TECHNICAL NOTE

USDA-Natural Resources Conservation Service

Spokane, Washington

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EASTERN WASHINGTON

RANGE AND PASTURE SEEDINGS

PLANNING-INSTALLATION-EVALUATION

This Technical Note is an adaptation of a Plant Materials Technical Note from Washington and adjacent states that addressed issues of range and pasture seeding (Refer to Ogle, et al, Plant Materials TN(10) Revised January 2006.

Seeding can be challenging. A complete resource inventory to determine soil type, climatic parameters and existing vegetation is necessary. Revegetation must be based on a desired future condition or goal. A successful seeding is expensive and requires time and patience.

INTRODUCTION

Seeding can improve or change vegetation to meet resource objectives. However, good management of existing vegetation is usually more economical than seeding the site to new or improved species. A careful economic analysis of the planned seeding is necessary.

Before beginning any seeding, two basic questions must be answered.

1. What is the primary goal or purpose of the seeding?
   - Increased and improved forage and/or hay.
   - An earlier, later or longer grazing season.
   - Erosion control and stabilize watershed values.
   - Reduce wildfire hazards.
   - Cover, nesting, and escape habitat for wildlife.
   - Nutrient management.
   - Change plant community composition.
2. Is seeding practical?
   - Will the soil support a different plant community?
   - Will the water holding capacity of the soil allow reseeding and support higher production?
   - Do undesirable plants dominate or have the potential to dominate the site?
   - Can the site be conventionally tilled or will herbicides be required for site preparation?
   - Is the existing stand capable of meeting the producer's goals with manipulation or management?

Some basic principles must be followed to ensure a successful seeding.

- Competition must be controlled
- Seedbed preparation and firmness
- Seed quality
- Seeding methods
- Time of seeding
- Seeding depth
- Proper post seeding management

Species selection in the seeding is dependent on:

- Purpose of seeding
- Seed Availability
- Mean annual precipitation and seasonal distribution
- Elevation
- Minimum temperatures
- Soil type and properties
- Site exposure
- If irrigated, reliability of water supply

Limiting factors are accentuated in dry climates where seasonal distribution and amount of moisture are most critical. The water holding capacity of the soil affects the species composition of natural vegetation found on the site. In addition, the water holding capacity of the soil limits the species that can be successfully established. Climatic adaptation for each species must be investigated.

SPECIES SELECTION

Determine resource objectives and complete good resource inventories before making species selections. Selected species must contribute to the objectives and be adapted to site conditions. The seeding must be within the landowner's economic ability with available manpower and equipment.

Many grass, forb, legume, and shrub releases are available for the different soil and climatic conditions in Eastern Washington. Released plant materials may provide an opportunity to improve current vegetation to meet resource objectives. NRCS plant releases are listed in the document at http://plant-materials.nrcs.usda.gov/pubs/mdpmcpurel2002.pdf

Species must be tolerant or adapted to soil limitations, such as, droughtiness, texture (fine or coarse), restrictive layers or pans, wetness, salinity or sodicity, acidity (pH), depth and toxicity or severe nutrient imbalances. Other soil limitations include slope, stoniness and the amount and quality of surface soil materials. (Refer to Table 3-Grass Species Characteristics and Adaptation to Moisture and Soils, Table 4-Forb/Legume Species Characteristics and Adaptation to Moisture and Soils and Table 5-Shrub Species Characteristics and Adaptation to Moisture and Soils.)

For additional information including species characteristics, seeding depths and seeding rates ; and soil protection qualities refer to Washington NRCS Plant Materials Technical Note 1- Conservation Seeding and Planting Guide for Washington State, Washington NRCS Plant Materials Technical Note 2- Grass, Grass-Like, Forb, Legume, And Woody Species For The Intermountain West Plant Identification.

Desirable species characteristics are more than the ability to produce high yields. Other important characteristics are:

- Nutritive value, see Table 6-Three year average of percent crude protein obtained at 15 day intervals
- Palatability, see Table 7-Total Percent Consumed During Dates Indicated
- Preference by growth stage, see Table 8-Sheep Preference For Grass Varieties By Growth Stage-Preference Is Expressed As A Percentage Of The Most Preferred Grass
- Regrowth characteristics, see Table 9-Regrowth Characteristics of Selected Irrigated Forage Grasses

Selected species should provide adequate forage when it is needed most, withstand expected grazing intensity, persist under the proposed grazing system, provide adequate soil protection, and suppress invasive species. Other factors include competitive ability, longevity, distinctive growth habits, and potential to move off site.

Only perennial species are considered on non-irrigated sites. Perennial plants provide a dependable source of highly nutritious forage and do not require annual seeding.

Seeding Introduced Species

Crested wheatgrass, Siberian wheatgrass, 'Sherman' big bluegrass, and alfalfa are species best adapted to areas receiving less than 12 inches of annual precipitation. Intermediate wheatgrass, pubescent wheatgrass, Russian wildrye, and alfalfa perform best in areas receiving 12-18 inch of annual precipitation. Meadow brome, tall fescue, orchardgrass, small burnet, alfalfa, sainfoin, and cicer milkvetch perform best at 15 inches or more annual precipitation. On wet soils, creeping foxtail, timothy, tall fescue, cicer milkvetch, birdsfoot trefoil and clover species should be considered.

Photo 1-'Bozoisky Select' Russian Wildrye-Saline - by Mark Majerus, Manager, Bridger PMC

On wet saline sites with a water table within 3 feet of the soil surface, consider beardless wildrye, tall wheatgrass, 'Newhy' wheatgrass, slender wheatgrass, Altai wildrye, tall fescue, and strawberry clover.

On dry saline sites consider Russian wildrye, tall wheatgrass, slender wheatgrass, crested wheatgrass, and Siberian wheatgrass.

Adapted forbs and legumes should always be considered in seedings. Forbs and legumes add diversity, forage yield and contribute to improved soil and forage quality. Small burnet is a non-bloat forb. Legumes such as sainfoin, birdsfoot trefoil and cicer milkvetch have low bloat potential as compared to alfalfa.

Seeding Native Species

When selecting species for native seedings, determine the soils on the site from a soil survey. Then look at the ecological site description (Rangeland Productivity and Plant Composition Table in the published soil survey) assigned to that soil. Select 4 to 6 major species found in the site description for your seeding mixture. Seeding all species found in the ecological site description is not realistic, practical or even possible.

Complex native mixtures may be required to meet objectives in some rangeland areas. Complex mixtures are most practical in mountainous or rolling areas and areas having a variety of soil and moisture conditions.

Native mixtures provide a number of benefits:

- Many areas have variable topographic and soil moisture conditions. Each species in a mixture will produce most efficiently on the specific microsite that matches its ecological requirements.
- Since species establish differing root systems, a mixed native seeding realizes more efficient use of soil moisture and nutrients and suppression of invasive plants.
- Species vary in growth and periods of lush growth and dormancy. Quality forage is available through a greater part of the season in a mixed stand of species. A mixed stand is beneficial to both livestock and wildlife.
- Native forbs provide diversity and attributes beneficial to wildlife including native pollinators.
- Native and non-native legumes improve nutrient cycling by nitrogen fixation.

