or other types of equipment. Mechanical seedbed preparation must bury cheatgrass seed at least 2 ½ inches deep to obtain effective cheatgrass control (Pellant, 1996). After the tillage operation is completed, the land should be smoothed and firmed using equipment such as a roller harrow, culti-packer, spike tooth harrow or other implement to firm the final seedbed. The seed is then planted directly into the prepared seedbed using a disc or furrow type drill.

Chemical – Seed can also be inter-seeded directly into rangeland sites that are free of brush. Multiple applications of a broad spectrum herbicide such as glyphosate and 2, 4-D will control existing vegetation. Sites infested with winter annual grasses may require treatment with additional herbicides such as Plateau. Rangeland or no-till drills should be used if no mechanical seedbed preparation is used. If the weed competition can not be controlled using chemicals alone, then conventional tillage and herbicide combinations are recommended.

Many landowners want “instant” results and try to inter-seed into existing plant communities without first controlling the existing vegetation. Numerous studies and practical experience have shown that inter-seeding into existing plant communities almost always fails. This is because there is too much competition for water and nutrients from the established existing vegetation. In addition, there may be allelopathic effects from living and/or dying and decaying vegetation. **Therefore, interseeding is not recommended.** Plantings where existing vegetation can be completely destroyed with labeled non-selective herbicides prior to seeding with inter-seeding type equipment have been successful when the site is irrigated or receives 15 inches or more mean annual precipitation. However, it should be fully understood that these plantings are still more risky than conventional land preparation methods (Idaho PM TN No. 10, USDA-NRCS, 2008).

Plant Materials

Plants used in green strips must be adapted to the site, able to compete with annual weeds, easy to establish, have low flammability, produce an open canopy and have resilience and regrowth capabilities (Monsen, 1994). Palatability to grazing animals and other management considerations are also important. Plants must be able to disrupt fuel continuity, reduce fuel accumulations and volatility and contain high moisture content (Pellant, personal communication).

The most common plants used in green stripping in low rainfall areas (less than 15 inches annual precipitation) are crested wheatgrass, Siberian wheatgrass, Russian wildrye, dryland alfalfa, blue flax, Lewis flax and forage kochia. In higher rainfall areas hard fescue, sheep fescue, Russian wildrye and small burnet should be considered.

The following descriptions are from USDA-NRCS Idaho PM TN No. 24, Grass, Grass-like, Forb, Legume, and Woody Species for the Intermountain West.

Low Rainfall Areas

Wheatgrass, Crested (Fairway type-AGCR) *Agropyron cristatum*



Fairway type crested wheatgrass is a very long-lived, drought-tolerant, vigorous introduced bunchgrass. Similar to standard crested wheatgrass but shorter-statured, earlier maturing, with finer stems and leaves. Establishes on similar sites (10-18 inches precipitation) as standard and grows more effectively than standard at higher elevations. This species does not survive as well as standard crested wheatgrass under severe drought conditions. Planting depth is 1/4 to 1/2 inch. Adapted varieties are 'Fairway', 'Ephraim', 'Douglas' and 'Roadcrest'. 'Ephraim', is a tetraploid variety of *A. cristatum* that is weakly rhizomatous in higher rainfall areas. 'Roadcrest' is a turf-type with short rhizomes and is recommended for low maintenance lawns and roadside plantings. 'Douglas' crested wheatgrass is the first

hexaploid on the market. Douglas is characterized as having larger seed, broader leaves and it stays green longer into the summer than other types mentioned above, but requires 14 inches of precipitation or more for long-term survival. It also establishes easily, but produces less forage. Because Douglas stays green longer than other types, it is a preferred forage selection. Douglas and other Fairway type crested wheatgrass cultivars are not as drought resistant as Nordan, Summit, Hycrest or Hycrest II. Other cultivars available but less adapted to the Intermountain West include 'Parkway', 'Kirk' and 'Ruff'. The average seeds per ft² at 1 lb. rate is 4. Recommend pure stand seeding rate is 5.0 lb/ac.