1 Native Species Planting
Photo by: Steve Ray, DC Driggs, Idaho

Irrigated Pasture Seedings-Mixtures vs. Single Species Seedings

Relative palatability is critical in mixtures. The more palatable species will decline from excessive utilization by grazing animals unless intensive grazing management techniques are initiated. Less intensively managed multispecies stands ultimately end in a single species stand mixed with weedy patches. A good example is tall fescue, which is very competitive and less palatable than many other irrigated forage species. Because of these traits, tall fescue should generally be planted in a monoculture unless alternate row seeding techniques are used to add a legume.

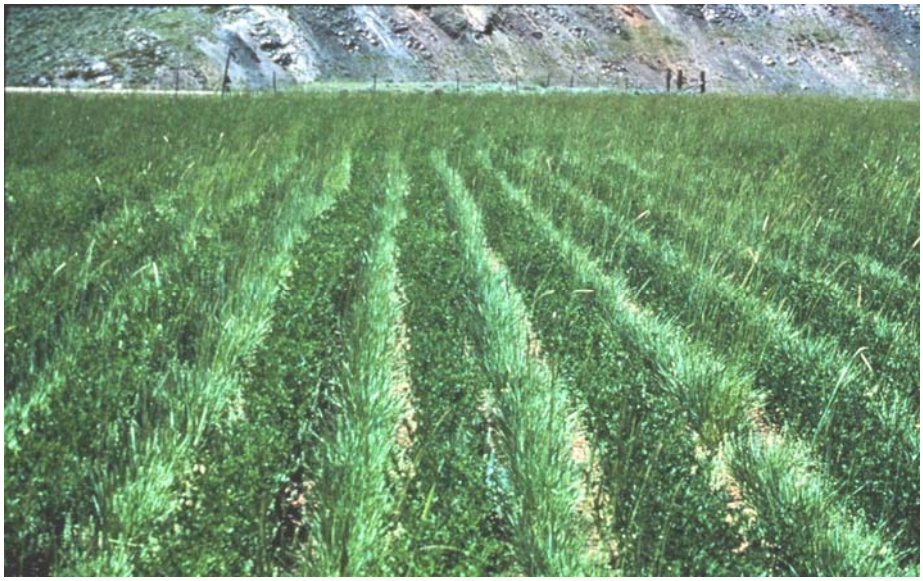
Single species seedings or one grass-one legume seedings are best in areas with fairly uniform soil, terrain and moisture conditions. They are easier to seed and establish, are more uniformly palatable and require a lower level of management than multiple species seedings. Simple mixes of one grass and one legume are recommended for irrigated seedings. Simple mixes produce as much forage as complex mixtures and are easier to manage and graze uniformly. Simple mixes require less total seed and are easier to establish in alternate rows, which is recommended.

Complex mixtures are most practical in mountainous or rolling areas, areas having a variety of soil and moisture conditions and/or where livestock and wildlife utilize the same area. The addition of a forb such as small burnet adds diversity. Legumes such as alfalfa or low bloat legumes such sainfoin, birdsfoot trefoil and cicer milkvetch contribute to soil nitrogen and animal nutrition. As the number of species in the mixture increases, applied management must increase to maintain the composition and health of the stand.

Some grass-legume mixtures for Eastern Washington are shown in Table 10-Recommended Grass-Legume Mixtures for Hay, Pasture and Silage. The table includes the moisture requirements for stand establishment and maintenance.

Grass-legume mixtures are desirable for many situations and objectives:

1. Mixtures have proven value in controlling soil erosion, improving soil tilth and fertility and reducing water runoff.
2. Mixtures normally utilize more space, reducing the potential invasion by weeds and the need of herbicides for weed control.
3. Mixtures are as nutritious and productive in terms of livestock products as legumes alone in feed trials.
4. Mixtures equal or exceed the forage yields of legumes or grasses alone.
5. Mixtures are more suitable for use as silage, hay and pasture.
6. Mixtures have less bloat hazard than a straight legume seeding. To help avoid bloat problems, a mix of 25-40% bloat type legume and 60-75% grass is recommended.
7. The grass portion of the mix will help maintain forage yields as the legume portion declines over time.
8. Many producers find it easier to gauge pasture condition and readiness when a legume is present.



2 Alternate Row Planting - Russian Wildrye-Alfalfa
Photo by: Larry Holzworth, Plant Materials Spec., Montana-Wyoming

On irrigated sites, annual species for forage (such as cereal grains, turnips, and annual ryegrass) may be a viable alternative based on the client's objectives.

SEEDBED PREPARATION

For additional information including seedbed preparation refer to Washington NRCS Plant Materials Technical Note 6-Seedbed Preparation and Seed to Soil Contact on the web at: http://www.wsu.edu/pmc_nrcs/Technology.html.

Successful pasture and rangeland seedings require careful and timely land preparation. Unlike cereal grains; grass, forb, legume and shrub seeds are generally small and germinate slowly. Grass, forb, legume and shrub seeds should generally be seeded from ¼ to ½ inch deep for optimal emergence.

Seedbeds should be weed free, level, firm and moist prior to seeding. The seedbed should be firm enough that a person's heel-print does not go deeper than ¼-½ inch into the prepared seedbed. All weeds need to be controlled to reduce competition and facilitate seedling establishment.

Each producer has a unique set of machinery and many different tillage methods can be used to prepare a seedbed. If the proper equipment and experience is not available, the producer should make arrangements with individuals that can apply the proper seedbed preparation and seeding techniques.

Two methods of seedbed preparation are recommended:

Conventional or Clean Tillage-This seedbed can be prepared with plows, discs, chisels, tool-bars using sweeps or other types of equipment. After the tillage operation is completed, the land should be smoothed and firmed using equipment such as a roller harrow, cultipacker, spike tooth harrow or other implement in the spring. The seed is planted directly into the prepared seedbed using a disc or furrow type drill.

A variation to this seedbed is used in the wheat-fallow region of Eastern Washington. Instead of packing the seedbed after cultivation(s), the seedbed is left loose and weed-free. The seed is broadcast late in the fall on the soil surface, and natural soil settling slightly buries the seed. The seeding rate is increased to compensate for the loose seedbed conditions. In some cases, operators use heavy split packer wheels to create furrows that improve conditions for the seeds that fall into the furrows.

Standing Stubble

Seed can also be planted directly into cereal grain stubble on coarse to medium textured soils. Stubble that is free from weeds and volunteer grain provides a firm seedbed and a favorable microclimate for seedling establishment. Winter wheat stubble is not recommended for fall dormant seeding because grassy weeds and volunteer grain commonly germinate over winter or in early spring. Grain straw should be removed from the field or shredded and uniformly scattered to improve seed-soil contact and reduce chaff toxicity. Harrowing and other chaff spreading operations disturb the soil and normally cause a flush of volunteer grain. A broad spectrum herbicide such as glyphosate will control this flush. Double disc or deep furrow drills with Acra-Plant™ openers are recommended for seeding into stubble. Spraying the field with appropriate herbicides prior to seeding is recommended. If the weedy competition can not be controlled using chemicals alone, use conventional tillage and herbicide combinations.