Wheatgrass, Crested (Standard type-AGDE2) *Agropyron desertorum*

Standard type crested wheatgrass is a very long-lived, drought tolerant bunchgrass adapted to a wide range of sites and precipitation zones as low as 9-10 inches. Growth begins early in the spring and again with fall moisture. Palatability is excellent in the spring and late fall, less during summer dormancy and after seed formation. It has very vigorous seedlings. Adapted to the plains, foothills, sagebrush, ponderosa pine, mountain brush, and juniper-pinyon rangelands with 9-16 inches mean annual precipitation. Expect low vigor and poor stands above 6500 feet elevation. This species is more drought tolerant than the Fairway type crested wheatgrass varieties. Planting depth is 1/4 to 1/2

inch. Adapted varieties are 'Nordan' and 'Summit'. Average seeds per ft² at 1 lb. rate 4. Recommend pure stand seeding rate is 5 lb/ac.

Wheatgrass, Crested (Hybrids) *Agropyron cristatum x A. desertorum*

This crested wheatgrass is a hybrid cross between Standard type and induced tetraploid Fairway type crested wheatgrass. Seedlings are extremely vigorous during germination and early establishment. It survives under greater competition than other crested wheatgrass varieties. It yields more forage (15-20%) in younger stands; is an outstanding seed producer, but is also more stemmy. It occupies the same sites as Standard and Fairway type crested wheatgrass. It is especially useful in drier sagebrush - cheatgrass sites and survives in areas with 9-16 inches precipitation. It does not persist as well as Standard type crested wheatgrass or Siberian wheatgrass in very droughty sites. Planting depth is 1/4 to 1/2 inch. Cultivars include 'Hycrest II' and 'Hycrest'. Average seeds per ft² at 1 lb. rate 4. Recommend pure stand seeding rate is 5 lb/ac.

Wheatgrass, Siberian *Agropyron fragile*

Siberian wheatgrass is similar to crested wheatgrass. Siberian wheatgrass has finer leaves, and retains its greenness and palatability later into the summer than crested wheatgrass. It yields less than most crested wheatgrass cultivars during average to better moisture years, but yields more than crested wheatgrass cultivars during extended drought periods. It occupies sites where standard crested wheatgrass will grow but is more drought tolerant (7-16 inches of precipitation). Once established, it is well adapted to light-sandy to loamy, droughty soils. Planting depth is 1/4 to 1/2 inch. Adapted cultivars include 'Vavilov II', recently released with significantly improved seedling vigor, and 'Vavilov'. Average seeds per ft² at 1 lb. rate is 4. Recommend pure stand seeding rate is 6 lb/ac.



Wildrye, Russian

Psathyrostachys juncea



Russian wildrye is a long-lived introduced and very drought tolerant bunchgrass. It grows rapidly in the spring and produces abundant basal leaves that remain green and palatable through summer and fall most years as long as soil moisture is available. It tolerates close grazing better than most grasses. It cures well on the stump (better than most cool season grasses) and makes excellent late fall and winter forage. Russian wildrye is not suited for hay production due to the predominance of basal leaves, which make it difficult to harvest. Once established, it competes very effectively against undesirable plants and it withstands drought as effectively and is more palatable than crested wheatgrass and Siberian wheatgrass. However, most varieties are erratic in establishment and demonstrate poor seedling vigor. Plant this grass in areas receiving at least 8 inches of precipitation. It is adapted to sagebrush, mountain brush, juniper-

pinyon, and moderately saline sites. It is useful on soils too alkaline for crested wheatgrass and Siberian wheatgrass and too dry for tall wheatgrass. The recommended planting depth is 1/4 to 1/2 inch; and it is very sensitive to deeper placement. Wide row spacing of equal to or greater than 18 inches is recommended (especially for green strips) and results in the highest production potential. On steep slopes it should be planted on the contour. Canadian releases include 'Swift', which was selected for seedling vigor, and 'Cabree', selected both for seedling vigor and reduced seed shattering. U.S. releases include 'Bozoisky II' and 'Bozoisky-Select' which were selected for increased seedling vigor and forage production and 'Mankota', selected for establishment from deeper seeding depths. In plantings in the Intermountain West, the Bozoisky II, Bozoisky-Select and Mankota should be the varieties of choice. They should be planted in 18 inch or wider rows and in alternate rows when planted with other species. Average seeds per ft² at 1 lb. rate is 4. The recommend pure stand seeding rate is 6 lb/ac.

Alfalfa

Medicago sativa

A very productive, palatable perennial introduced legume with numerous varieties that have specific characteristics for given purposes. Suited for use as hay, pasture, or haylage under irrigation or on dryland where the effective precipitation is 12 inches or more. Compatible with most dryland and irrigated forage grasses. Alfalfa does not persist with moderate to heavy grazing on rangeland unless rest periods occur. It is vulnerable to pocket gophers because of the taproot; however, creeping varieties are less susceptible to

damage. Root proliferating alfalfa types are more tolerant to grazing than crown type alfalfa types. Seeding should occur in spring to avoid risk of a killing frost. Seed requires inoculation with nitrogen-fixing bacteria before planting. The addition of phosphorus and potassium increases tolerance to close grazing or haying; increases number of nodules present improving nitrogen fixation; and improved production. Bloat can be a problem when grazing alfalfa. Planting a 75% grass- 25% alfalfa mixture will significantly reduce the risk of bloat. It is adapted to well-drained intermediate and favorable sagebrush, juniper, mountain brush, and ponderosa pine sites. It does poorly at higher elevations and areas with a high water table. 'Ladak', 'Trevois', 'Ranger', 'Spreador 3', and 'Nomad' are commonly used for low precipitation sites. Consult Extension Service or seed supplier for information on new varieties adapted to specific areas. Planting depth is 1/16 to 1/2 inch in a very firm, weed-free seedbed. Average seeds per ft² at 1 lb. rate 5. Full seeding rate for pasture and range plantings is 5 lb/ac.

Flax, Blue *Linum perenne*

An introduced, perennial, semi-evergreen, deep blue-flowered forb that prefers well-drained soils that range from moderately basic to weakly acidic. It prefers open areas, but does have some shade tolerance. It is not tolerant of poor drainage, flooding and high water tables. It grows well in 10-18 inch precipitation areas including the big sagebrush, juniper and mountain brush communities. It has been successfully seeded in the higher rainfall portions of the salt desert shrub type. Blue flax does well seeded in mixtures with other species. It can be surface seeded on disturbed seedbeds and should not be seeded deeper than 1/8 inch. This semi-evergreen forb is readily eaten by big game especially during spring and winter. Upland game and songbirds relish the seed. This species does well when seeded on disturbed sites. 'Appar' was released for its superior forage and seed production and palatability to livestock and wildlife. Average seeds per ft² at 1 lb. rate is 6. Pure stand seeding rate is 4 lb/ac. Not recommended in pure stands.

Flax, Lewis *Linum lewisii*

A native, perennial, semi-evergreen, light blue to white flowered forb that prefers well-drained soils that range from moderately basic to weakly acidic. It prefers open areas, but does have some shade tolerance. It is not tolerant of poor drainage, flooding and high water tables. This species grows well in 10-18 inch precipitation areas including sagebrush, juniper and mountain brush communities. It has been successfully seeded in the higher rainfall portions of the salt desert shrub type. Lewis flax does well in mixtures with other species. It can be surface seeded on a disturbed seedbed and should not be seeded deeper than 1/8 inch. This semi-evergreen forb is eaten readily by big game especially during spring and winter.