Competing vegetation must be eliminated for any seeding to be successful. Small grain production is often advisable for 1-2 years prior to the final seeding. Tillage and labeled herbicides used for small grain production controls weeds and reduces the soil weed seedbank. Small grain rotation is especially important when renovating old pasture or hayland because it helps to break disease and insect cycles. Small grain production also allows high levels of organic matter (root and shoot mass) time to decompose. High organic matter soils make poor seedbeds because they are difficult to firm resulting in poor seed-to-soil contact. High organic matter soils also tend to dry rapidly.

I**nterseeding is not recommended**.

Many landowners want “instant” results and try to plant into existing plant communities. Seeding into existing plant communities almost always fails due to severe competition for water and nutrients from the existing vegetation. In addition, allelopathic effects from living and/or dying and decaying vegetation are often present. Seeding using interseeding type equipment has been successful where existing vegetation is completely destroyed with labeled non-selective herbicides prior to seeding, and the site is irrigated or receives greater than15 inches of mean annual precipitation. However, interseedings are still more risky than conventional land preparation methods.

If conventional land preparation is not possible on very wet soil locations, ‘Garrison’ creeping foxtail can be established in an existing stand of less palatable species including Baltic rush

(wiregrass) and sedges. ‘Garrison’ creeping foxtail is very opportunistic and aggressive on wet sites. The seed can be broadcast when the site is frozen or by feeding ‘Garrison’ hay and allowing livestock trampling to plant seed. With proper irrigation and fertilization, Garrison can establish and eventually crowd out less desirable species over a 6 year or longer period.

SEEDING

Grass, forb, legume and woody seeds feed through a seed drill at variable rates because of differences in seed size, seed shape and seed weight. 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. When seeding a mixture of different-sized seeds, use a carrier such as rice hulls to reduce seed separation.

Never fill a drill more than 1/3-1/2 full to reduce seed bridging. Always check the drill before filling it. Rusty gears, grease globs, mouse nests, hornet nests, and bag string can collect in the slots of the feed mechanism and interfere with proper seed flow. Cracked, plugged and kinked delivery tubes also interfere with seed flow. Other difficulties arise when the drill is not properly calibrated and/or in poor operating condition.

For additional information refer to Washington NRCS Plant Materials Technical Note 7-Seed Quality, Seed Technology and Drill Calibration on the web at: http://www.wsu.edu/pmc_nrcs/Technology.html.

Under rangeland conditions, grass-forb-legume-shrub stands can be dormant seeded in late fall or in early spring. However, if the soil is not moist to a depth of 12” in the spring, the possibility of stand failure exists. Refer to state conservation practice Standards (327, 512 and 550) for additional guidance on seeding dates.

> **Rule-of-thumb:** *Dormant fall seedings-have the seed in the ground late enough (soils are cold) so seed does not germinate until spring. Spring seedings- seed as early as you can get on the ground with seeding equipment.*

A grass or grain drill equipped with an agitator, double disc openers, depth bands and packer wheels is the ideal drill for seeding grass and grass-legume mixtures. This equipment provides positive seed placement at proper depths, with good seed-soil contact for moisture retention.

A properly prepared seedbed overcomes many drill shortcomings. For example, a drill without depth bands can place seed at the proper depth on a good firm seedbed if the spring tension on the openers is reduced. On a drill without press wheels, small drags can be installed behind the openers. Alternatively the field can be rolled or cultipacked following seeding to ensure good seed-soil contact. Drills 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 and reduce seedling vigor and growth. Companion or nurse crops delay, suppress and shorten the productive life of the stand. Companion crops are not recommended under dryland conditions unless the soils tend to crust or are prone to high rates of erosion. Cereal grain companion crops when needed are seeded at less than 15 pounds pure live seed (PLS) per acre under dryland conditions. Companion crops are less damaging under irrigated conditions if they are seeded at light rates (½ or less of the normal seeding rate for that small grain crop) and harvested for hay.

Under irrigated pasture conditions, grass and grass-legume seedings can be seeded following small grain harvest after the most severe heat of the summer. At least 6 weeks of growing season should remain before the first expected fall frost. The stand is irrigated immediately to initiate germination and stand establishment. Control volunteer grain and weeds before seeding.

When seeding into standing grain stubble, drill across or at an angle to the row direction of the grain stubble to ensure that most of the seed is placed into mineral soil rather than into stubble organic matter.

FERTILIZER FOR SEEDING ESTABLISHMENT

Nitrogen fertilizer should not be applied before seeding or during the first growing season. Nitrogen generally benefits annual grasses and weeds at the expense of the slowly establishing perennial species.

Irrigated and Sub-Irrigated Pasture

Long-term supplies of phosphorus, potassium and sulfur are needed to enhance root growth. These nutrients should be applied prior to land preparation at rates determined by a soil analysis and nutrient budget based on your land grant college fertilization guides.

EVALUATION OF SEEDINGS

Judging the success of new seedings is very difficult, especially during the first season because the plants are small and difficult to identify. Inspect seedings periodically during the establishment period, since failures may still occur after the initial seedling emergence.

Seeding failures are usually due to a lack of attention to proper seedbed preparation, seeding technique, and management. Other common causes for seeding failure include inadequate moisture and unfavorable soil conditions. Seed may germinate but fail to emerge due to a soil crust or erosion. After emergence, seedlings may die because of adverse climatic conditions or damage from pests. In some cases failure may occur during the second year in unusually dry weather.

Seeding failure represents an expensive risk. Early recognition of the failure allows reseeding, salvaging a part of the seedbed preparation expense. Perhaps only a portion of a seeding will have to be replanted; and careful evaluation of seeding success will identify the areas that need to be reseeded.

Seedings should be inspected as soon as possible after plant emergence. If a failure is recognized early there may be time to allow reseeding in time to capitalize on spring precipitation. Refer to the conservation practice Standards 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 stand has few weeds.

Caution must be used especially in 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 or two of deferment could have allowed the seeded perennials to become established and eliminate the weeds through competition.

The criteria for success of seedings should be based upon some quantitative measure of stand establishment, such as seedlings per foot of seeded row or plants per square foot. The absolute values related to various success ratings will vary with site, year, species, and measurement method. Thus, a stand density that would be considered poor on a well drained, moist upland site might be excellent on a drier site. For these reasons the criteria to be applied to any particular seeding should be based on local experience, observation and production potential.

In addition to quantitative data on stand establishment, the examiner should note the kinds and amounts of weeds and desirable perennials that may become established. In some cases weed control may be necessary to allow seeding establishment.

A careful evaluation must be made before deciding to re-apply the practice or destroy a potential grass stand. The following factors should be considered when establishing guidelines for non-irrigated sites. These attributes include: number of seedlings per square foot (plant density), uniformity of seedling distribution over the site, and abundance of undesirable weed species.

Plant Density

The density of plants in a successful seeding will vary considerably from place to place, but if seedling plants are uniformly distributed, with a minimum amount of undesirables, the seeding probably is establishing successfully. Some native species may be particularly slow to establish. Full stands may not be present the first 1 to 3 years, especially for species with a high amount of dormant seed. Watch and manage native seedings for a year or two before deciding whether they are successful. Similarly, most rapidly growing introduced species should establish a rather solid stand the first year to year and a half. When evaluating the success of mixtures, note the relative abundance of the species seeded.

A monoculture of species such as crested wheatgrass, may establish at densities below potential, producing large "wolf" plants with bare spaces between.

Diverse mixtures of grasses, forbs, legumes, and shrubs with varying rooting depths and phenologies, result in maximum densities because soil moisture use during the growing season is enhanced.

Plant densities that produce successful stands for rangelands vary from site to site. A survey of the literature shows that a seeding will stabilize at a density typical for the native plant community of that site, with some qualifications. Plant density data from seedings in the Intermountain West indicates that for most soil types suitable for reseeding with <15 inches average annual precipitation, the target plant densities is between 1 to 3 plants per square foot. The seeded species are expected to fully occupy the site when mature.

Table 1-PLANT DENSITY GUIDE

Average Annual Precipitation	Soil Types	Target Density* plants/sq. ft.
22"+	Loamy, deep to moderately deep	3.0-5.0
22"+	Shallow, Gravelly, etc.	2.0-4.0
15"-22"	Loamy, deep to moderately deep	2.0-4.0
15"-22"	Shallow, Gravelly, Eroded, etc.	1.0-3.0
12"-15"	Loamy, deep to moderately deep	1.0-3.0
12"-15"	Shallow, Gravelly, Eroded, Stony, etc.	0.8-2.0
9"-12"	Loamy, deep to moderately deep	0.7-2.0
9"-12"	Shallow, Gravelly, Stony, Eroded, etc.	0.5-2.0
<9"	Loamy, deep to moderately deep	0.5-2.0
<9"	Shallow, Gravelly, Saline, Calcareous, etc.	0.3-2.0

Hull and Holmgren (1964) found that plant densities of well-established seedings are relatively insensitive to seeding rates. High seeding rates, those exceeding 25 seeds/ft^2, produced the same plant densities as the standard seeding rate 20-25 seeds/ft^2 in the second or third growing season following seeding. High seeding rates might be warranted on sites with very adverse conditions such as intense weed competition or soil crusting.

In summary, target plant densities for most ecological sites in eastern Washington are between 0.5- 3.0 plants/ft^2. Target densities should be ecologically site specific; adjusted upward for higher precipitation, adjusted downward for lower precipitation and problem soils. Observation of similar ecological sites and reseeded areas will help establish target densities. Stand densities measured after the first growing season (or any subsequent season), should equal or exceed the target density for the site.

Plant Vigor

Seedlings reaching the three-leaf stage (or beyond), and in healthy condition, have greater than a 90 percent chance of becoming established on most ecological sites suitable for seeding (Johnson 1986, White and Currie 1980).

> **Rule-of-thumb:** *Stand counts should apply to seedlings with 3 true leaves or more and in healthy condition. There should be slight to no evidence of insects, disease, or physical damage to the plants.*

Time of Evaluation

Stand counts at the end of the first growing season usually correlate strongly with seeding rates, and often exceed the target density for the site. Using the three-leaf and target density rules, a seeding can be evaluated at any time and judged adequate when there are a sufficient number of three-leaved seedlings to equal the target density. A reasonable time to check is following the

first growing season. If stands are inadequate at end of the first growing season, evaluation can continue into the second growing season. Only in exceptional circumstances (such as extended drought or the mixture contains species with hard (or dormant) seed) should evaluation need to continue past the second growing season.

Reseeding Versus Natural Recruitment

Plant succession on abandoned cropland was documented in southern Idaho (Piemeisel 1938, 1951), and northeastern Colorado (Costello 1944). These studies provide a basis for sound judgments on the need to reseed a field with an inadequate stand of desirable perennial grasses. Experience has shown that stands with 15% or greater of the production being from desirable perennial grasses can be successfully managed for natural recruitment.

Generally Russian thistle, *Salsola kali*; cheatgrass, *Bromus tectorum*; and tumble mustard *Sisymbrium altissimum* play an important role in succession on abandoned cropland fields. The year following abandonment, the greatest source of seed is provided by Russian thistle as the previous year's plants tumble across the field depositing seed. These seeds germinate and grow into large individual plants, which often completely cover the field and produce enormous seed crops.

The second year is also dominated completely by Russian thistle, but plants are usually single-stemmed, stunted, and produce very little seed. The soil seed bank is replenished by mustard and cheatgrass invading from adjacent areas. The third year may be dominated by mustards (Descurania and Sisymbrium spp.), and sporadic, large "wolf" plants of cheatgrass. However; thereafter, for the next 15 to 20 years, solid stands of cheatgrass dominate the field. A sub-climax of cheatgrass can persist indefinitely. In areas with greater than 12 inches of precipitation, perennial grasses slowly increase in importance 15 to 30 years after the field is abandoned.

If a grass seeding is rated a failure after two growing seasons, a decision to reseed depends on the resource objectives. If weedy plant cover is adequate reseeding may not be required to control erosion. However, successional data indicates that cheatgrass dominated areas will not return to dominance by perennial grasses before 25 to 30 years, if ever.

Recruitment

Recruitment from seeded species is a factor to consider when sampling densities are less than adequate. Species such as bluebunch wheatgrass recruit or reseed very poorly, whereas bluegrasses and fescues tend to reseed prolifically. Vegetative spread is important for species such as thickspike, streambank, intermediate and pubescent wheatgrasses.

Sampling Methods

One practical method of stand evaluation is:

1. Walk perpendicular, or diagonally, to the drill rows across the field and appraise the variability of the stand. Remember; appraise the stand based on the various soils and their inherent production potential.
2. On the way back, sample representative areas of the field using a belt transect. Record the number of seedlings with greater than 3 leaves in a 100 square foot belt (6 inches by 200

feet is the preferred size) run diagonally across drill rows and diagonally across slopes. Avoid drill turn rows and double-seeded areas. Count only those plants that are rooted in the belt transect. Divide the total number of plants by 100 to calculate the number of seedlings per square foot.

3. Complete at least three belt transects in each field, with more in larger fields as judged necessary (based on uniformity).
4. Identify large areas of poor seedling establishment and judge whether it should be reseeded based on considerations addressed above, resource objectives, and other factors.

IRRIGATION WATER MANAGEMENT FOR SEEDING ESTABLISHMENT

Sprinkler, furrow or flood irrigation methods are suitable for forage stand establishment. Light, frequent sprinkler irrigations are best for keeping the surface soil moist until the seedlings germinate and emerge from the soil. Crusting occurs when the soil surface is allowed to dry out. Crusting prevents seedlings from emerging. Crusting can be broken or softened by roller, rotary hoe or by sprinkler or furrow irrigation.