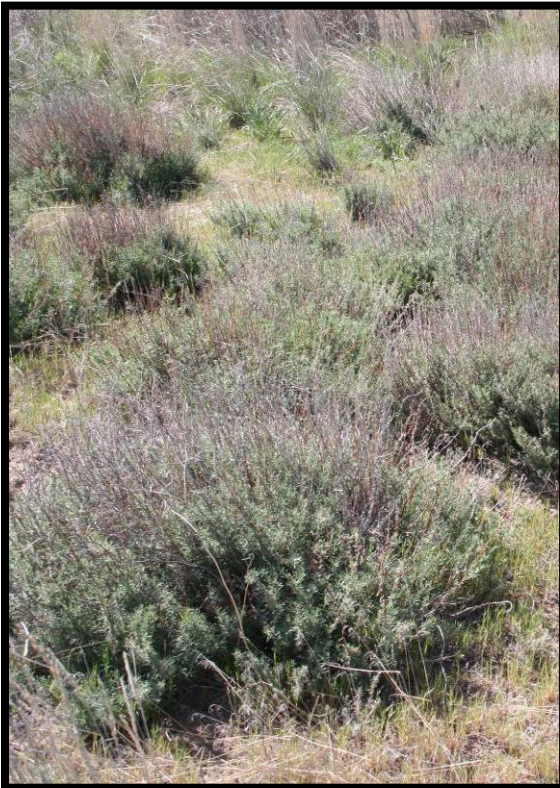


Upland game and songbirds relish the seed. This species does well when seeded on disturbed sites. Maple Grove Selected Germplasm Lewis flax (*Linum lewisii*) is a native release. Average seeds per ft² at 1 lb. rate is 7. Pure stand seeding rate is 4 lb/ac. Not recommended in pure stands.

Kochia, Forage *Kochia prostrata*

A semi-evergreen perennial sub-shrub introduced from southern Eurasia. On many arid and semi arid rangelands in Russia, it is considered a valuable forage shrub often associated with crested wheatgrass. It has been seeded in the Western United States for many years as a forage and reclamation plant in semi arid locations. Forage kochia is well adapted to basic soils, but it is not suitable for neutral or acid soils. Successful plantings have occurred on soils ranging from sandy loam to heavy clay, with the most successful plantings on medium to heavier soils.

This shrub develops a fibrous root system with a large deep taproot, and has been established in areas that receive as little as 5 inches and up to 27 inches of annual precipitation.



Forage kochia has demonstrated its adaptability to the juniper, basin big sagebrush, Wyoming big sagebrush, greasewood, and shadscale communities.

Important characteristics include: ability to establish and persist on disturbed harsh soils; high salinity and drought tolerance; tolerance of extreme temperatures (-25°C to 104°C); low oxalate levels (lower than winterfat and fourwing saltbush); ability to spread slowly from seed; high seed production; moderate shade tolerance; fair palatability for livestock and big game; food and cover for upland game birds; good fire tolerance; compatibility with other perennials; competitiveness with annuals including winter annual grasses such as cheatgrass and medusahead; and ability to improve fall and winter forage quality of perennial grass stands. The lower one-third of the plant remains green and succulent

year around. The upper stems and seed stalks turn brown to red and dry after seed shatter (November to December).

Protein content during winter (upper dry stems 6%, lower green stems 8-9%) is higher than what occurs in antelope bitterbrush and true mountain mahogany. Summer protein content has been found to be over 13%. Sheep, antelope and deer find this shrub palatable year around. Cattle and elk utilize it primarily in fall and winter. In annual plant communities such as halogeton or cheatgrass, forage kochia can compete with annuals by reducing their dominance, density, forage and seed production. In perennial communities, this shrub fills interspaces but has not been observed to reduce the density of other established perennials.

It is compatible in mixtures with drought tolerant grasses. Direct seeding on rangeland is best accomplished in the fall or winter by broadcasting on top of disturbed or undisturbed soil. Seed viability is generally limited to one year and use of fresh seed with a current germination analysis is highly recommended. If a drill is used for seeding, seed should not be placed deeper than 1/16-inch. Seeding can be in combination with other perennial species. One cultivar, 'Immigrant' has been released. Average seeds per ft² at 1 lb. rate is 9. Recommended full seeding rate is 2 lb/ac. It is not recommended in pure stands except when used in green strips. Recommended seeding rate in mixtures is approximately 1/4 of a pound PLS per acre.

High Rainfall Areas

Fescue, Hard *Festuca brevipila*

A very fine-leaved, low growing introduced bunch grass with poor palatability to livestock. It is widely used for turf, highway plantings, airport landing strips, burned over timberland and reclamation areas where a long-lived, persistent, competitive ground cover is needed. It is adapted to areas having an excess of 16 inches precipitation. It is not recommended for pasture or hay. Seedlings are slow to establish but persist through the development of abundant fibrous roots. The dense root system commonly excludes other species establishing in the interspaces between fescue plants. Early spring seeding is recommended. Only pure stands or mixtures with sheep fescue are recommended. Planting depth is 0-1/4 inch. 'Durar' is the adapted variety. Average seeds per ft² at 1 lb. rate 13. The recommended pure stand seeding rate is 4 lb/ac.