POST SEEDING MANAGEMENT

More established seedings fail for lack of post seeding treatment and grazing management than for any other reason. The seeding project investment is only as sound as the management that follows.

Rule of Thumb: *Seeding is not a substitute for good management.*

Early weed removal controls competition and allows stand establishment. Weeds can be controlled using labeled herbicides or by mowing above the desired seedlings prior to seed set by the weeds.

Seedlings must receive adequate protection until they become established plants. Stand establishment may take up to the end of the second or third growing season to occur under non-irrigated conditions. Establishment may take even longer for native species seedings. As a general rule, grazing should be deferred until the first seed crop is mature. Only light grazing should be allowed in that season.

During the establishment period, plants can easily be pulled out of the ground by grazing animals. Pull out occurs because the root system is not developed enough to fully anchor the plant. If you can uproot plants by hand, a grazing animal surely can.

ESTABLISHED STAND MANAGEMENT

Dryland Fertilization

Fertilizer application is not recommended for native range or introduced species stands in areas receiving less than 16 inches of precipitation.

Irrigated Pasture Management

Several cultural practices maintain productive irrigated pasture.

Fertilization can be a profitable way to improve pasture. Production can usually be increased two to three times or more with a well planned fertilization and management program. For grass pastures to be productive, first priority should be given to meeting nitrogen needs. Grasses require large quantities of nitrogen and respond vigorously when fertilized with this nutrient. Grasses may also respond to phosphorus and potassium when supplies in the soil are low. However, response to applied phosphorus and potassium is not usually profitable unless nitrogen supplies are adequate.

Legumes-When properly inoculated, legumes can fix nitrogen from N^2 in the atmosphere and need little or no additional nitrogen. However, legumes require relatively large amounts of phosphorus, potassium and sulphur. Legumes will respond to additions of these nutrients when they are not adequately supplied by the soil. Follow the recommended rates based on the appropriate fertilizer guides.

Grasses-Grasses require relatively large amounts of nitrogen fertilizer and smaller amounts of phosphorus, potassium and sulphur. Where moisture conditions are favorable, grasses will respond to high rates of nitrogen fertilizer and moderate rates of phosphorus, potassium and sulphur on soils deficient in these elements. Fertilizer guides commonly recommend up to 150 pounds of nitrogen per acre based on a soil test.

Grass-Legume Mixtures- Legume-grass mixtures can be manipulated by fertilizer applications. Grass is stimulated by nitrogen. Increase or maintain the amount of legume in the mixture by applying larger amounts of phosphorus, potassium and sulphur. Proper nutrient combinations help maintain the desired species composition. Apply fertilizer in split applications as indicated by soil tests to enhance the fertilizer efficiency and reduce contamination of surface and subsurface water.

Applying the ideal combination of nutrients for both grasses and legumes is not possible. Nitrogen will increase grasses at the expense of the legume. Legumes will use available soil nitrogen. If nitrogen is added to a grass-legume mixture, both will respond well, but excessive nitrogen fertilization will eventually shift plant composition toward a greater percentage of grass. The legume will use some nitrogen fertilizer at the expense of the rhizobium nitrogen fixing process. In effect, some of the nitrogen applied is wasted because it is used in place of nitrogen that the legume would have fixed from the atmosphere.

In many cases, better results have been obtained from applying phosphate and potassium fertilizers at relatively high rates every 2-3 years than from applying the same amounts in annual applications. Do not attempt this with nitrogen however, because of potential pollution to surface and ground water sources. Split applications of nitrogen according to the plant needs and soil type are recommended.

Broadcast application is the most common method of applying nitrogen fertilizer to established forage stands. Fertilize forages in the fall or very early spring to provide an opportunity for precipitation to move the fertilizer into the root zone before the growing season. To avoid volatilization and loss of nitrogen to the atmosphere, fall and spring applications should be made when the soil temperatures are less than 50 degrees. Never apply fertilizer to frozen ground or

over snow cover. Caution should be used to avoid runoff on clayey soils or deep percolation on sandy soils.

Nitrogen fertilizers are soluble and move readily in moist soils. Response to nitrogen application is usually rapid if moisture conditions are favorable. However, nitrogen fertilizers, particularly urea, may be lost by volatilization if they remain on the soil surface during warm, dry weather. On irrigated land, mid-season applications of nitrogen should be watered in immediately. Split applications following each haying or grazing are recommended for nitrogen fertilization.

Phosphorus does not move as readily in soils and the response to surface-applied phosphate fertilizers will not be rapid or as dramatic as the response to nitrogen applications. Some research indicates a positive response from deep banding phosphorus into established stands. Residual responses are common for 2-3 years after application. Many fertilizer companies have special equipment equipped with coulters and narrow shanks that can deep band fertilizer with minimal disturbance to the pasture.

Application rates can be determined by taking soil tests and developing a nutrient budget based on the land grant university fertilizer guide recommendations.

Caution: Always consider water quality implications for all fertilizer recommendations.

Proper irrigation of pastures requires an understanding of fundamental soil, water, and plant relationships. Irrigation must be coordinated with management practices. The timing and amount of irrigation water required by pastures, like any other crop, depends on the soil water-holding capacity, weather conditions, and crop growth. Unless there is a limiting layer in the soil, most of the plant roots in a grass pasture will be found within the top 2 to 3 feet. The soil-water holding capacity varies from about 1 inch per foot of depth in a loamy sand to about 2 inches per foot depth in a loamy soil. This means that in a sandy soil, approximately 2-1/2 inches of water are available for plant use in the 2-1/2 foot root zone; whereas, in a loamy soil approximately 5 inches of water would be available for the grass to use in the same 2-1/2 foot root depth (See Table 2-Typical available water holding capacity of various soils).

For optimum forage production (grass), irrigate when approximately 50% of the water has been used or depleted from the root zone. Fill the soil profile at scheduled irrigations to the rooting depth of each forage species. Grass pastures need to be irrigated about twice as often as a deeper-rooted alfalfa crop.

Table 2-Typical available water holding capacity of various soils

Soil type	Water Holding Capacity (inches/foot)
Coarse sand	0.50
Fine sand	0.75
Loamy sand	1.00
Fine loamy sand	1.25-2.00
Silt loam	1.75-2.00
Silty clay loam	2.00
Clay loam	2.00
Heavy clay	1.75-2.00

(Source: Intermountain Planting Guide (2001), Utah State Univ. Extension Publication AG510, Utah State Univ., Logan, UT 84322)

Irrigate according to plant and soil needs. Irrigation water should be applied immediately following grazing. Do not graze a pasture during irrigation. To reduce soil compaction problems, the soils should be allowed to dry before livestock and/or harvesting equipment enter the field

The combination of grazing and haying improves the persistence of legumes over grazing alone.

Animal numbers may not be adequate to efficiently harvest the forage during rapid growth. Some pastures may need to be harvested by haying or mowing. Intensively managed pastures may not need mowing to knock down old wolfy plants.

Proper management reduces weed problems. Manage or control weed problems as they are identified.

Harrow to breakup and distribute manure, especially prior to green-up in the spring.

Feeding hay on irrigated pasture causes compacted soils and reduces forage production. If hay is fed on irrigated pasture, use light mechanical tillage to improve infiltration and soil aeration.

Many irrigated pasture species require re-establishment every 10-15 years to maintain high levels of production. In the short term, yields can be increased or maintained by proper fertilization. Chiseling or light disking to break up the sod and increase yield in rhizomatous species that tend to become sod-bound.

Grazing and Haying Management

Species vary in their ability to withstand grazing and haying pressure. Some species can withstand excessive utilization events but future productivity is reduced with continuous heavy use. To maintain productivity, minimum stubble height recommendations for pre and post grazing and haying have been developed, as shown in Table 11-Growth Stage for Harvesting Forage.

A prescribed grazing plan is essential to the long-term survival and productivity of seedings.

Prescribed Grazing uses guidelines provided in the Prescribed Grazing standard (528) to manage the harvest of vegetation with grazing animals to improve or maintain: 1) the health and vigor of the plant communities, 2) livestock health and productivity, 3) water quality and quantity, 4) riparian and watershed function, 5) soil condition and erosion reduction, 6) quantity and quality of food and/or cover available for wildlife, and 7) promote economic stability through grazing land sustainability.

The prescribed grazing plan will address timing, intensity, frequency and duration of grazing.

The prescribed grazing plan includes the following components:

- An inventory of the quantity and quality of available forage for each management unit
- An inventory of the grazing animals
- A Feed and Forage Balance Worksheet that includes the forage demands of wildlife species
- Documentation of actual use and season-of-use
- A description of livestock movements, grazing periods, deferment, rest, season of use, grazing schedule, and other treatment activities such as fertilization, manure management, irrigation water management, and pest management for each management unit. Herd movements may be shown on maps, in tables, or described in a narrative

- Appropriate re-growth periods, refer to Table 11-Growth Stage for Harvesting Forage
- A monitoring plan to determine trend, and make adjustments in the prescription to meet objectives
- Alternatives to deal with extremes in weather, fire and other factors that reduce forage production

The prescribed grazing plan may require facilitating practices such as fencing, water developments and trails.

Table 3-Grass Species Characteristics and Adaptation to Moisture and Soils

GRASSES	Native or Introduced	Bunch or Sod	Precipitation Zone 8 12 16 20 +	Adaptation to Soils Sand Sandy Silty Clayey Clay	Shallow Soils	Calcareous Soils	Salinity Tolerant	Acid Tolerant	Irrigation Response	Wetness	Extreme Drought	Dry Periods
Timothy	I	B	//XXX	clay – silt loam				x	x	x		
Wheatgrass, Beardless	N	B	//XXXXXX//	clay – silt loam			x		x			x
Wheatgrass, Bluebunch	N	B	//XXXXXX//	clay loam – silt loam								x
Wheatgrass, Crested AGCR	I	B	//XXXXX//	clay – silt loam								x
Wheatgrass, Crested AGDE	I	B	//XXXXXX//	clay – silt loam							x	x
Wheatgrass, Crested Cross	I	B	//XXXXXX//	clay – silt loam							x	x
Wheatgrass, Intermediate	I	S	//XXXXX//	clay loam – silt loam					x			x
Wheatgrass, Newhy - hybrid	I	S	//XXXX//	clay loam – silt loam		x	x		x	x		
Wheatgrass, Pubescent	I	S	//XXXXX//	clay loam – silt loam					x			x
Wheatgrass, Siberian	I	B	//XXXXXX//	clay loam – silt loam							x	x
Wheatgrass, Slender	N	B	//XXXXXX//	clay loam – silt loam	x	x	x					x
Wheatgrass, Snake River	N	B	//XXXXXX//	Clay loam – silt loam							x	x
Wheatgrass, Streambank	N	S	//XXXXXX//	Clay loam – silt loam	x						x	x
Wheatgrass, Tall	I	B	//XXXXX//	clay – silt loam			x		x	x		x
Wheatgrass, Thickspike	N	S	//XXXXXX//	clay loam – silt loam							x	x
Wheatgrass, Western	N	S	//XXXXX//	clay – silt loam			x			x		x
Wildrye, Altai	I	B	//XXXXX//	clay – silt loam			x					
Wildrye, Basin	N	B	//XXXXXX//	silt loam– sandy loam		x	x				x	x
Wildrye, Beardless	N	S	//XXXXX/	clay – silt loam		x	x					
Wildrye, Blue	N	B	//XXX	clay loam – silt loam				x	x			
Wildrye, Canada	N	B	//XXXX	loam – sandy loam				x	x			
Wildrye, Mammoth	I	S	//XXXXX//	clay loam–sandy loam		x	x				x	x
Wildrye, Russian	I	B	//XXXXXXX//	clay loam – silt loam		x	x		x		x	x

Table 4-Forb/Legume Species Characteristics and Adaptation to Moisture and Soils

FORBS - LEGUMES	Native or Introduced	Annual-Biennial-Per	Precipitation Zone 8 12 16 20 +	Adaptation to Soils Sand Sandy Silty Clayey Clay	Shallow Soils	Calcareous Soils	Salinity Tolerant	Acid Tolerant	Irrigation Response	Wetness	Extreme Drought	Bloat Tendency
Alfalfa	I	P	//XXXXXX	silt loan –sandy loam					x			x
Balsamroot, Arrowleaf	N	P	//XXXXXX//	silt loan –sandy loam							x	
Burnet, Small	I	P	//XXXXXX	clay loam – silt loam					x			
Clover, Alsike	I	B	//XXX	clay loam-sandy loam					x	x		x
Clover, Red	I	B	//XXX	clay loam-sandy loam					x			x
Clover, Strawberry	I	P	//XXX	clay loam-sandy loam			x		x	x		x
Clover, White	I	P	//XXX	clay loam-sandy loam					x	x		x
Crownvetch	I	P	//XXXX	silt loam-sandy loam								
Flax, Blue	N	P	//XXXX//	silt loam-sandy loam	x						x	
Globemallow	N	P	//XXXXX//	clay loam-sandy loam	x	x	x				x	
Milkvetch, Cicer	I	P	//XXXXX	clay- sandy loam					x	x		
Penstemon, Venus	N	P	//XXXX	clay loam-silt loam					x			
Penstemon, Firecracker	N	P	//XXXXX//	clay loam-silt loam	x	x					x	
Penstemon, Palmer	N	P	//XXXXX//	clay loam-silt loam	x	x					x	
Penstemon, Rocky Mtn.	N	P	//XX	clay loam-silt loam					x			
Sagewort, Louisiana	N	P	//XXXXX//	clay loam-silt loam	x	x					x	
Sainfoin	I	P	//XXXX	silt loam-sandy loam					x			
Sweetclover, White	I	B	//XXXX//	clay loam-silt loam	x	x	x		x			x
Sweetclover, Yellow	I	B	//XXXX//	clay loam-silt loam	x	x	x		x			x
Sweetvetch	N	P	//XXXX//	clay loam-silt loam							x	
Trefoil, Birdsfoot	I	P	//XX	clay loam-sandy loam					x	x	x	
Yarrow, Western	N	P	///XXXXXXXX	clay loam-silt loam					x	x	x	