Fescue, Sheep *Festuca ovina*

A long-lived short stature introduced bunchgrass with short leaf blades. It is more drought tolerant than other fescues. Production is low, but ground cover and root production is excellent. It is used for turf, highway plantings, airport landing strips, burned over timberland and reclamation areas where a long-lived, persistent, competitive ground cover is needed. It has poor palatability to livestock and is not recommended for pasture or hay. Sheep fescue is best adapted to 14 plus inch precipitation zones. It is a very good erosion control and understory species that competes well with weeds. Seedlings are slow to establish but persist through the development of abundant fibrous roots. The dense root system commonly excludes other species establishing in the interspaces between fescue plants. Early spring seeding is recommended. Only pure stands or mixtures with hard fescue are recommended. Planting depth is 0-1/4 inch. Adapted varieties are 'Covar' and 'Bighorn'. Average seed per ft² is 16 at a 1 lb. rate. The recommended pure stand seeding rate is 4 lb/ac.

Wildrye, Russian *Psathyrostachys juncea*

Russian wildrye is a long-lived introduced and very drought tolerant bunchgrass. It grows rapidly in the spring and produces abundant basal leaves that remain green and palatable through summer and fall most years as long as soil moisture is available. It endures close grazing better than most grasses. It cures well on the stump (better than most cool season grasses) and makes excellent late fall and winter forage. Russian wildrye is not suited for hay production due to the predominance of basal leaves, which make it difficult to harvest. Once established, it competes very effectively against undesirable plants and it withstands drought as effectively and is more palatable than crested wheatgrass and Siberian wheatgrass. However, most varieties are erratic in establishment and demonstrate poor seedling vigor. Plant this species in areas receiving at least 8 inches of precipitation. It is adapted to sagebrush, mountain brush, juniper-pinyon, and moderately saline sites. It is useful on soils too alkaline for crested wheatgrass and Siberian wheatgrass and too dry for tall wheatgrass. The recommended planting depth is 1/4 to 1/2 inch; and it is very sensitive to deeper placement. Wide row spacing of equal to or greater than 18 inches is recommended (especially for green strips) and results in the highest production potential. On steep slopes it should be planted on the contour. Canadian releases include 'Swift', which was selected for seedling vigor, and 'Cabree', selected both for seedling vigor and reduced seed shattering. U.S. releases include 'Bozoisky II' and 'Bozoisky-Select' which were selected for increased seedling vigor and forage production and 'Mankota', selected for establishment from deeper seeding depths. In plantings in the Intermountain West, Bozoisky II, Bozoisky-Select and Mankota should be the varieties of choice. They should be planted in 18 inch or wider rows and in alternate rows when planted with other species. Average seeds per ft² at 1 lb. rate is 4. The recommended pure stand seeding rate is 6 lb/ac.

Burnet, Small

Sanguisorba minor



A perennial semi-evergreen introduced forb, growing to 2 feet tall. It has moderate forage production and is non-leguminous, deep-rooted, and has excellent palatability. Growth is most vigorous in fall and spring. It is best adapted to well-drained soils in the sagebrush-grass, juniper, mountain brush and other high rainfall areas. It can be grown on low fertility, droughty soils as well as moderately wet acid soils. It establishes with ease but will not persist in areas below 14 inches of mean annual precipitation or poorly drained, high water table areas. Small burnet is very palatable to livestock and wildlife and upland game and songbirds utilize its seed. Grazing should be deferred to the second growing season to allow plants to become established. 'Delar' is an improved variety that should be seeded at 1/4 to 1/2-inch depth. Average seeds per ft² at 1 lb. rate 1. Recommended pure stand seeding rate is 20 lb/ac.

Seeding

Grass, forb, legume and woody seed generally feed through a seed drill at variable rates because of differences in seed size, seed shape and seed weight. Because of these differences, seed mixtures tend to separate with heavy seed migrating to the bottom and light seed migrating toward the top of the drill box as the drill bounces across the field during the seeding operation.

When planting a mixture of different-sized seeds, it is recommended that a carrier such as rice hulls be used to facilitate the drilling operation. Idaho PM TN No. 7 Mixing Seed with Rice Hulls provides details on how to complete seed - rice hull mixtures.