Table 5-Shrub Species Characteristics and Adaptation to Moisture and Soils

SHRUBS	Native or Introduced	Evergreen or Decid.	Precipitation Zone 8 12 16 20 +	Adaptation to Soils Sand Sandy Silty Clayey Clay	Shallow Soils	Calcareous Soils	Salinity Tolerant	Wetness	Extreme Drought
Bitterbrush, Antelope	N	D	//XXXXXX//	clay loam-silt loam					
Ceanothus, Snowbrush	N	E	//XXXXX	silt loam-sandy loam					
Chokecherry	N	D	//XXXXXX//	silt loam-sandy loam					
Current, Golden	N	D	//XXXXXX//	silt loam-sandy loam					
Current, Wax	N	D	//XXXXXX//	silt loam-sandy loam					
Dogwood, Redosier	N	D	//XXXX	silt loam-sandy loam				x	
Kochia, Forage	I	D	XXXXXXXX//	silt loam-sandy loam	x	x	x		x
Mahogany, Curlleaf	N	D	//XXXXXX//	silt loam-sandy loam	x	x			x
Mahogany, B. Mountain	N	D	//XXXXX	silt loam-sandy loam	x	x			
Rabbitbrush, Green	N	D	//XXXXXX//	clay loam-sandy loam		x			x
Rabbitbrush, Rubber	N	D	//XXXXXX//	clay loam-sandy loam		x			x
Rose, Woods	N	D	//XXXXX//	silt loam-sandy loam					
Sagebrush, Basin Big	N	E	//XXXX//	silt loam-sand			x		x
Sagebrush, Mountain Big	N	E	//XXXX//	clay loam-sandy loam					
Sagebrush, Wyoming Big	N	E	//XXXXX//	clay loam-sandy loam		x			x
Sagebrush, Black	N	E	//XXXXX//	clay loam-sandy loam	x	x			x
Saltbush, Fourwing	N	D	//XXXXXX//	silt loam-sandy loam			x		x
Saltbush, Gardner	N	D	//XXXXXX//	clay-sandy loam	x	x	x		x
Serviceberry	N	D	//XXXXX//	silt loam-sandy loam			x		
Silverberry	N	D	//XXXXX//	silt loam-sandy loam					
Snowberry	N	D	//XXXXX//	silt loam-sandy loam					
Sumac, Skunkbush	N	D	//XXXXX//	silt loam-sandy loam					x
Winterfat	N	E	//XXXXXXX//	silt loam-sandy loam	x	x	x		x

Table 6-Three year average of percent crude protein obtained at 15 day intervals

Species	Percent Crude Protein By Date										
	6-1	6-15	7-1	7-15	8-1	8-15	9-1	9-15	10-1	Ave.	Rank
Nordan Crested Wheatgrass	13.6	9.3	7.2	5.8	4.5	4.3	3.8	3.5	3.4	6.16	13
Fairway Crested Wheatgrass	12.9	9.7	7.1	5.7	4.9	4.2	3.6	3.4	3.0	6.06	14
Tall Wheatgrass	12.4	10.0	8.6	7.4	6.0	5.3	4.2	3.6	3.3	6.76	7
Intermediate Wheatgrass	12.1	9.5	7.7	6.1	4.9	4.6	3.6	3.2	2.8	6.06	14
Pubescent Wheatgrass	12.1	10.4	8.6	6.9	5.2	5.5	4.5	4.1	3.3	6.73	8
Beardless Wheatgrass	13.0	9.7	7.0	6.6	5.0	4.7	4.1	3.9	3.2	6.36	11
Slender Wheatgrass	10.8	8.3	6.4	4.8	3.8	3.2	2.9	2.6	2.4	5.02	17
Mountain Brome[1]	10.4	8.1	6.2	4.6	2.3	2.4	2.1	2.5	2.4	4.56	18
Smooth Brome	10.3	7.9	6.5	4.6	4.6	4.7	3.8	3.5	3.0	5.54	15
Big Bluegrass[1]	10.2	7.1	5.4	4.8	4.2	3.8	3.6	3.8	3.4	5.15	16
Big Bluegrass[1], 36" rows	10.6	8.2	7.4	6.0	5.5	5.8	4.2	4.3	3.9	6.21	12
Timothy	12.2	10.5	8.7	7.1	5.8	4.9	4.1	3.4	3.2	6.66	9
Orchardgrass[1]	13.5	10.4	8.2	8.0	7.1	6.3	5.2	4.8	4.7	7.58	3
Russian Wildrye	14.9	11.3	9.4	8.0	7.1	6.2	6.4	5.1	4.1	8.06	2
Russian Wildrye, 36" rows	15.6	12.6	9.5	9.8	8.3	7.9	6.6	6.2	5.1	9.07	1
Standard Crested, 36" rows	14.1	11.0	8.8	7.0	5.9	5.0	4.0	3.5	2.8	6.90	6

[1] Two year average

Shaded values show peak protein periods.

Source: This information appeared as Table 5 in Dubbs, Arthur, 1966. Yield, Crude Protein, and Palatability of Dryland Grasses in Central Montana. Mont. Ag. Exp. Sta. Bul. 604. 18pp.

Table 7-Total Percent Consumed During Dates Indicated

	Year 1			Year 2			Year 3		
	Sheep						Heifers		
	DATE RANGE								
Species	5-15 to 6-12	6-13 to 7-26	7-27 to 8-27	5-1 to 5-29	5-30 to 6-30	7-1 to 8-26	5-18 to 6-15	7-1 to 7-29	7-30 to 9-12
Beardless Wheatgrass	0	45	0	3	0	0	60	95	50
Big Bluegrass	0	35	0	5	0	0	80	20	80
Big Bluegrass, 36" rows	0	25	10	10	0	0	60	15	35
Fairway Crested Wheatgrass	95	50	0	50	35	35	95	50	50
Intermediate Wheatgrass	98	85	0	30	25	0	95	75	50
Mountain Brome	85	80	25	50	60	100	100	90	95
Nordan Crested Wheatgrass	98	20	10	70	15	15	95	25	10
Orchardgrass	100	98	98	100	100	100	95	95	98
Pubescent Wheatgrass	98	85	20	25	40	0	95	75	60
Russian Wildrye	95	100	95	95	100	100	90	100	98
Russian Wildrye, 36" rows	90	100	95	75	95	100	90	100	98
Slender Wheatgrass	85	85	0	40	55	45	90	95	50
Smooth Brome	98	98	95	100	95	100	95	95	95
Standard Crested, 36" rows	95	25	5	60	85	20	95	15	10
Tall Wheatgrass	75	60	15	30	10	50	85	45	60
Timothy	100	98	90	100	100	100	95	98	95

Summary of Palatability of grasses to sheep and heifers at three stages of growth as determined by total percent of forage consumed during each period*

Source: This information appeared as Table 11 in Dubbs, Arthur, 1966. Yield, Crude Protein, and Palatability of Dryland Grasses in Central Montana. Mont. Ag. Exp. Sta. Bul. 604. 18pp.