Under rangeland conditions, grass-forb-legume-shrub stands can be planted in late fall or early spring dormant plantings. The rule of thumb for dormant fall plantings is to have the seed in the ground late enough so seed does not germinate until spring and for spring plantings to plant the seed as early as you can possibly get on the ground with planting equipment. The advantage of an early spring seeding is that it allows one additional weed control operation (control of winter germinated species such as cheatgrass and medusahead) just prior to or during the planting process. However, if the soil is not moist to a depth of 12" in the spring, the possibility of increased stand failure exists. Deferring the planting until fall might be advisable if spring and summer rains are historically low.

Refer to NRCS state conservation practice Standards (327, 512 and 550) for additional guidance on plantings dates.

In general, a grass or grain drill equipped with an agitator, double disc openers, depth bands and packer wheels is the ideal drill for planting grass and grass-legume mixtures. This type of equipment provides ideal seed placement at proper depths, with good seed-to-soil contact for moisture retention. Seeding difficulties can often arise when the drill is filled too full with seed. Never fill a drill more than ½ full. Filling the drill to the top frequently results in seed bridging on one or more of the openers. Other difficulties arise when the drill is not properly calibrated and/or in poor operating condition. Always check the drill before filling it. Rusty gears, grease globs, mouse nests, wasp or hornet nests and bag string frequently collect in the slots of the feed mechanism. All of these situations will interfere with proper seed flow. Cracked, plugged and kinked delivery tubes also interfere with seed flow. Refer to Idaho PM TN No. 19, Calibrating a Seed Drill for Conservation Plantings.

With a properly prepared seedbed, many shortcomings of a drill can be overcome. For example, a weed free and very firm seedbed will allow a drill without depth bands to place seed at the proper depth if the spring tension on the openers is reduced. If the drill is not equipped with press wheels, drag chains can be installed behind the openers and/or the field can be rolled or cultipacked following planting to ensure good seed-soil contact. Drills equipped with furrow openers can be modified by fastening delivery tubes behind the openers so the seed falls into the furrow and is properly firmed or pressed with the packer wheels.

Companion or nurse crops (usually small grains) compete for soil moisture, light and nutrients. They reduce seedling vigor and growth, and delay, suppress and shorten the productive life of the stand. Companion crops are generally not recommended under dryland conditions. Cereal grain companion crops, at a rate of 15 pounds pure live seed (PLS) per acre may be recommended under dryland or irrigated conditions if the soils tend to crust or are prone to high rates of erosion (Idaho PM TN No. 10, NRCS, 2008).

Post Seeding Management

Plantings should be inspected as soon as possible after plant emergence. If an obvious failure is recognized early there may be time to allow reseeding to capitalize on stored soil moisture. Reseeding should occur before May at lower elevations (valley bottoms such as the Snake River Plain) to no later than late May at higher mountain elevations. Refer to the Conservation Practice Standards in the Field Office Technical Guide for timing of seeding practices. If adequate germination and emergence has occurred, the summer survival should be evaluated that fall. If failure is noted at that time, reseeding without complete seedbed preparation may still be possible as long as the site has few weeds.

Care must be taken when evaluating dryland and rangeland seedings since first year results may be misleading unless closely examined. Often good seedling establishment is masked by heavy weed growth. Many such stands have been plowed up and reseeded,

when another year of deferment and observation could have allowed the seeded perennials to become fully established and eliminate the weeds through competition.

More established seedings fail for lack of post seeding treatment and grazing management than for any other reason. Early control of weeds eliminates competition and allow establishment of a vigorous stand. Weeds can be controlled using labeled herbicides or by mowing above the desired seedlings and prior to seed set by the weeds.

Seedlings must receive adequate protection until they become established plants. As a general rule, grazing should be deferred until the first seed crop is mature, after which only light grazing during that season should be allowed. Grazing deferment may need to occur through the end of the second or third growing season under dryland or rangeland conditions. Establishment may take even longer for native species plantings.

Not only are plants more easily overgrazed during the establishment period, they can sometimes be pulled out of the ground by grazing animals. This occurs because their root systems are not established enough to fully anchor the plant. Test this by pulling plants by hand. If you can uproot them, a grazing animal surely can (Idaho PM TN No. 10, NRCS, 2008).

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