Table 8-Sheep Preference For Grass Varieties By Growth Stage-Preference Is Expressed As A Percentage Of The Most Preferred Grass

Species	Vegetative	Boot	Anthesis	Seed- Ripe	Mean
Orchardgrass 'Latar'	94	100	100	87	95
Orchardgrass 'Pomar'	100	95	76	88	90
Mountain Rye	83	88	87	100	90
Smooth Brome 'Manchar'	80	88	87	90	86
Barley, Bulbous	83	82	67	100	83
Pubescent Wheatgrass 'Topar'	59	81	73	83	74
Bottlebrush Squirreltail	69	75	44	86	69
Tall Fescue 'Alta'	52	81	58	80	68
Crested Wheatgrass 'Nordan'	61	68	49	78	64
Indian Ricegrass 'Nezpar'	57	67	56	72	63
Crested Wheatgrass 'Fairway'	46	72	44	72	59
Meadow Brome 'Regar'	56	70	42	64	58
Russian Wildrye	41	77	44	64	57
Tall Wheatgrass	37	63	49	71	55
Basin Wildrye	11	77	53	74	54
Beardless Wheatgrass 'Whitmar'	33	61	31	52	44
Bluebunch Wheatgrass	39	23	24	67	38
Hard Fescue 'Durar'	15	32	11	45	26

Source: Shewmaker, G.E., H.F. Mayland, R.C. Rosenau, and K.H. Asay. 1989. Silicon in C-3 Grasses: Effects on Forage Quality and Sheep Preference. J. Range Management. 42(2):122-127. Study was conducted at NW Irrigation and Soils Research Laboratory, USDA-ARS, Kimberly, Idaho.

Table 9-Regrowth Characteristics of Selected Irrigated Forage Grasses

Species	30 Day Regrowth-Inches Average For Three Years
'Latar' Orchardgrass	13.8
'Paiute' Orchardgrass	14.0
'Napier' Orchardgrass	11.8
'Potomac' Orchardgrass	13.6
'Regar' Meadow Brome	13.8
'Manchar' Smooth Brome	11.8
'Alta' Tall Fescue	10.2
'Fawn' Tall Fescue	11.0
'Durar' Hard Fescue	9.6
'Garrison' Creeping Foxtail	9.8
'Climax' Timothy	8.8
'Bastian' Perennial Ryegrass	7.6
Standard Timothy	7.7

Notes:

Latar Orchardgrass-responds to irrigation rapidly-quickest following harvest-good choice where rust is not a problem
Paiute Orchardgrass-similar regrowth to Latar and Potomac-more drought tolerant-good choice under 18" of irrigation
Napier Orchardgrass-slower regrowth than other Orchardgrasses-not recommended
Potomac Orchardgrass-regrowth similar to Latar-resistant to rust-good choice with rust resistance
Regar Meadow Brome-1st to 6" years 2 and 3-averages 7-10 days earlier to reach 6" height-very heat tolerant-good choice
Manchar Smooth Brome-2nd to 6" years 2 and 3-poorer regrowth than Regar-not heat tolerant-will sod bound-use for erosion
Alta and Fawn Tall Fescue-early green-up, suffered from early frost-stayed green longer-poor regrowth-use in saline areas
Durar Hard Fescue-early green-up, suffered from early frost-stayed green-poor regrowth-use for erosion control only
Garrison Creeping Foxtail-difficult to establish-performs best in wet sites-good drought tolerance-responds to high fertility Timothy-not tolerant of high pH soils-not as drought tolerant as Garrison-poorly suited to Snake R. soils-use in high elevation
Bastian P. Ryegrass-excellent seedling vigor-open winters severely reduced stand-not recommended in mid-upper Snake River
Source: Irrigated Pasture Grass Variety Trial, Bill Hazen, University of Idaho Extension Service. October 1991. 3p. unpublished.
Magic Valley, Idaho-Three years of data (1987-1990), 5 replications, 30 day average height following first harvest

Table 10-Recommended Grass-Legume Mixtures for Hay, Pasture and Silage

Mixture[1]	Full Irrigation[2]	Short Irrigation[2]	Non-Irrigated-Min. Precipitation[2]
Alfalfa and Orchardgrass	X	No	18"+
Alfalfa and Meadow Brome	X	X	14"+
Alfalfa and Tall Fescue	X	No	18"+
Alfalfa and Intermediate Wheatgrass	No	X	12"+
Alfalfa and Russian Wildrye	X	X	12"+
Sweetclover and Russian Wildrye	X	X	12"+
Birdsfoot Trefoil and Orchardgrass	X	No	18"+
Birdsfoot Trefoil and Creeping Foxtail	X	No	18"+
Birdsfoot Trefoil and Canarygrass	X	No	18”+
Cicer Milkvetch and Orchardgrass	X	X	18"+
Cicer Milkvetch and Meadow Brome	X	X	14”+
Cicer Milkvetch and Tall Fescue	X	No	18"+
Ladino Clover and Creeping Foxtail	X	No	18"+
Alsike or Red Clover and Creeping Foxtail	X	X	18"+
Sainfoin and Intermediate Wheatgrass	No	X	14"+
Sainfoin and Meadow Brome	X	X	14"
Sainfoin and Orchardgrass	X	No	18"

Notes:

[1] Alternate row seeding of grass and legume is recommended when possible to ensure good establishment of both species. Do not plant tall fescue, creeping foxtail or Russian wildrye and legume in same row.

[2] Irrigation as indicated or water-table w/in 3 feet of the soil surface to meeting minimum precipitation levels

Double seeding rate if seed is broadcast; Smooth brome is not recommended for hay and pasture due to poor regrowth characteristics; Short season irrigation indicates enough water to produce one crop of hay. Orchardgrass is not adapted to areas with frequent spring and fall frosts (mountain valleys).

Table 11-Growth Stage for Harvesting Forage

Plant Species-Common Name	Minimum Leaf Length(inches) Prior to Grazing or Haying	Minimum Stubble [1]/ Height (inches) after Grazing or Haying
Smooth Brome	6	4
Meadow Brome	6	4
Canarygrass	8	6
Tall Fescue	6	4
Creeping Foxtail	6	4
Orchardgrass	6	4
Timothy	6	4
Tall Wheatgrass	8	8
Crested Wheatgrass	6	3
Intermediate Wheatgrass	8	4
Pubescent Wheatgrass	8	4
Siberian Wheatgrass	6	3
Western Wheatgrass	5	4
Altai Wildrye	6	5
Beardless Wildrye	5	4
Russian Wildrye	8	4
Alfalfa	6	3
Milkvetch, Cicer	4	3
Alsike Clover	4	3
Red Clover	6	3
White Clover	6	3
Sainfoin	12	6
Sweetclover	8	4
Trefoil, Birdsfoot	5	3

[1]/ The minimum stubble height at the end of grazing period or hay harvest operation. When a mixture is harvested for hay, use the most limiting stubble height for the mixture.

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